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**Editorial policy**- The Editor reserves the right to make changes that may clarify or condense papers where this is considered desirable.

**Type of submission**- Original articles, review articles, case reports, clinical studies, short communications.

**Covering letter**- Principal author must sign covering letter indicating full responsibility for paper submitted with signatures of all authors. Article must be accompanied by a declaration by all authors stating that the article has not been published in any journal/book. Authors should mention complete designation and departments on the manuscript.

**Title page**- It should be brief and informative. It should bear the title of the paper, the full names of the authors and their affiliations, together with the name, full postal address, telephone and fax number and e-mail address of the author to whom correspondence are to be sent.

**Manuscript**- It should be typewritten in word with font size 11 and style Times New Roman, single spaced throughout. It should contain- covering letter, title page, abstract, keywords, introduction, material and methods, results, discussion, references, tables and figures and legends for tables, figures and graphs.

**Abstract and key words**- This should not exceed 200 words and should be constructed under the following subheadings: Objectives; Methods; Results; Conclusions. Beneath the abstract please select up to 4 keywords from the current Medical Subject Headings (MeSH) found at [http://www.nlm.nih.gov/mesh/MBrowser.html](http://www.nlm.nih.gov/mesh/MBrowser.html). It must convey essential features of paper. It should not contain abbreviations, footnotes or references.

**Introduction**- It should briefly review the current state of knowledge strictly concerning topic of paper. It should also make statement on the reason for undertaking the study and what’s the aim to achieve.

**Material and methods**- It should be described giving sufficient relevant information to permit the work to be repeated. Statistical analysis method, if used should be specified. Ethical guidelines followed by investigators should be described.

**Results**- These should be presented succinctly in the same order as the experiments are described in the Materials and Methods. Tables and especially graphics are encouraged for quantitative information.

**Discussion**- This should comment critically on the findings from the results obtained, their relationship to existing knowledge and their significance for improved understanding of fields of dentistry. Speculation and new hypotheses are encouraged, provided they are firmly rooted in the data presented. The last paragraph of the discussion should begin “In conclusion,” and then the conclusions should be drawn.

**References**- They should be in Vancouver style. References should be numbered in order in which they appear in text and these numbers should be inserted above the lines on each occasion the author is cited.

**Tables**- Each should be typed double spaced on separate sheet, having underlined title followed by a legend if any.

**Figures**- Two complete sets of glossy prints of high quality should be submitted all photomicrographs should indicate the magnification of the print. Special features should be indicated by arrows or letters which contrast with the background. Legends to all photos should be typed on a separate sheet of paper.

**Case Reports**- The format for Case Reports is Abstract, Case Report and Discussion.

**Review Articles**- Reviews will generally be solicited by the Editor but submissions and suggestions for such material are welcome.

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**For Editorial Correspondence**

**Dr. Mandeep Singh Virdi**, Principal, Professor and Head, Deptt. of Paedodontics and Preventive Dentistry, PDM Dental College & Research Institute, Bahadurgarh-124507, Haryana, India. Email – principal_dcri@pdm.ac.in
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POSTER PRESENTATION

Save pulp, Save space
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To evaluate and compare Barr bodies and Davidson bodies-A forensic study

Dahiya K. 1

Abstract:
Aim: To determine the sex of the individual from buccal mucosa smear and Peripheral smear. Objectives: To compare the buccal smear and peripheral smear in same individual. To compare the difference in the determination between male and female individuals using barr bodies and drumsticks bodies. Study Design: For the study to be conducted, 20 samples were taken in total with 10 smears obtained from male patients and 10 smears being obtained from female patients. The smears collected was subsequently stained with PAP stain. The peripheral blood smears from same 20 individuals was stained using Leishmans stain.

Key words: Barr Bodies, Drumstick Bodies, PAP Stain, H&E Stain, Leishmans Stain.

Introduction:

Establishing the identity of an individual is of utmost importance in forensic science, and sex determination is one of the first steps in personal identification in the field of forensics. Various methods have been described for sex identification including use of craniofacial morphology, tooth dimensions, and DNA analysis. Human specimens including blood, semen, hair, and saliva stains containing buccal mucosal cells found in various parts of the body or on lethal weapons at a crime scene as well as at disaster sites can be used in sex determination. Elaborate techniques like PCR and karyotyping have been employed, but they are expensive and not feasible for use in most institutions. In contrast, sex estimation via observation of the presence of Barr bodies is a relatively simple, inexpensive technique that yields immediate results. Sex chromatin in mammals was first described by Barr and Bertram in 1949, when they found a small body presentin the nuclei of neurons of female cats but absent in the neurons of male cats. This body was first called a ‘nucleolar satellite’, but the name was changed to ‘sex chromatin’ when it was found that in many types of cells the body was not associated with the nucleolus. The chromatin pattern is very distinctive in normal males and females.

The presence of sex chromatin is a characteristic feature of female nuclei [1]. A Barr body/sex chromatin is an intense staining body, about 1 μm in diameter, which is plano-convex or triangular in shape. It is most commonly situated on the inside of the nuclear membrane and is seen at the periphery of the nucleus in profile [2]. Sex chromatin has been studied in buccal epithelial cells, fibroblasts of pulp, cervical cells, skin, and hair [3–7]. The buccal smear method is widely popular as the specimens can be obtained with minimal inconvenience. Different stains like Papanicolaou (PAP) and H & E staining have been used to demonstrate the presence of barr bodies.

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Sex chromatin is an approximately 1 micron clump of chromatin seen usually at the periphery of female nuclei in certain tissues like corneal epithelium, buccal mucosa, oral and vaginal mucosa, fibroblasts etc. and as a drumstick in the blood smears [11-12]. Sex chromatin is derived from one of the two X chromosomes in the female which replicates its deoxyribonucleic acid much later than the other and is thus positively heteropyknotic. This process of inactivation of X chromosome is known as “Lyonization”. The inactive X chromosome in neutrophils appears in one of the three forms. They are drumsticks, racquet forms and sessile nodules. Davidson and Smith are the first to identify and report the presence of neutrophil drumsticks and nonspecific appendages and their differences in sexes.

**Inclusion Criteria:**
1. Sample population age and sex matched.
2. Healthy subjects with good oral hygiene were included in this study.
3. Normal quantitative distribution of blood cells.

**Exclusion Criteria:**
1. Subjects with harmful habits such as smoking, gutkha consumption etc
2. Subjects suffering from any form of carcinomas. Or having undergone treatment for the same in the form of surgery chemo therapy or radiotherapy.
3. Patients undergoing Hormonal therapy.

**Materials and methods:**
20 healthy subjects (10 male and 10 female) was used to collect samples from normal buccal mucosa from the Department of Oral Pathology and Microbiology, PDM Dental College and Research Institute, Bahadurgarh, Haryana.

**Method of Collection of Data:**
After obtaining informed consent, the subjects asked to rinse the mouth with mouthwash and then with water. A sterilized wooden spatula was used to obtain the smears from surface of cheeks drawn. The cellular material was collected and smears was prepared. The slides was immediately fixed using alcohol as fixative. The peripheral blood smears was prepared and fixed by air drying.

For the study to be conducted, 20 samples will be taken in total with 10 smears obtained from male patients and 10 smears being obtained from female patients. The smears collected was subsequently stained with PAP stain. The peripheral blood smears from same 20 individuals was stained using Leishmans stain.

For Papanicolaou staining, the smears was fixed in 95% ethyl alcohol for 15–30 min, rinsed in distilled water, and stained in Harris’s hematoxylin for 4 min. The slides was washed under tap water for 1–2 min, differentiated in acid alcohol, blued in tap water or 1.5% sodium bicarbonate, and rinsed in distilled water. Now they were transferred to 70% and then 95% alcohol for a few seconds. After staining in OG 6 for 1–2 min, they will be rinsed in three changes of 95% alcohol for a few seconds each and then stained in EA 36 for 1–2 min. They were rinsed again in three changes of 95% alcohol for a few seconds each. Finally, they dehydrated in absolute alcohol, cleared in xylol, and mounted in dibutyl phthalate and xylene.

Leishman stain is a mixture of methylene blue and derivatives complexed by eosin. Leishman solution fix blood smear by its methyl alcohol content. As a neutral stain in an alcoholic medium, Leishman solution releases its staining action only after the addition of buffered solution. Staining procedure of leishman stain for peripheral smear will be prepared and fixed by air drying. Cover the smear with Leishman stain for 2 minutes .Add twice the volume of buffered water and leave for 5 to 7 minutes then A scum of metallic sheen forms on the surface then wash the stain with buffered water, wipe back of the slide clean and set it upright to dry. Mount the slide in suitable mounting medium with clean and dry coverslip.

The smears stained with PAP and Leishmans stain was observed under an oil immersion microscope. Each slide was observed using zigzag method that there is no overlap of the fields and no recounting of the cells. 50 cells will be observed in each slide. Out of these 50 cells, the total number of Barr body positive cells was counted. Also, a comparison was done between the pap stained smears and drumsticks bodies in leishman staining blood smears.

**Discussion:**
The chromatin pattern of interphase nuclei is distinctive for normal males and females. The
presence of sexchromatin is a distinguishing feature of the female nuclei and has been used in the past to characterize normal females [3–7]. Since the discovery of Barr bodies, it has been employed in nuclear sexing to differentiate between female and male cells. The mean percentage of Barr bodies in an individual varies not only with the sex of the person [4,] but also as a function of ethnicity, age, and in females the phase of the menstrual cycle.

Further, the frequency of these sex chromatids is aberrant in patients suffering from Down’s syndrome, Klinefelter’s syndrome, and other chromosomal abnormalities. The percentage of Barr bodies also demonstrates variation in premalignant and malignant lesions. Karyotyping, fluorescent in situ hybridization, and PCR are considered confirmatory methods for sex determination [1, 2,]; however, use of routine cytological smears with various staining techniques is more feasible and cost-effective.

In the present study, the mean percentages of Barr bodies were consistently higher in females than in males, which is in concordance with other studies [3, 4]. Identification of Barr body-like structures in males, though the range was significantly lower than in females.

Davidson and Smith [8] are the first to identify and report the presence of neutrophil drumsticks and non-specific appendages and their differences in sexes. Brahmi et.al., observed 200 neutrophils from 74 blood smears of both sexes (35 females and 39 males) and reported 3 types i.e. neutrophils with type A (drumstick), type B (sessile nodule) and type C (tag or hook). In the literature there was no mention about the percentage incidence of nonspecific appendages like sessile nodules, racket structures, minor lobes and small clubs in the blood neutrophils along with the drumsticks. Morphology, morphometry and incidence of these nonspecific appendages were dealt in the present work. Though it was stated in the literature that drumsticks are never seen in males [15]our study and several other studies [4,6] in literature suggests that true drumsticks are also present in males though their percentage incidence is less. In this study

For Barr body:

- Only cells with a fine vesicular or granular nucleus and an easily distinguishable nuclear border which was clearly visualized without any folding were considered.
- Cells with bacterial contamination were excluded. To be identified as a Barr body, it had to be located on the nuclear membrane, seen in profile as a bar, semidisc, or triangle, with the flat side against the nuclear membrane. Centrally placed Barr-like bodies were excluded
- The length of the chromatin body had to exceed 1 μm in size.
- (as measured with an eyepiece micrometer scale).
- Doubtful cells were considered negative

The count of morphologically acceptable Barr bodies was expressed as a percentage.

For drumstick bodies:

A drumstick consists of a small nuclear mass of about 1.5 μ in diameter, attached to the body of the nucleus by means of a thin stalk and the incidence of drumsticks varied between 1% to 17% with an average of 2.9%.

- A total of 1000 neutrophils were observed in blood smears collected from 10 males and 10 females of 17-30 years age for sexual differences in percentage incidence, morphology and morphometry of true Drumsticks and non

The percentage incidence of Drumsticks including non-specific appendages in females was higher than in males

- The term ‘sex chromatin’ primarily encompasses two structures:
- 1) Barr body, present in epithelial cells;
- 2) Drumstick of the polymorphonuclear leukocytes.

It is now accepted fact that the drumstick is an expression of an X-chromosome in cells and that the drumsticks and Barr bodies are equivalent structures.

Drumstick:

- Total number of cells counted = 500
### Barr Bodies:

- Total number of cells counted = 500

<table>
<thead>
<tr>
<th>Average</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td></td>
<td>10.3</td>
<td>15.2</td>
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<table>
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<tr>
<th>Standard Deviation</th>
<th>Male</th>
<th>Female</th>
</tr>
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<tr>
<td></td>
<td>1.49</td>
<td>2.39</td>
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<table>
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<tr>
<th>Minimum number of Barr Bodies found/50 cells</th>
<th>Male</th>
<th>Female</th>
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<tr>
<td></td>
<td>8</td>
<td>11</td>
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<table>
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<tr>
<th>Maximum number of Barr Bodies found/50 cells</th>
<th>Male</th>
<th>Female</th>
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<tr>
<td></td>
<td>12</td>
<td>20</td>
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</table>

- Conclusion: A paired sample t-test for means was done. At 95% level of significance the difference between male and female cells was significant.

### Conclusion:

Results found to have 1% positivity for males and 2% positivity for females. Positivity for Barr-body in males is due to the inheritance of males to carry primary sex organs of both the sexes. But the range of positivity differed when compared with males, which is more significant in females. The present study forms a data base for morphological and morphometric parameters of drumsticks and suggests that true drumsticks, sessile nodules and racket structures are sex specific and provides relevant information regarding the diagnostic accuracy of this method in a representative sample of Indians. However, studies with a larger sample size of diverse age groups and varied ethnic backgrounds.

### Reference

Methylene blue as a diagnostic aid for oral cancer and oral potentially malignant disorders

Mehta S.1 Shende V.2

Abstract:
Introduction: Oral health is important to the quality of life of individuals of all age groups. Different types of lesions show predilection for different sites in the oral cavity. Many malignancies are not diagnosed, until the late stages of disease despite the general accessibility of the oral cavity during physical examination. Oral Cancer is very common in a country like India due to habits of smoking and chewing tobacco containing pan masala. Tobacco consumption is the main etiologic factor inducing carcinogenesis in oral mucosa. Aims And Objectives: To establish Methylene blue as a useful diagnostic aid in Oral Potentially Malignant Disorders (OPMD) and Oral squamous cell carcinoma (OSCC) and to determine the efficacy of Methylene blue staining so as to popularize Methylene blue staining as a fairly sensitive, simple and inexpensive method. Material and methods: The present study involved the examination of 60 patients suspected of having oral malignant or potentially malignant lesions by Methylene blue staining. The results of Methylene blue uptake were compared with a simultaneous biopsy of these lesions. Results: The overall sensitivity was 95.55% and specificity was 70.58%. The positive predictive value was 89.58% and negative predictive value of 85.71% was observed in the study. Conclusion: We consider that Methylene blue staining is a useful diagnostic adjunct in a large, community-based oral cancer screening program for high-risk individuals.

Key words: Methylene blue, Oral Squamous Cell Carcinoma (OSCC), Oral Potentially Malignant Disorders (OPMD), Dysplasia

Introduction:
In 2016, 1,685,210 new cancer cases and 595,690 cancer deaths are projected to occur in the United States.1 More than one million new cases are being detected annually in the Indian subcontinent. Prevalence of Oral cancer in Asia-Pacific region is at an alarming stage due to the adverse habits of both tobacco and alcohol consumption in the different socio-economic population. High incidence of oral cancer is seen in South Asian countries like Sri Lanka, India, Pakistan, and Bangladesh and in India the incidence is 7-17/100,000 persons/year with 75,000-80,000 new cases registered annually.2

The oral cavity is amenable to physical examination and oral cancer responds well to early detection and prevention.3 Many OSCCs develop from premalignant lesions & conditions of the oral cavity.4 Lack of public awareness about the signs, symptoms and risk factors, along with the absence of knowledge for early detection by health-care providers are believed to be responsible for the diagnostic delay in identifying the OPMDs.5

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1MDS Student, 2Professor & Head, Deptt. of Oral Pathology & Microbiology, PDM Dental College and Research Institute, Bahadurgarh, Haryana, India.
Material & Method:

The study was conducted in the Department of Oral Pathology and Microbiology in PDM Dental College & Research Institute. The study subjects were taken from the out patients attending the Department of Oral Medicine, Diagnosis and Radiology in PDM Dental College & Research Institute and out patients attending the Department of Surgery-Oncology in Action Cancer hospital. The Study population consisted of 60 patients above 18 years of age, both female and males selected randomly. The study sample was divided into two groups consisting of 30 OPMD (Group I) and 30 OSCC (Group II). The subjects were made to sit comfortably on the dental chair and were thoroughly examined under artificial illumination. Relevant data were entered into the case history performa. An informed consent was obtained from each subject for carrying out the diagnostic procedure. The patients name, age, gender, address were noted. Vital parameters along with the smoking & tobacco habit details were recorded.

Gargling solution:

A set of Methylene blue dye system includes 2 bottles of solution. The dye rinse solution (Bottle A) contained active ingredient Methylene blue 1%, with the addition of 1% malachite green, 0.5% eosin, dimethyl sulphoxide and distilled water. Pre- and post-rinse solution (Bottle B) contained 1% lactic acid, and distilled water.

Methylene blue dye application was as follows:

Patient were directed to rinse their mouth with (Bottle B) containing 1% lactic acid and distilled water for 20 seconds to remove food debris and excess saliva and to provide a consistent oral environment. The mucosa of the clinically appearing diseased area was dried gently with gauze to ensure that the lesion was free from contamination with saliva. Methylene blue dye (Bottle A) containing 1% Methylene blue, 1% malachite green, 0.5% Eosin, 0.5% dimethyl sulphoxide was applied directly on to the lesion with the help of cotton bud initially and simultaneously the patient was made to rinse for 20 seconds ;then expectorated the dye. Patient then rinsed again with (Bottle B) for 20 seconds to wash out the excess dye. The pattern of dye retention was assessed by the intensity of stain retention on the lesion. Deep blue stains were marked as positive reaction whereas shallow or faint blue stain were marked as negative reaction. The results of Methylene blue dye staining were recorded with photographs and biopsies were performed simultaneously in the suspected lesions to compare the accuracy of the diagnostic capability of Methylene blue.

Histological examination:

All the specimens were microscopically evaluated by the pathologists. The pathology reports of the lesions were classified as: (A) Oral potentially malignant disorders (1) Mild dysplasia (2) Moderate dysplasia (3) Severe dysplasia. (B) Oral Cancer- Squamous Cell Carcinoma (1) Well differentiated squamous cell carcinoma (2) Moderately differentiated squamous cell carcinoma (3) Poorly differentiated squamous cell carcinoma (C) Lesions neither precancerous nor malignant (1) Hyperkeratosis without dysplasia.

The results were then deduced and were statistically analyzed using the Spss software and various statistical tests such as Anova test, t-test and correlation test were applied and the final results were drawn.

Data analysis:

The pathologically proven cancers and precancerous lesions were the targets of screening. The results of positive/negative uptake of methylene blue in each lesion were correlated with the histopathologic diagnosis. Statistical analysis was performed, including sensitivity, specificity, positive and negative predictive values. The association of methylene blue uptake and pathologic diagnosis among the Group I and Group II were analyzed using t test. The overall sensitivity was 95.55% and specificity was 70.58%. The positive predictive value was 89.58% and negative predictive value of 85.71% was observed in the study.

A p value of less than 0.001 was considered significant. The diagnostic accuracy of the study was 80%.
Leukoplakia patient with the habit of smoking beedi since 7 years

Intraoral picture after application of Methylene blue dye

Intraoral picture after rinsing with 1% lactic acid

Photomicrograph showing moderate dysplasia

Fig 1. Depicts patient of oral potential malignant disorders.

Oscc patient with the habit of chewing Guthka and consuming alcohol since 20 years

Intraoral picture after application of Methylene blue dye

Intraoral picture after rinsing with 1% lactic acid

Photomicrograph showing well differentiated Squamous cell carcinoma

Fig 2. Depicts patient of oral squamous cell carcinoma.
Discussion:
Detection of oral cancer at its earliest clinical manifestation is essential because there is a direct correlation between survival and the stage of the disease at the time of diagnosis. Recent studies have demonstrated that early lesions have a characteristic appearance and can be predictably recognized by the development and use of diagnostic aids & tests that could help the general dentist identify or assess persistent potentially malignant disorders and oral cancer at its initial stages. Early detection of oral cancer is a continuing goal. Periodic clinical examination of the oral cavity is the mainstay for early detection of oral cancers. It was shown to reduce mortality from oral cancer by 32% in high-risk individuals.

Using adjunctive aids such as toluidine blue (also referred to as tolonium chloride) has been widely accepted to improve the effectiveness in large-scale screening for oral cancer diagnosis. However, it is hazardous if swallowed and was shown to have toxicity to fibroblasts. Another kind of dye material, Methylene Blue, has a similar chemical structure and exhibits similar physicochemical properties to toluidine blue.

For a large-scale community screen, some dye materials help to identify abnormal mucosa tissue which raise oral examiners attention and refer the patients with suspicious lesions to oral surgeons for further examinations.

Diagnostic aids can be used in different situations specially when a surgical biopsy is not indicated and can help the clinician to: Choose the best site for biopsy, follow up a patient with a premalignant lesion, screen for oral cancer in high risk patients or high risk sites of oral cavity (e.g. ventral tongue, floor of the mouth etc.), make a preliminary diagnosis when there is a systemic contraindication for surgical biopsy.

However, staining can also reveal where certain chemicals or specific chemical reactions are taking place within cells or tissues and thus aid in accelerating biopsies, diagnosis and treatment. Such dye materials are important adjuncts such as vital stains which are used in oral screening programme worldwide. Vital staining is usually simple, cheap, sensitive, and efficient. It can be used and interpreted by clinicians by the chair. Vital staining can enhance lesion characteristics, identify satellite or clinically non-apparent lesion sites, and assist in the choice of site and the timing of a biopsy.

Classification of screening aids to oral cancer and pre cancer:
1. Standard screening test
   a. COE
2. Established screening adjuncts
   a. Oral cytology
   b. Oral brush biopsy
3. Vital staining
   a. Toluidine blue (TB) (tolonium chloride)
   b. Lugol’s Iodine
   c. Methylene Blue
4. Light-based detection systems
   a. Chemiluminescence
   b. ViziLite plus
   c. MicroLux DL
   d. VELscope

Methylene Blue is a heterocyclic aromatic chemical compound. At room temperature appears as a solid odorless, dark-green powder, when yields a blue solution when dissolved in water. Considering its low toxicity and the fact that is cheaper than Toluidine Blue, it may be convenient to substitute it for Toluidine Blue in large-scale oral screening in high-risk patients.

Applications Of Methylene Blue:
1) Early Detection of suspected oral cancer.
2) Methylene blue has predominantly been used to reverse vasoplegia in a post-operative setting.
3) Methylene blue has been used to detect gastric, prostate, and bladder cancers.
4) Methylene blue-directed biopsies improve detection of intestinal metaplasia and dysplasia in Barrett’s esophagus.
5) Methylene blue can also be used to examine Ribonucleic acid (RNA) or DNA under the microscope as well as in northern blotting technique.²

6) Methylene blue is increasingly used in cancer chemotherapy regimens based on the use of ifosfamide. The efficacy of i.v. and oral methylene blue for the treatment and prophylaxis of ifosfamide – associated encephalopathy has been confirmed by several groups.¹⁸

Results:

For this study 60 patients were screened. Patient age group ranged from 17 to 75 years (mean age 22.6 years). The study group were further divided in both the groups according to their age group as below and above 50 years of age. In Group I patients below 50 years of age (n=16) and above 50 years of age (n=14) whereas in Group II below 50 years of age (n=13) and above 50 years of age (n=17) (Table 1)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Group</th>
<th>Group I Oral Potentially malignant disorder</th>
<th>Group II OSCC</th>
</tr>
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<tbody>
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<td></td>
<td>Age Group</td>
<td>No.</td>
<td>Percentage%</td>
</tr>
<tr>
<td>1.</td>
<td>Below 50 yrs.</td>
<td>14</td>
<td>46.66</td>
</tr>
<tr>
<td>2.</td>
<td>Above 50 yrs.</td>
<td>16</td>
<td>53.33</td>
</tr>
</tbody>
</table>

Table 1: Age Wise Distribution

Oral potentially malignant disorders were depicted in Group – I with male (n=21) & females (n=9) and Oral squamous cell carcinoma were Group – II with male (n=26) & females (n=4) (Table 2)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Gender</th>
<th>Group I Oral Potentially malignant disorder</th>
<th>Group II OSCC</th>
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<tr>
<td></td>
<td>No.</td>
<td>Percentage%</td>
<td>No.</td>
</tr>
<tr>
<td>1.</td>
<td>Male</td>
<td>21</td>
<td>70</td>
</tr>
<tr>
<td>2.</td>
<td>Female</td>
<td>9</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 2: Gender wise distribution

The study groups consisted of two groups:- Group I (n=30) and Group II (n=30). Group I was further divided into Group A, B and C. Group I were the Cases of all oral potentially malignant disorders in which Group A consisted of cases of Leukoplakia (n=20), Group B consisted of cases of Erythroplakia (n=2) and Group C consisted of cases of Tobacco pouch Keratosis (n=8). On this group t-test and Annova test were applied using Spss software which showed that the Group A (Leukoplakia group) shows high sensitivity and specificity to Methylene blue stain. Group B (Erythroplakia group) also taken the deep blue stain shows high sensitivity and specificity to Methylene blue stain. Patients (n=2) who showed hyperkeratosis without dysplasia histologically took shallow blue staining pattern. Patients (n=3) with histological diagnosis of mild dysplasia were the ones who took Methylene blue as a deep blue stain retention after rinsing with 1% lactic acid (Bottle B). Dye retention in (n=5) patients was deep blue in colour whose histological grading showed moderate dysplastic features histopathologically. All the cases who were histopathologically proven to have severe dysplasia (n=8) took deep blue staining pattern of Methylene blue. In the clinically proven cases of OSCC (n=30), patients (n=7) were histopathologically poorly differentiated SCC cases, (n=11) moderately differentiated SCC and (n=12) were well differentiated SCC cases. All the OSCC cases have taken deep intense blue stain.

Bar Graphs:

Graph 1: Age Wise Distribution in both the males and females.
Graph 2: Gender Wise Distribution in both the groups.

Pie Graphs:

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<th>Methylene Blue Dye Retention</th>
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<th>Dye Uptake Pattern</th>
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<th>Erythroplakia</th>
<th>Tobacco Pouch Keratosis</th>
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<tr>
<td>Shallow Blue</td>
<td>4</td>
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<td>3</td>
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</tr>
</tbody>
</table>

Conclusion

Staining should be routinely used as a method to assist the choice of biopsy site and in the follow up of oral potentially malignant lesions and in the experienced hands marginal demarcation of the malignant lesions enables an intervention method to be adopted earlier for the disease, which carries a high rate of morbidity and mortality.

Further study is recommended to study the exact binding mechanism of Methylene blue in both cancerous and oral potentially malignant disorders to establish this dye- Methylene blue staining as a fairly sensitive, simple and inexpensive method.

References


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Rehabilitation of mutilated endodontically treated teeth: The leading edge

Yadav A.1

Abstract:
The longevity of endodontically involved teeth has been greatly enhanced by continuing developments made in endodontic therapy and restorative procedures. It has been reported that a large number of endodontically treated teeth are restored to their original function with the use of intraradicular devices. By eliminating the use of a post and filling core, the number of adhesive bond interfaces is reduced, thus making the restoration less susceptible to the adverse effects of degradation of the hybrid layer. This paper describes a series of cases of endodontically treated teeth restored with endocrowns and compo-core

Key words: Endocrown, compo-core, endodontically treated teeth

Introduction:

Endodontically treated teeth usually present inadequate remaining coronal structure to retain the core which is used to support the crown. Restoring the entirety of coronal hard tissues of non-vital molars and premolars is a challenge in prosthodontic crown therapy. In severely decayed root canal treated teeth, the necessity for using root canal posts is broadly accepted[1]. For many decades, it was stated that root canal posts should reach up to the apical third of the root in order to provide sufficient retention and stabilise the weakened radicular tooth substance[2,3]. Luting shorter posts to the root canal dentin has shown to provide sufficient retention for coronal restoration while minimising the risk of perforation[4]. Coronal retention of the restoration is usually compromised, thus intraradicular posts combined or not with the core materials may be required[5]. Despite all clinical success advised with the use of intraradicular posts, one disadvantage of this system is the additional removal of the radicular dentin needed for fitting the post into the canal which affect the overall biomechanical behaviour of the restored teeth[6-7]. Moreover, bonding in the coronal part of the root proved to be more efficient and more predictable than bonding in deeper regions[8].

Currently available adhesive techniques permit the use of alternative treatment modalities for the restoration of endodontically treated teeth, that includes endocrown and compo-core. With the evolution of CAD/CAM ceramic systems, endocrowns can be considered as a feasible alternative to full crowns for restoration of non-vital posterior teeth, especially those with minimal crown height but sufficient tissue available for stable and durable adhesive cementation[9]. Endocrown utilizes a circular butt-margin and a central retention cavity inside the pulp chamber, lacking intraradicular anchorage. The endocrown provides full occlusal coverage and the use of the pulp chamber increases the available surfaces for adhesion[10].

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The use of direct restorations without placing any post for restoring such teeth has also been advocated. Coronal-radicular stabilization of endodontically treated teeth can be accomplished by condensing amalgam into the pulp chamber and 2-4 mm into the root canal space. The amalcore technique utilizes amalgam in the large and retentive contours of the root canal orifices and the pulp chamber to provide a monoblock foundation (Nayyar’s technique). Another option of intra-canal anchorage based on this principle is restoration with a composite radicular retention[11-13]. This paper describes a series of cases of endodontically treated teeth restored with endocrowns and compocore.

**Case reports**

**Case 1 (Endocrowns)**

A 26-year-old male patient reported to the Department of Prosthodontics and Crown and Bridge, PDM Dental College and Research Institute for restoration of his lower 2nd molar on left and right side of mouth. On clinical examination tooth number 37 and 47 were found to be root canal treated one and a half months back. Both the teeth were asymptomatic and the occluso-gingival height of the remaining crown structure was approximately 2.5mm for 37 and 3 mm for 47 [fig. 1 (a)]. A conservative approach of restoring the tooth with an endocrown was decided as the treatment option as more than half of the tooth structure was remaining.

After removal of the restoration, preparation for endocrown was started on both the teeth (37, 47) simultaneously [fig (b)]. The preparation consisted of a circular equigingival butt-joint margin and central retention cavity into the entire pulp chamber constructing both the crown and the core as a single unit. Adequate preparation of the buccal and lingual walls was done[11]. Occlusal clearance of 2mm was achieved. Shade selection was done by using VITA shadeguide(VITAPAN Zahnfabrik, Germany). Polyvinyl siloxane (Addition silicone) impression material (AquaSil LV, Putty/Light body, Dentsply DeTrey, Germany) was used to make impression by putty wash technique. The fabrication of die stone model was done and fabrication of Monolithic Zirconia endocrown (Lava 3M ESPE) was done. The finished endocrown was checked for shade, fit and occlusal contacts were checked in various excursive movements in patient’s mouth and then cemented using dual-cure resin luting cement(Rely X U200, 3M ESPE)[fig 1(c),d),(e),(f)].
Case 2 (Compo-core technique):

A 56-year-old male patient reported to Department of Prosthodontics, Crown and Bridge for replacement of missing maxillary right first premolar. On examination, 15 was found with three remaining walls ≥1mm (Class II) and missing mesial wall.[15] [Fig. 2 (A)] On radiographic examination, 15 was found to be endodontically treated. The treatment plan consisted of fabrication of 3-unit porcelains-fused-to-metal FPD after reinforcing the root-canal treated 15 with compo-core technique. Gutta percha was removed from the pulp chamber and 2 mm of the canal by using piezoreamer and endosolve (Septodont)[Fig. 2 (b)]. After post space preparation, dentin surface was etched with 37% phosphoric acid (Echo Etch, Ivoclar Vivodent) for 10 seconds and washed with water for 15 seconds and dried with absorbent points. 5th generation bonding agent (Te-Econom Bond, Ivoclar vivadent) was applied with microbrushes on the conditioned radicular dentin and walls of pulp chamber. [Fig. 2 (C),(D)] Light curing was done for 20 seconds from occlusal buccal and palatal direction with LED (Dentomed light cure) after this, the post space was completely filled with flowable composite(Tetric N Ceram, Ivoclar vivadent) and core build-up was done with bulkfill composite(Ivoclar Vivadent).[Fig. 2(C),(D)] Then, tooth preparation was done on tooth 13 and 15. Impression was made in Polyvinyl siloxane(Addition silicone) impression material(Aquasil LV, Putty/Light body, Dentistry DeTrey, Germany) by putty-wash technique. The model was poured and a 3-unit fixed partial denture was fabricated. Bisque trial was done for occlusal correction and then after glazing, final cementation was done with Glass-ionomer cement(GC Fuji I Luting).[Fig. 2(E)]
Fracture strength of endocrown increases when luted with resin cements (Rely X U200, 3M ESPE)\textsuperscript{14}.

Furthermore, intracanal composite anchorage (compocore) is also a good alternative to post and core systems for restoring severely compromised posterior teeth with the pulpal chamber and the canal system orifice offer adequate retention for the restoration. As studies have shown that proportion of favourable fractures increase with the use of only composite in intraradicular anchorage. Also, some studies suggest that intracoronal anchorage with composite may be regarded as a valuable time saving alternative for non-adhesive post cementation\textsuperscript{13}.

**Conclusion**

Endocrown and compocore may perform similarly or better than the conventional treatments using the intra-radicular posts. Endocrown requires the adhesive intracanal anchorage to a 3mm pulp chamber depth, for anchorage. While compocore requires depth of 3mm using resin composite only.

**References**

CASE REPORT


Infected OKC mimicking radicular cyst: A case report

Kaur G.¹, Pandey A.²

Abstract:
Odontogenic Keratocyst (OKC) is a developmental non-inflammatory odontogenic cyst which is proposed to be arising from cell rests of dental lamina. Among the jaw cysts OKCs account for the third most common odontogenic cyst following radicular and dentigerous cyst. Most of the studies have stated that posterior part of mandible as the most common site, but there are inconsistencies regarding the promonent location of OKCs in the maxilla. Most cases are diagnosed on routine radiographic examination as these tend to expand anterio-posteriorly within the medullary spaces without causing any bony expansion or other symptoms. At times the lesion may become secondarily infected and become symptomatic. Here we report of one such case which was provisionally diagnosed as a draining abscess. According to WHO reclassification, this cyst is now considered as Keratocystic Odontogenic Tumor (KCOT) because of its neoplastic nature.

Key words: KCOT, infected dental cyst, odontogenic cyst.

Introduction:

Odontogenic keratocyst (OKC) was categorized as a form of odontogenic tumor in 2005 by a WHO working group. WHO defined OKC as “a benign multicystic, intraosseous tumor of odontogenic origin, with a characteristic lining of parakeratinized stratified squamous epithelium and potential for aggressive, infiltrative behavior”¹. It is of great interest to dentist because of its high recurrence rate and its ability to grow to a large size before it manifests in oral cavity. It is one of the most common cysts in the oral cavity with a frequency of 5-11%. The term OKC was first introduced by Philipsen in 1956. Although the term only indicates the formation of keratin and is non-specific, as keratin formation may be seen in radicular cyst also and in dentigerous cyst as result of metaplasia. It has been suggested to be considered as benign tumor hence renamed as keratocystic odontogenic tumor (KCOT)²,³.

Malignant transformation into squamous cell carcinoma is unusual. There exists a second variant of OKC, the orthokeratocyst, which is less aggressive and occurs less frequently (12% of OKC) but is still classified as an odontogenic cyst³.

The odontogenic keratocyst is often associated with Gorlin-Goltz syndrome and is characterized by the presence of multiple nevoid basal cell epitheliomas, multiple keratocysts in jaws, and bifid ribs². Most cases are diagnosed on routine radiographic examination as these tend to expand anterioposteriorly within the medullary spaces without causing any bony expansion or other symptoms. The most common clinical symptoms are swelling, discharge, and pain but in most cases OKC may be asymptomatic: the frequency of a casual diagnosis ranged between 5.5% and 42.5%²,⁴,⁵,⁶.

Case report:
A 52 year old male patient reported to the dental clinic with pain and discharge from mandibular right posterior region. He had no relevant past medical history nor any positive habit history. On intraoral examination 47 and 48 were mobile but not carious.

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IOPA showed minimal interdental bone loss with periapical radiolucency in relation to 48. (Photograph 1) The dental surgeon extracted the mobile teeth and sent the periapical tissue for histopathologic examination.

The periapical tissue was routinely processed and H & E stained sections showed tissue from a cystic lesion. The lumen was filled with eosinophilic material resembling keratin with inflammatory infiltrate (photomicrograph 2).

The epithelium lining the cystic space showed proliferation in an arcing pattern in most areas and enclosed a connective tissue with intense inflammatory infiltrate (Photomicrograph 3).

The report was sent to the dentist and an OPG was advised. It revealed multilocular radiolucencies in the molar ramus region (Photograph 5). The patient was counseled and
referred to an oral surgeon for further treatment.

Photograph 5. Showing OPG with multilocular radiolucency in mandibular right molar ramus region

Discussion:
Differential diagnosis represents an important and complex phase of clinical process. Diagnosis can often be no more than hypothetical, despite thorough anamnesis, accurate clinical analysis, and instrumental examination[2,3].

A radiolucent lesion, located in the mandibular area, can be more or less aggressive in nature (myxoma, ameloblastoma, keratocyst, etc). Differential diagnosis must therefore be executed in order to accurately identify the lesion[2,3].

Odontogenic cysts are the most common form of the cystic lesions that affect maxillofacial region. OKC is so called because of its ability to produce keratin which gradually fills the cyst lumen. The first to point out the neoplastic potential of OKC was Toller. In 1967, Toller suggested that OKC may best be regarded as benign neoplasm rather than conventional cyst based on its clinical behavior[2,3].

KCOT was included in the list of benign odontogenic tumors derived from odontogenic epithelium with mature fibrous stroma without odontogenic ectomesenchyme. World Health Organisation (WHO) defined it as a benign uni or multi cystic, intra osseous tumor of odontogenic origin, with a characteristic lining of parakeratinized stratified squamous epithelium and potential for aggressive, infiltrative behavior.

KCOT occurs over a wide age range with peak incidence in second and third decades. Distribution between genders varies from equality to a male to female ratio of 1.6:1, except in children.

KCOT tend to involve mandible much more frequently than maxilla. 73% cases occurring in third molar to ramus region.

The radiographic findings, although highly suggestive, are not diagnostic. The radiographic findings in KCOT may simulate those of dentigerous cyst, ameloblastoma, radicular cyst etc. Radiographically, KCOT may appear as small, round ovoid, well defined radiolucency, usually with corticated margins, which can be either unilocular or multilocular.

There is a consensus that the histologic diagnosis of KCOT is straight forward. Typical histologic features of KCOT have been well characterized by Philipsen and Browne as: thin uniform lining of stratified squamous epithelium with a tendency to detach from underlying connective tissue capsule; a thin corrugated surface layer of parakeratin; a spinous cell layer 4 to 8 cells in thickness often showing intracellular oedema; a regular layer of columnar basal cells with nuclear palisading; a flat epithelial fibrous tissue junction, usually devoid of epithelial rete ridges; and relatively thin fibrous capsule that mostly lacks inflammatory cell infiltrate. The final diagnosis of KCOT requires proper clinical radiographic and histopathological coordination[2,3,7,8].

Conclusion:
The difficulty of diagnosing KCOT based upon clinical features, radiographic features has well recognized in other studies and was confirmed in this case. However, final diagnosis must always be done based upon microscopic examination which is the gold standard for the diagnostic dilemma.

REFERENCES:


CASE REPORT

Class 1 with severe crowding- A case report

Singh G.¹, Malik A.², Walia P.S.³, Kumar A.⁴

Abstract:
This case report describes the treatment of a 12-year-old boy from Delhi having Class I malocclusion with Class II skeletal base. The main issue in determining the appropriate treatment plan was procumbent and everted lips. Four first premolars were extracted to reduce lip procumbancy. The change in the patient’s facial esthetics was dramatic. Significant retraction of the upper and lower lips was achieved, and lip eversion was significantly improved.

Key words: Class I malocclusion, crowding

Introduction:
Dental crowding can be defined as a disparity in the relationship between tooth size and jaw size which results in imbrications and rotation by the presence of mesial component of force[1]. In treating a Class I malocclusion by means of comprehensive orthodontics, there are two main therapeutic approaches: extraction and non-extraction[2]. The main goal of orthodontic treatment is to obtain a normal relationship of the teeth with facial structures and it is generally accepted that orthodontic treatment will have some sort of an effect on facial proportions[3].

The present case report describes the extraction orthodontic treatment of a class I malocclusion patient who had severe maxillary and mandibular arch crowding and anterior cross bite.

Case Report:
A 12-year-old male patient reported to the Orthodontic Department with the chief complaint of forwardly placed upper front teeth. There was no remarkable dental history and his general history showed no contraindication to orthodontic treatment.

Diagnosis and Etiology:
Extraorally: The patient had a normal facial form with no asymmetries but exhibited severe convex profile and excessive vermilion show of the upper and lower lips. He had procumbent and everted upper and lower lips, deep mentolabial sulcus, and lip strain on closure (fig. 1).

Intraorally: He presented with Angle class I malocclusion with anterior crowding in both the arches and right lateral incisor in crossbite (fig. 2). He showed an overjet and overbite of 4mm and mandibular midline shifted towards the left by 1mm. Oral hygiene was satisfactory and soft tissue analysis indicated that he had protrusive lips (table. 1).

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The panoramic radiograph (fig. 3) showed no evidence of bony pathology. All 32 teeth were present. The lateral cephalometric radiograph (fig. 3) and analysis (table 1) showed a skeletal class II malocclusion (ANB = 8°) with proclined and forwardly placed mandibular anteriors (Md1 − NB = 34°/10 mm, interincisal angle = 117°). As evidenced by the SN-mandibular plane angle of 35° and FMA of 28°, the skeletal pattern was hyperdivergent. Study model analysis showed 9 mm space requirement in maxillary and mandibular arch.
**Case Report**

**Dental Angle (Ar-Go-Me)**

<table>
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<td>34°/10mm</td>
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<tr>
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<td>6mm</td>
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<tr>
<td></td>
<td>Upper lip to Steiner’s S line</td>
<td>5mm</td>
<td>3mm</td>
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<tr>
<td></td>
<td>Lower lip to Steiner’s S line</td>
<td>9mm</td>
<td>9mm</td>
</tr>
</tbody>
</table>

**Gonial Angle (Ar-Go-Me)**

- 140°
- 136°

**A:** A point; **B:** B point; **IMPA:** Incisor-mandibular plane angle; 
**M×1:** Maxillary central incisor; **Md1:** Mandibular Central incisor; **MP:** Mandibular plane; **N:** Nasion; **Pg:** pogonion; **S-Sella**

### Treatment Objectives and Treatment Plan:

The treatment objectives included:

1. Achieving good and stable dentoalveolar changes,
2. Maintaining the pleasing profile,
3. Maintaining the Class I molar and canine relation bilaterally,
4. Relieving of maxillary and mandibular crowding,
5. Correction of anterior cross bites,
6. Achieving ideal overjet/overbite.

In summary, based on clinical examination, cephalometric findings and study model analysis treatment plan was to extract the 4-th premolars and maximum retraction of anterior teeth with maximum anchorage control to decrease the dentoalveolar protrusion and improve the soft tissue balance.

### Treatment Progress

A 0.022 inch MBT pre-adjusted edgewise appliance was used. Initially, the maxillary and the mandibular arches were banded and bonded. For anchorage Nance holding arch in the maxillary and lingual arch in the mandibular arch was given. After the first premolars were extracted, 0.016 inch NiTi archwires were ligated in the maxillary and the mandibular arches for initial alignment (fig. 4).

Subsequently, in the maxillary arch, 16×22 NiTi, 17×25 Niti, 19×25 NiTi and 0.018-in stainless steel archwires were progressively installed every 30 days. Once the 0.018-in Australian steel wire had been installed, open springs were compressed between teeth #11 and #13 to create space between them for #12. 0.012-in NiTi was then used as a piggy back wire on the main arch wire to bring the right
lateral incisor labially. Bite was also raised to correct the crossbite (fig. 5). Once correction was achieved 17x25 SS, followed by 19x25 SS was used for individual torque control and treatment finishing.

In the mandibular arch the maloccluded teeth were corrected by progressively installing 16x22 NiTi, 17x25 NiTi, 19x25 NiTi and 19x25 stainless steel wires for individual torque control and treatment finishing.

**TREATMENT RESULT**

After 20 months of treatment, the change in the patient’s facial esthetics was the most dramatic part of his treatment. With extraction of the first premolars, the canines and mandibular incisors were retracted along with significant retraction of his upper and lower lips. His lip eversion and dentoalveolar protrusion were improved. In addition, as the upper and lower lips were retracted, mentalis strain was reduced, which improved his chin projection (fig. 6).

Posttreatment Intraoral photographs, study models, and lateral cephalogram and analysis (figs. 7-8 and table 1) showed that the maxillary and mandibular incisors were inclined appropriately, and their position significantly improved when compared with the start of treatment. Cephalometric analysis showed maintenance of skeletal divergence (table 1). The panoramic radiograph (fig. 8) showed adequate root parallelism in the maxillary and mandibular arch.
Retention:
Maxillary and mandibular removable Hawleys retainers were delivered at the completion of active treatment. Instructions for the removable retainers were 24 hr/day for the first year, then nighttime wear for 6 months.

Discussion:
On the basis of the patient’s chief complaint and the diagnosis of the malocclusion, extracting the maxillary and mandibular first premolars was indicated. When extracting premolars is desired to correct the malocclusion, the treatment plan must address space closure of the extraction sites. Anchorage control in hyperdivergent growth pattern patient is critical due to weaker musculature\(^4\), and very weak occlusal forces\(^5\) so Nance holding arch and lingual arch were used in the maxillary and mandibular arch respectively. Lacebacks and bendbacks were given for anteroposterior anchorage control during leveling and aligning.

Conclusion:
In this patient with procumbent upper and lower lips, excessive lip strain, and crowded maxillary and mandibular incisors, and vertical growth pattern an acceptable treatment result was obtained with 4-first-premolars extraction plan. Treatment was completed in
20 months. The patient’s profile was improved, with reduction in lip procumbency, decrease in lip eversion and protrusion, and decreased mentalis strain. Dentally, the interincisal angulation improved significantly because both the maxillary and the mandibular incisors were uprighted after space closure.

Reference:


Lateral dermoid cyst of submandibular region- A case report

Nagpal I.1

Abstract:
Dermoid cysts located in the lateral cervical region are relatively rare. We describe a case of a lateral sublingual dermoid cyst in a 22 year-old girl. This girl presented with double chin for cosmetic reason. The lesion was a painless and slowly enlarging mass of the right submandibular region. Intraorally, there was no obvious swelling. There is always a difficulty of making a correct diagnosis of these lesions with clinical examinations and conventional radiography. To achieve a diagnosis and to develop correct surgical strategy specialized imaging examinations such as ultrasonography, computed tomography, Magnetic Resonance Imaging and histopathological examination should be carried out. In our case, ultrasonography demonstrated as subcutaneous mass. FNAC showed lipomatous growth. Intraoperatively, it was found to be a dermoid cyst, and was documented to be lateral in position. Histopathology revealed a cyst containing a keratinizing stratified squamous epithelial lining. Based on the radiographic and clinicopathological findings, the patient was finally diagnosed as having a lateral dermoid cyst.

Key words: Lateral sublingual dermoid cyst, Neoplasm, cystic hygroma, Ranula

Introduction:
The dermoid cyst is an uncommon clinicopathological lesion of developmental origin which describes three histologically closely related lesions: dermoid cyst, epidermoid cyst and teratoma. Epidermoid and dermoid cysts are benign nature, which may occur anywhere in the body, but most predominantly in the ovary and scrotal regions.[1] Only about 7% are found in the head and neck region. The floor of the mouth is the second most common site in the head and neck region after the lateral eyebrow as these are the sites of embryonic fusion. The occurrence in oral cavity is approximately 1.6%. The floor of the mouth is one of the most commonly affected areas, however, these cysts can also be found in the tongue, lips, buccal mucosa and jaw bones.[2,3] Dermoid cyst is even rare in lateral sublingual situation. Very few cases have been reported. The dermoid cyst is an uncommon clinicopathological lesion of developmental origin which describes three histologically closely related lesions: dermoid cyst, epidermoid cyst and teratoma. Epidermoid and dermoid cysts are benign nature, which may occur anywhere in the body, but most predominantly in the ovary and scrotal regions.[1] Only about 7% are found in the head and neck region. The floor of the mouth is the second most common site in the head and neck region after the lateral eyebrow as these are the sites of embryonic fusion. The occurrence in oral cavity is approximately 1.6%. The floor of the mouth is one of the most commonly affected areas, however, these cysts can also be found in the tongue, lips, buccal mucosa and jaw bones.[2,3] Dermoid cysts are derived from epithelial rests that are included during midline union of the first and second branchial arches.

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The vast majority of dermoid cysts of the floor of mouth (DCFOM) are located in the midline (sublingual 52%, submental 26%), 16% involve more than one of the three possible spaces in the floor of the mouth region (submental, sublingual, submandibular), and only 6% are situated exclusively in the submandibular space where they appear to be lateral neck cysts.[4] However, the origin of lateral dermoid cyst remains somewhat of a riddle. Other common benign cystic lateral cervical masses are typically soft, slow-growing and painless, making clinical distinction difficult. An accurate diagnosis is of course necessary for the choice of treatment plan. Advanced imaging techniques such as magnetic resonance imaging are useful to achieving this end, leading to successful and uneventful management of such lesions. The final diagnosis of a dermoid depends on histologic investigation of its cyst wall.

This case report describes a relatively rare case of a true lateral sublingual dermoid cyst arising in the left submandibular region, and discusses the etiology, differential diagnosis and clinical management of a lateral dermoid cyst.

**Case Report:**

A 22 year old female patient reported to our department with double chin for cosmetic reason on middle line to slightly left side since one and half years. Initially the swelling was small with gradual increase to resent size. Patient had no history of pain in the mass. On examination, obvious facial asymmetry was seen with extraoral painless swelling on left midline to submandibular region with no associated swelling intraorally. The edges were indistinct, surface was smooth, soft in consistency, non tender, compressible, fluctuant in nature and overlying skin was normal in colour and there was no rise in temperature. The swelling was freely mobile and not attached to the underlying tissues. No sinus or fistula was evident. There was no cervical ymphadenopathy. Her past medical and dental history were not relevant.

Based on the clinical findings, the differential diagnosis of the lateral cervical mass included cystic masses like cystic hygroma, thyroglossal duct cyst, plunging ranula, branchial cleft cyst; benign or malignant salivary gland tumours, infectious or inflammatory processes, lipoma, lymphoma. Dermoid cyst was not considered in the differential diagnosis of lateral cystic mass. All routine laboratory investigations were normal. Secondly, FNAC was performed which revealed white granular cheesy material and the presence of epithelial remnants, desquamated tissue and cellular debris which pointed to be a diagnostic hypothesis of lipomatous mass.
Fig.3: Ultrasonography shows subcutaneous mass of appr.

Fig.4: Submandibular incision.

Fig.5: Cyst floor.

Fig.6: Macroscopic view of excised specimen.

Fig.6: Microscopic examination revealed a cyst inside a thick, fibrous capsule lined by stratified squamous epithelium with marked orthokeratosis. A few sebaceous glands were seen lying in the subepithelial stroma. No malignancy was seen. Enucleation of cyst under local anaesthesia was done by submandibular approach. The specimen received was yellowish in color; soft tissue mass with 4cm × 4m × 3 cm in dimension. On palpation it had dough-like consistency. It had a thin walled capsule surrounding, with a cheesy whitish material inside. The excised specimen was sent for histopathological examination.

Microscopic examination revealed a cyst inside a thick, fibrous capsule lined by stratified squamous epithelium with marked orthokeratosis. A few sebaceous glands were seen lying in the subepithelial stroma, which established the diagnosis of dermoid cyst. No malignancy was seen.

On follow-up, the incision was healed well with good cosmetic result. Post-operative recovery was uneventful throughout follow-up period of one year and no recurrence was observed.

**Discussion:**

Dermoid cyst are unusual, but well recognized lesions in the head and neck. In the region of the oral cavity, they are present as solitary, painless, slow growing mass in the floor of the mouth but in occasion, they can be situated in submental and submandibular space[5,6]. There are three theories of etiology of dermoid cyst:

i) Congenital inclusion of dermal and epidermal elements of germ layers in deeper tissues along the embryonic lines of fusion,

ii) Acquired traumatic implantation of dermal and epidermal elements of surface epithelium which may proliferate and keratinize

iii) Growth from rest of totipotent cells displaced from the blastomere.[7]

Histopathologically, the terms "dermoid" or "dermoid cysts" have been used as umbrella titles to describe the three subtypes of these congenital cysts containing keratinous squamous material. Epidermoid cysts or epidermal inclusion cysts are lesions lined with a simple squamous epithelium with no adnexal structures. True dermoids are stratified.
squamious epithelial-lined cysts that contain skin adnexal structures, including hair, hair follicles, sebaceous and sweat glands. Finally, teratoid cysts are masses lined with a variety of epithelia, including stratified squamous and ciliated respiratory epithelia, and contain elements of ectodermal, endodermal and/or mesodermal origin [8]. Leveque et al. [9] regard lateral Dermoid Cysts as merely median Dermoid Cysts that have migrated during their expansion because such cysts frequently have fibrous attachments to deep structures or those surrounding the midline of the mandible such as genioglossus, geniohyoid, mylohyoid, digastic, and platysma muscles; these attachments mark the path taken in cyst migration. Indeed, a lot of reported cases have been considered to have migrated from median DCs, suggesting that a true lateral DC does not exist in reality [8,9,10,11,12]. As acquired DCs arise from epithelium implanted during trauma, it is more plausible that they can occur at sites away from the midline. However, in our case, the whole of the lesion lay in the submandibular region without traces of migration from the medial region. Likewise, some investigators have reported true lateral DCs existing in the submandibular region [13,14,15] Generally, DCs are classified into 3 types by their anatomical position [8,10]: (1) median; developing between the genioglossus muscle, (2) lateral sublingual; developing between the genial muscles and mylohyoid, (3) true lateral; developing between the genioglossus and hyoglossus medially and the mylohyoid laterally. According to this classification, the cyst in our case was type (3) spreading laterally inferior to the mylohyoid muscle to its present position in the submandibular region. Likewise, some investigators have reported true lateral DCs existing in the submandibular region [13,14,15] Generally, DCs are classified into 3 types by their anatomical position [8,10]: (1) median; developing between the genioglossus muscle, (2) lateral sublingual; developing between the genial muscles and mylohyoid, (3) true lateral; developing between the genioglossus and hyoglossus medially and the mylohyoid laterally. According to this classification, the cyst in our case was type (3) spreading laterally inferior to the mylohyoid muscle to its present position in the submandibular region. Although the origin of true lateral DCs is somewhat of a riddle, it has been thought that they probably arise from the ventral end of first pharyngeal pouch or from the extreme ventral end of the first branchial cleft [11,16]. The differential diagnosis of a lateral submandibular mass should include cystic masses like cystic hygroma, enteric duplication cyst, thyroglossal duct cyst, branchial cleft cyst, neoplasms, odontogenic or mucus extravasation masses, infectious or inflammatory processes as well as salivary gland pathology [13,14]. Fine needle aspiration cytology, ultrasound, CT and MRI provide essential information on the cyst location that allows optimal preoperative planning.

Ultrasonographic findings comprise solid and cystic structures within a heterogeneous mass.[17] On CT scans, the dermoid cyst appear as moderately thin walled, unilocular masses filled with an homogeneous, hypoattenuating fluid substance with numerous hypointense fat nodules giving the pathognomonic “sack-of marbles” appearance.[18] MRI of dermoid cysts give variable signal intensity on T1-weighted images and are usually hyperintense on T2-weighted images and are of considerable importance in depicting the relationship of cystic mass and muscles of floor of the mouth. MRI has been reported to be superior to other imaging modalities in demonstrating the exact location and extent of cystic lesions. This in turn aided surgical planning. While FNAC biopsy of dermoid cysts may provide sufficient diagnostic material, this method is complicated by potential sampling bias, given the copious keratinaceous cyst contents and relatively scarce epithelium-lined cyst wall. Needle biopsies of a dermoid cyst will often yield inconclusive, variable or non-diagnostic results. Imaging modalities are valuable to distinguish these lesions for a provisional diagnosis. In the case report described here, ultrasonography and FNAC shows inconclusive.

Treatment comprises surgical excision. The lesions can be exposed by intraoral or extraoral approach depending upon its location in relation to mylohyoid muscle. Lateral Dermoid cyst of the submandibular or sublingual space and are most conveniently excised via submandibular approach.[13] Large lesions may require both intraoral and extraoral incisions to provide direct visualization. In our case, surgical excision was done under local anaesthesia via submandibular approach. Recurrences are unusual after total surgical excision.[18,19]. The present case was approached surgically by a submandibular approach.

Intraoperative it showed to be lateral in position. Histologic examination established a diagnosis of Dermoid Cyst. All true dermoid
cysts are lined by epidermis with the presence of adnexal structures such as sweat glands, sebaceous glands, hair follicles. In our case it was lined by sebaceous glands confirming the diagnosis. 5% rate of malignant transformation of the teratoid variety of oral dermoid cysts has also been reported in literature.[18] In our case though the lesion was long standing, there was no evidence of malignant transformation. The patient is under review since last one year without any recurrence.

**Conclusion:**

Laterally situated dermoid cysts are rare lesions but should nevertheless be considered in the differential diagnosis of any lateral oral cavity or cervical lesion in both adult and pediatric patients. FNA interpretation is limited due to the cystic nature of these masses. Ultrasonography may be inconclusive. Radiologic imaging, in particular MRI, may provide nearly pathognomonic xenotypic findings that arevaluably diagnostic and may influence surgical planning. Surgical excision is curative, and recurrences are rare.

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Management of radicular cyst: A case report

Mehlawat K.1

Abstract:
Traumatic injuries to the teeth are relatively common, usually involving the anterior teeth of young patients. Such trauma is often followed by pulpal necrosis. If microbial infection occurs, a periapical lesion may develop, possibly evolving into a chronic inflammatory lesion (e.g., granuloma, periapical cyst or scar tissue) [1]. Periapical or radicular cysts are inflammatory jaw cysts affecting teeth with infected and necrotic pulp[2]. Radicular cysts are common odontogenic cyst. It involves the apex of carious tooth. It is a true cyst, since the lesion consists of pathologic cavity lined by epithelium and is often fluid filled[3].

Key words: Radicular cyst, surgical enucleation, marsupalization.

Introduction:
Cyst is defined as a pathologic epithelium lined cavity usually containing fluid or semi-solid material. Odontogenic cysts are derived from the epithelium associated with the development of dental apparatus. Several types of cyst may occur depending on the stage of odontogenesis during which they originate. Odontogenic cysts are derived from (1) Tooth germ (2) Epithelial rests of malassez (3) Reduced enamel epithelium of a tooth crown (4) Remnants of dental lamina or (5) possibly the basal layer of oral epithelium. Very few cases are seen in the first decade of life, after which there is a fairly steep rise, with a peak frequency in the third decade. Radicular cysts are rare in the primary dentition, representing only 0.5–3.3% of the total number in both primary and permanent dentitions[4].

Case report:
A 19 year old male patient reported to Deptt of Oral & Maxillofacial Surgery, PDM Dental College with swelling in upper left anterior part of oral cavity from past 3 months, which slowly increased to present size. On clinical examination swelling measured was about 2×2 cm extending from ala of the nose anteriorly to the 3cm away from tragus of ear posteriorly, superio-inferiorly from the nasolabial fold to the upper border of lip. Swelling was non fluctuant, soft in consistency. There was no raise in temperature, no change in color of overlying skin and no pus discharge. Teeth 21 were tender on percussion and 22 was non vital (tested with electric pulp tester). Maxillary occlusal view radiograph was taken that showed well defined radiolucency measuring approximately 2×4 cms involving apex of 21 and 23.

In the present case a definitive diagnosis of cyst was made i.r.t 21, 22, 23 on radiographic examination but the final call for type of cyst was left to histopathologic report. Treatment plan comprised of root canal treatment and cyst enucleation for which consent was taken from the patient. Root canal treatment was carried up till biomechanical preparation and remaining stages of root canal treatment carried out following surgical cyst enucleation as there was continuous drainage of yellowish color fluid from the canal of infected teeth and the chances of recurrence are more if the cysts remnants remained.

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Cyst enucleation procedure: Lignocaine with 2% adrenaline injected to anaesthetize the operating site. Crevicular incision was placed on palatal aspect extending from 11-24 to reflect full thickness flap that exposed a wide labial bone defect (fig. 1).

Fig 1. Reflected full thickness flap.

Cyst lining excavated along with its content. Obturation of tooth was done along with apisectomy. Large labial bone defect measuring about 2 by 2 cm (fig. 2) was filled with PRF after thorough curettage was done. Flap closure done with 3-0 silk suture (fig. 3).

Fig 2. Reflected full thickness flap showing wide labial defect.

Fig 3. Flap closure done with 3-0 silk suture.

Specimen sent for histopathological examination which confirmed radicular cyst (fig. 4). Patient follow up was done after 24 hrs 3rd and 7th day. No complication was observed.

**Discussion:**

Radicular cyst also known as periapical cyst, periodontal cyst, root end cyst or dental cyst, originates from epithelial cell rests of malassez in periodontal ligament as a result of inflammation due to pulp necrosis or trauma. Radicular cysts have an incidence of 0.5-3.3% of the total number in both primary and permanent dentition. Most of the cases of radicular cyst show a clear male predilection (1.3 times more frequent in men), which explains their increased tendency to trauma, the poor oral hygiene, caries and retention of carious teeth.

Fig 4: Specimen sent for histopathological examination which confirmed radicular cyst

Histopathologically it shows disrupted bits of nonkeratinized stratified squamous epithelium over a delicate connective tissue stroma with intense chronic inflammatory cell infiltrates consisting of lymphocytes, foamy macrophages and multinucleated giant cells. Rushton bodies were noted. These bodies are thought to represent eosinophilic straight, rounded or curved irregular structures with an epithelial lining. They probably develop when secretory products of odontogenic epithelium are deposited on particulate matter, such as cell
debris or cholesterol crystals, in the cyst wall[5].

The treatment of choice is dependent on the size and localization of the lesion, the bone integrity of the cystic wall and its proximity to vital structures[6]. Two techniques can be used in clinical practice for surgical removal of cysts: enucleation and marsupialization. Enucleation is defined as a complete removal of the cystic lining with healing by primary intention while marsupialization is synonymous with Partsch’s operation, and is the conversion of a cyst into a pouch, it requires considerable aftercare and patient cooperation in keeping the cavity clean whilst it resolves and heals by relieving the internal pressure, it is indicated when cyst is in close proximity to vital structures and where there is significant risk of injury with enucleation .The marsupialization concerns not only the radicular cysts, also follicular cysts can be treated by this technique in order to conserve and guide the eruption of permanent teeth[7].

To conclude, a radicular cyst is a common condition found in the oral cavity. However, it usually goes unnoticed and rarely exceeds the palpable dimension[6]. Squamous cell carcinoma may occasionally arise form epithelium lining of radicular cyst. Kay and Kramer (1962) reported squamous cell carcinoma form residual cyst[9]. It suggest that the treatment of the radicular cysts should be defined according to the clinical and radiographic evaluations according to each case[10].

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Low Grade Mucoepidermoid Carcinoma: A case report

Manisha

Introduction:

Mucoepidermoid carcinoma (MEC) is believed to arise from the reserve cells of excretory ducts, and the tumor consists of three cell types: epidermoid cells, mucous cells and poorly differentiated intermediate cells. MEC displays a variety of biological behaviors, and that while the high-grade MEC is a highly aggressive tumor, its low-grade counterpart usually demonstrates a more benign nature. Several systems have been proposed to grade this neoplasm, but none has been universally accepted. A recent grading schema (Goode’s grading) proposed by Auclair et al. and Goode et al. has been shown to be reproducible and to be predictive of the patient’s outcome by defining low, intermediate and high-grade tumors using five histopathologic features. However, some patients with low-grade MEC according to Goode’s grading at its early stage have occasionally developed distant metastases. MEC is usually associated with salivary glands and comprises 5–10% of all salivary gland tumors. Steward and associates described its mucous-secreting and epidermal cellular elements thus establishing it as a distinct pathologic entity. The palate was the most common site for minor salivary gland involvement, accounting for 41.1% of intraoral lesions.

Case Report: A 55 years old male patient reported with chief complaint of a painless swelling on the left side of hard palate extending from 27 & 28 region. The swelling was round in shape with well-defined borders measuring 2.5cm × 3cm. On palpation the swelling was soft in consistency. Patient had a medical history of loss of memory for 2-4 months, 20-40 years back and taking medication for the same. There was a history of smoking 15-20 bidi per day since 30 years. Intraoral periapical radiograph was taken that revealed ill-defined radiolucency involving the distal aspect of coronal and radicular portion of 27 & 28 and bone loss. A provisional diagnosis of Radicular cyst? / Uniocystic ameloblastoma?? / Salivary gland tumors / malignancies?? was made. An incisional biopsy was performed for histopathological evaluation.
On histopathological examination sections revealed islands of dysplastic epidermoid cells and interspersed mucus cells and numerous intermediate cells. Small cystic areas in islands were also noticed. The epidermoid cells showed nuclear hyperchromatism, altered nucleo-cytoplasmic ratio and scant mitotic figures. Islands were separated by fibrous connective tissue septae consisting of fibroblasts, fibrocytes and blood vessels.

Histopathologically low grade mucoepidermoid carcinoma should be differentiated from salivary cyst, Warthin’s tumor, Pleomorphic adenoma with mucoid stroma and Kuttner’s tumor. [6]

Correlating these histological findings the final diagnosis given was Low grade mucoepidermoid carcinoma.

**Photograph 1:**

Intraoral examination showing round shaped swelling measuring 2.5 cm × 3 cm on left side of posterior hard palate in respect to 27 & 28.

**Photograph 2:**

IOPA showing ill-defined radiolucency involving the distal aspect of 27 & 28.

**Photograph 3:**

Occlusal radiograph showing ill-defined round shaped radiolucency on the distal aspect of 27 & 28 measuring 2.5 cm × 3 cm

**Photomicrograph 4:**

H & E stained section (4 X) showing numerous islands with cystic spaces and intervening connective tissue stroma.

**Photomicrograph 5:**

H & E stained section (10 X) showing islands of epidermoid cells with interspersed mucus cells and intervening connective tissue stroma.

**Photomicrograph 6:**
H & E stained section (10 X) showing island of epidermoid cells surrounded by intense inflammatory infiltrate

Photomicrograph 7:

H & E stained section (40 X) showing cystic spaces in island of epidermoid cells with interspersed mucus cells and numerous intermediate cells

Discussion: Mucoepidermoid carcinoma is a malignant epithelial tumor of salivary glands, first described by Stewart, Foote and Becker in 1945. The tumor is composed of both mucus secreting cells and epidermoid type cells in varying proportions. Columnar and clear cells are also seen and often demonstrate prominent cystic growth. It is the most common malignant neoplasm observed in the major and minor salivary glands. It represents 29–34% of malignant tumors originating in both major and minor salivary glands. This carcinoma of the salivary glands accounts for 5% of all salivary gland tumors. The parotid gland is the most common site of occurrence. Intraorally, mucoepidermoid carcinoma shows a strong predilection for the palate.

Mucoepidermoid carcinoma shows a slight female predilection. It occurs primarily in the third or fifth decades of life, but can occur in virtually all decades. It is the most common malignant salivary gland tumor of children. Prior exposure to ionizing radiation appears to increase the risk of developing mucoepidermoid carcinoma.

The tumor of low-grade malignancy usually appears as a slowly enlarging, painless mass which simulates the pleomorphic adenoma. Unlike the pleomorphic adenoma; however, the low-grade mucoepidermoid carcinoma seldom exceeds 5 cm in diameter, is not completely encapsulated and often contains cysts which may be filled with a viscid, mucoid material. In addition to palate intraoral tumors occur on the buccal mucosa, tongue and retromolar areas. Because of their tendency to develop cystic areas, these intraoral lesions may bear close clinical resemblance to the mucous retention phenomenon or mucocele, especially those in the retromolar area.

The tumor of high-grade malignancy grows rapidly and does produce pain as an early symptom. Facial nerve paralysis is frequent in parotid tumors. The patient may also complain of trismus, drainage from the ear, dysphagia, numbness of the adjacent areas and ulceration, noted particularly in tumors of the minor salivary glands. The mucoepidermoid carcinoma is not encapsulated, but tends to infiltrate the surrounding tissue, and in a large percentage of cases, it metastasizes to regional lymph nodes. Distant metastases to lung, bone, brain and subcutaneous tissues are also reported. [5]

The sections in mucoepidermoid carcinoma are stained with mucicarmine and Periodic acid Schiff's reagent (PAS) to assess the nature of clear cells. The eosinophilic material in cyst like spaces is PAS and mucicarmine positive. Mucus-secreting cells are visualized through mucicarmine staining. The clear cells retain PAS positivity after diastase digestion with a focal positivity for mucicarmine. [7]

Mucoepidermoid carcinoma is characterized by the translocation of chromosomes 11q and 19p resulting in a fusion between the MECT1 ((mucoepidermoid carcinoma translocated-1,) and the MAML2 ((mastermind- like 2) genes. The MECT1-MAML2 fusion protein may activate both cAMP-CERB targets and Notch signaling targets, with the resultant disruption of both cell cycle and differentiation functions.
Since CREB regulates cell proliferation and differentiation, and MECT1 deletion abolishes transforming activity, it is likely that CREB dysregulation mediates tumorigenesis. MECT-MAML fusion transcript is an ancillary test to be performed on paraffin tissue (RT-PCR, FISH). The translocation status is confirmatory support for the diagnostic of MEC, with respect to high-grade tumors and variant morphologies.\(^8\)

In addition, Classical CD44 molecules are intimately involved in the pathogenesis of malignancies such as esophageal cancer, breast cancer, gastric cancer, and prostate cancer. A higher proportion of high-grade tumor tissues showed moderate or strong CD44 staining compared to low-grade tumors. Additionally, CD44 expression was stronger in tumors from patients with recurrences or metastases, but these differences were not statistically significant.\(^9\)

Although typical clinical picture of MEC is reported by various authors; the tumor can show diversity in clinical and histopathological presentation. The benign clinical appearance not only leads to less radical treatment but also risks further complications\(^10\). Thus we present this case of low grade mucoepidermoid carcinoma which may in future guide surgeons for perfect differentiation.

References:
CASE REPORT

‘Laminate veneers, a smile make over’: A case report

Makkar P.1

Abstract:
Veneers are the most frequently prescribed aesthetic restorations today. Ceramic veneers can be offered as the treatment option in a wide variety of different cases such as correcting tooth defects, abrasion, orthodontics, diastema, tooth discoloration, coronal fracture or to adjust occlusion. Before preparing the teeth a complete analysis should be carried out in order to optimize the result. In this way it can be ensured that the teeth being veneered will need only minimal preparation, or in some areas none at all. This paper presents a case report for rehabilitation of discoloured anterior teeth due to dental fluorosis in a 21 year old female patient using ceramic veneers.

Key words: Ceramic veneers, fluorosis, discoloured teeth.

Introduction:

According to the principle of so-called “minimal intervention dentistry” and due to the growing demand of patients for dental esthetics, the use of ceramic laminate veneer has become a widespread, reliable and successful technique for restoring discoloured, worn, malformed, fractured or slightly malpositioned anterior teeth.1 The Glossary of Prosthodontic Terms, defines porcelain laminate veneer as thin ceramic restorations that repair the vestibular face and part of the proximal surface of teeth that demand esthetic interventions.2

Crown preparation involves significant removal of tooth structure (63% to 73%) and may cause pulpal irritation and irreversible pulpotitis.3 Laminate veneers are more conservative than crowns and maintain the biomechanics of the original tooth with similar stress distribution.5 They are also known as “contact lens” veneers.6 They allow for superior translucency and consist of 0.5-1.0 mm thick ceramic bonded to prepared or unprepared teeth with resin cement.7 Increased preservation of enamel promotes a superior bond over dentin, lower post-cementation sensitivity, improved support of the ceramic restoration, and reduced endodontic intervention.8 Due to their excellent clinical performance, outstanding esthetics, and minimal-invasiveness, resin-bonded veneers9 offer an excellent treatment option with an ever-expanding range of indications.10

Features of ceramic laminate veneers:

- Indications11
  1. Stained or darkened teeth.
  2. Hypocalcification
  3. Multiple diastemas
  4. Peg laterals
  5. Chipped teeth
  6. Lingual positioned teeth
  7. Malposed teeth not requiring orthodontics

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• Contraindications

1. Insufficient tooth substrate (enamel for bonding)
2. Labial version
3. Excessive interdental spacing
4. Poor oral hygiene or caries
5. Parafuncional habits (clenching, bruxism)
6. Moderate to severe malposition or crowding

• Advantages

1. Conservative approach
2. Color
3. Bond strength
4. Resistance to abrasion
5. Strength
6. Periodontal health

Case Report:

A 20-year-old female patient reported to the department of Prosthodontics and Crown & Bridge, PDM Dental College & Research Institute, Bahadurgarh with the chief complaint of unpleasant appearance because of her discoloured and fractured upper front teeth. Patient gave a history of discoloration since her childhood and trauma few years ago. Past medical history was unremarkable for any systemic, metabolic, or endocrine condition that may have caused these enamel defects.

The intraoral examination revealed root canal treated tooth #21 Ellis & Davey’s Class III fracture. Teeth 11, 12, 21, 22 had opaque patches, pitting and brownish discoloration representing severe fluorosis according to Dean's fluorosis index.12 13 & 23 had mild opaque patches.

Treatment plan

In the treatment plan following options were given:

1. Tooth whitening and/or enamel microabrasion,
2. Composite veneers and direct composite restoration,
3. Porcelain-fused-to-metal crowns on 11, 12, 21 and 22
4. All-ceramic crowns 11, 12, 21 and 22
5. Full coverage all-ceramic Crown on 21 and laminate veneers on 11, 12, 22.

Various treatment options addressing the patient’s presenting complaint were discussed with the patient and her mother. It was decided to use full coverage all-ceramic crown on 21 and ceramic veneers on 11, 12 & 22.

Treatment Procedure:

• First visit: tooth preparation of RC treated 21 was done for full veneer zirconia crown, with overall reduction of 2 mm and heavy chamfer margin placed equigingivally. After tray selection, Polydimethylsiloxane (condensation silicone) impression material (Zeta plus, Putty/Light body, Zhermack, Italy) was used to make impression by putty wash technique.

• Shade selection was done by using VITA shade guide (VITAPAN Zahnfabrik, Germany).

Preoperative view

Labial view: Tooth preparation for full veneer zirconia crown on 21

Palatal view: Tooth preparation for full veneer zirconia crown on 21
Second visit
Lithium disilicate-reinforced crown was luted on 21 with resin cement and tooth preparation was carried out for porcelain laminate veneer on 11, 12 and 22.

Cementation of Crown on 21

Preparation of teeth for Veneers (11, 12, 22)
With the help of a three-depth cutting bur labial reduction was carried out, at middle third 0.5-0.8mm of enamel was reduced and cervically 0.3-0.5mm was reduced. Preparation extended till the interproximal contact area without opening the contact points. The preparation was equigingivally done to ensure a secure bonding and optimal integrity with soft tissues. An adequate facial preparation was done to prevent over-contour. 1mm of incisal edge was reduced, chamfer finishing line was prepared on the palatal surface of the tooth with round end tapered diamond bur which was held parallel to the lingual surface of the tooth with its end forming a chamfer 0.5 mm deep and 1 mm from reduced incisal edge (i.e. 1 mm height of palatal chamfer).

Impression and Shade selection
- After tray selection, Polydimethyl siloxane (condensation silicone) impression material (Zeta plus, Putty/Light body, Zhermack, Italy) was used to make impression by putty wash technique.

Shade selection was done by using VITA shade guide (VITAPAN Zahnfabrik, Germany).

Third visit:
Substrate Treatment:
1. Tooth surface:-
   a) The prepared tooth surfaces were conditioned with 37% Phosphoric acid (Ecoetch, Ivoclar Vivadent) for 15 sec & rinsed with water for 10 sec. Proper isolation was maintained. Bonding was proceeded after frosty white appearance was noticed. b) Then single step bonding agent (Te-Econom Bond, Ivoclar Vivadent) was applied on teeth and light cured for 5 sec with LED (Dento med light cure unit)

2. Porcelain: a) 9.5% Hydrofluoric acid was applied for 20 s, and washed for 1 min; b) Silanization (Rely X ceramic primer, 3M ESPE, St Paul, MN, USA) of etched porcelain was carried out.

Luting: Dual cure composite luting agent (Rely X U200, 3M ESPE, St Paul, MN, USA) of appropriate shade was selected and coated on the internal surface of the laminates.
- These were then placed over the teeth and initial polymerization was carried out for 5 sec by light cure LED (Dento med light cure unit)
Excess luting agent was removed with floss and explorer followed by curing for 60 sec on each tooth.

The laminates were cemented contralaterally one after the other.

Discussion

The primary objectives of cosmetic dentistry are to attain the best possible esthetic results and at the same time preserve the hard and soft tissues.

Conservative treatment options such as tooth whitening and/or microabrasion can produce dramatic improvements in brown and yellow discolouration, providing a satisfactory interim result. Direct composite veneer can be done with minimal chair time but exhibits inferior fracture resistance, long term wear resistance and color stability.13

Ceramic veneers are among the best esthetic modality to achieve a more pleasing and beautiful smile and are a good conservative alternative to full crowns for treatment of discolored teeth. Ceramic veneers are the least invasive preparation designs (removing approximately 3% to 30% by weight of the coronal tooth structure), in contrast to all-ceramic and metal-ceramic crowns, which reduces approximately 63% to 72% of tooth structure respectively. For a metal-ceramic crown, the amount of tooth structure removed is 2.4 times greater than that removed for a more extensive porcelain laminate veneer.14

Full coverage all-ceramic preparation was done on 21 which was endodontically treated with a fractured incisal edge with dentin exposed. As there is more risk of adhesive bond failure with use of veneers because of a decrease in enamel bonding.

In general, 4 types of preparation designs have been proposed for laminate veneers: the window preparation (limited to the labial tooth surface), the feathered incisal edge preparation (extended to the incisal margin but without a definite finish line), the incisal shoulder finish line, and the overlapped incisal edge preparation, in which a palatal chamfer is prepared.15 Some studies have found advantages in the mechanical and adhesive properties of the palatal chamfer preparation over the butt joint preparation design.15 In this case report overlapped incisal edge preparation with palatal chamfer was prepared on teeth 11, 12 & 21.

Materials for the fabrication of ceramic veneers can be divided into three main groups according to the fabrication technique: conventional feldspathic ceramics, pressable ceramics and machinable ceramics. A major concern with feldspathic veneers is their low strength as compared to pressed ceramics and therefore, these pressed ceramics was used in our study for fabrication of crown and laminate veneers.

Conclusion
Ceramic laminates due to its excellent esthetic qualities and conservative nature it may well be called “bonded artificial enamel”. This clinical report depicts porcelain laminates as a treatment of choice for severely fluorosed teeth. If properly fabricated and carefully inserted, porcelain laminates can last as long as any other esthetic dental restoration.

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Maxillary first molar with two palatal roots – A case report

Arora S.1

Abstract:
The presence of several canals and roots in a tooth has been established as a normal morphology of the root canal system. This case report represents a maxillary first molar with two palatal roots. The morphological pattern is atypical because it is characterized by two palatal roots with two separate canals.

Key words: Maxillary molar, palatal canals, root canal morphology, root variation

Introduction:
Knowledge of complex internal canal morphology dictates the parameter for execution of root canal therapy and can directly affect the success of root canal therapy. The internal anatomy of maxillary first molar has been studied by many investigators using replication techniques, macroscopic sections1, microscopic sections2, filling of canals with inert material and then decalcification3, filling of canals and clearing4 which has provided valuable insight into the size, shape and form of the pulp space. Maxillary first molars are usually three rooted with a canal in each root, except for the mesiobuccal root in which a second canal may be present. The disto-buccal root is generally rounded or ovoid in cross section and usually contains a single canal. The palatal root is more broad mesio-distally, ovoidal in shape and normally contains a single canal. However, Shahi et al.5 reported 0.73% of the first molars with two palatal canals and Zheng et al.6 reported a prevalence rate of 1.12 and 1.17% for presence of an extra canal in the palatal roots, respectively. The various authors concluded that to investigate the anatomy of the root canals depend on the magnification, adequate lighting, modified access, examination of radiographs and advanced use of computed tomography. Christie et al.7 reported 16 cases of maxillary molars and six extracted teeth with two palatal roots and classified them into three types as follows:

Type I the buccal roots are often similar to cow horns and less divergent, the two palatal roots are very divergent and often long and tortuous, which can be observed radiographically, Type II the palatal roots are shorter and parallel and root apices are blunt, with mesial and distal divergence on the buccolingual radiographic view and Type III the roots have a constricted morphology with mesiobuccal, mesiopalatal and distopalatal roots engaged in a weblike radiographic view similar to type II. The distobuccal root remains isolated and may diverge in distobuccal direction. This case report describes endodontic management of a permanent maxillary first molar with four roots and four canals (one mesiobuccal, one distobuccal and two palatal canals) with unusual palatal morphology with two separate roots.

Case Report:
A 45-year old female patient was referred for root canal treatment of her right maxillary first molar. The clinical diagnosis was irreversible pulpitis, as she complained of pain, both spontaneous and temperature related, on the right side of her face for several days prior to her appointment. The patient medical history was noncontributory. A preoperative radiograph was obtained.

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The patient received local anesthesia of 2% lidocaine with 1:100,00 epinephrine followed by rubber dam placement. A conventional coronal access opening was performed. There was a large pulp stone present in the pulp chamber space which was removed with the help of ultrasonics. After removing pulpal tissue, a complete clinical evaluation of the internal anatomy revealed four root canals one mesiobuccal, one distobuccal and two palatal canals. The DG-16 endodontic explorer helped to find a small point near the orifice of the main palatal canal. A small amount of dentin occluding the orifice of the second palatal canal was removed. The conventional triangular access was modified to a trapezoidal shape to improve access to the additional canal.

A thorough examination of the pulp chamber floor with a DG-16 explorer revealed 4 canal orifices, two distant orifices in palatal roots, one in mesial and one in distal root. The pulp was extirpated and pulp chambers were irrigated with 3% sodium hypochlorite.

An electronic apex locator (ROOT ZX II) and radiographs were used to determine the working length.

Coronal flaring was carried out with gates glidden burs/drill number 2 & 3. Prior to the use of rotary files, glidepath was established with the help of k- files. Copious irrigation was done with 3% sodium hypochlorite. Now the canals were cleaned and shaped with the help of universal protaper rotary system. The canals were dried with paper points, calcium hydroxide dressing was given and a sterile cotton pellet was placed in the pulp chamber and sealed with temporary restorative filling material. At the next appointment the canals were obturated with lateral compaction technique. Post obturation was done and a post operative radiograph was taken to evaluate the quality of obturation and unique palatal morphology. At a later visit the tooth was crowned with porcelain fused to metal crown (PFM).
CASE REPORT

Discussion:

The anatomical complexities of root canal anatomy have been highlighted in the literature and the need for the clinician to understand the probable alterations was emphasized. The tooth described in this case report has two separate roots with two canals. Pre-operative radiographs are of diagnostic value for determining the presence of two separate roots in the maxillary first molar. Evaluation of the radiographs is necessary to detect the anatomical variations of maxillary molars. Careful evaluation of unusually massive coronal morphology is necessary during clinical examination.

To detect additional roots, different methods should be used besides normal procedural protocols the dentist should look for the following signs which might show the presence of additional roots or canals:

1. Evaluation of multiple radiographs: Radiographs should be taken at different angles.
2. Digital radiography: This is recommended due to the diversity of software, especially in the diagnosis of undetected calcified or untreated canals.
3. Coronal flaring: It would be better to visualize the canal orifices.
4. White line test: The pulpal floor meets the dentinal walls and creates a groove which can be followed to detect canal orifices.
5. Red line test: In vital teeth the remaining blood in the orifices, fins and isthmus can help identifying the canal orifices.
6. Piezoelectric ultrasonic device: The grooves should be followed with ultrasonic tips.
7. Troughing: The floor of the pulp chamber should be examined with a sharp explorer.
8. Champagne bubbling test with sodium hypochlorite: After cleaning and shaping, the access cavity should be filled with NaOCl solution and observed to see if bubbles form at the pulp chamber floor this phenomenon is indicative of proteolytic activity of the NaOCl solution and shows the presence of remaining tissue within the undiscovered canals.
9. Dyes: Also a nontoxic dye such as 1% methylene blue, can be brushed over the chamber floor and then washed with water. Commonly it will be absorbed into orifices, fins and isthmus areas.
10. Armed eyes: Loupes or dental operating microscopes (DOM) can be very helpful.
11. Additional imaging techniques: CBCT images always help finding greater number of roots or canals compared to traditional methods.

The prognosis of treatment in these teeth should be similar to any other endodontically treated teeth.

An examination of the floor of pulp chamber offers clues to the type of canal configuration present. An eccentric location of the detected orifice may predispose the clinician to suspect the presence of another canal. The clinician should be suspicious of additional canals if endodontic files are not well centered in the canal on the radiograph or if endodontic files are not well centered in the canal clinically. Hence the ability to locate all the canals in the root canal system is an important factor in determining the eventual success of a case.

Conclusion:

It is concluded that a complete knowledge of the root canal morphology and application of various diagnostic aids are an important factor for success of endodontic therapy. Clinician should be familiar with all the abnormalities as well as their percentage when considering endodontic treatment of maxillary first molars.

Acknowledgment

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References:


Hard palate actinomycotic nodule with reactive actinomycotic tonsillar lesion: a rare case report

Rana S.1

Abstract:
Actinomycosis is a chronic suppurative bacterial disease caused by anaerobic gram positive bacteria of actinomyces species. Actinomycosis, because of its varied presentation has a propensity to mimic other diseases. Here I present a rare case of intraoral actinomycotic lesion of hard palate with incidental tonsillar actinomycosis in a 25 years old female

Key words: Actinomycosis, Hard palate, Tonsils, Oral cavity.

Introduction:
Actinomycosis is caused by branching, filamentous gram positive bacilli which results in chronic suppurative inflammatory disease. The organism is a commensal in human oral cavity1. The disease is characterized by disruption of anatomical barriers by trauma, surgery or other infections. In the tissue, it may form an abscess that develops into a hard red to reddish purple lump2. It spreads by burrowing through tissues as a result of direct contiguity without regard to anatomic structures. Eventually, sinus tracts develop through which yellowish purulent discharge and sulphur granules are released which have little tendency to heal3. In humans, approximately 60% of actinomycotic infections are cervicofacial4. Lesions in the oral cavity are rare and frequently involve the mandible, tongue, lips and oral mucosa4, 5. Actinomycosis is an important clinical entity because of its difficult diagnosis due to non specific clinical and imaging findings that can mimic other diseases6. If left untreated, it involves the bone in 15% of the cases, with gradual cortical erosions, which give way to localized lytic bone destruction5. With this background of the rarity and severity of actinomycosis, I present a rare case of hard palate actinomycotic nodule with simultaneous saprophytic infection of tonsils in a 25 year old female.

Case Report: A 25 years old unmarried female presented at the Ear, Nose, Throat outpatient department with complaints of pain in throat and difficulty in swallowing since one year. She also complained of a swelling hard palate since 3 months which was progressively increasing in size. She gave history of recurrent sore throat and trauma to hard palate by a toothpick. On examination, the patient was moderately nourished. Bilateral tonsils were enlarged. The hard palate swelling was reddish purple, firm and nodular. A small area of overlying skin was disrupted and covered with yellowish discharge (Fig. 1). Neck examination revealed 1.5x 1.5cm, firm, discrete, non-tender, mobile, jugulodigastric lymph nodes on both sides. CBC (Complete Blood Counts), ESR (Erythrocyte sedimentation rate), LFT (Liver function tests), KFT (Kidney function tests) were within normal limits. Ear, laryngeal and nasopharyngeal examinations were clinically normal.

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CASE REPORT

The clinical diagnosis was tonsillar hyperplasia with minor salivary gland neoplasm hard palate. FNAC of neck nodes and hard palate swelling were done. Neck nodes were found to be reactive on FNAC. The hard palate swelling was inconclusive on FNAC and revealed only blood. Tonsillectomy and excision of hard palate swelling was done. Histopathological examination of excised tonsils revealed lymphoid hyperplasia and colonies of actinomyces in the tonsillar crypts on H & E stain (Fig. 2a, 2b), Gomori methenamine silver (GMS) stain and Periodic acid Schiffs (PAS) stain (Fig. 2d).

The hard palate swelling revealed multiple actinomycotic colonies scattered in the subepithelial tissue (Fig. 3a, 3b, 3c). The patient received antibiotic therapy with penicillin G 2 lakh units IV 8 hourly for one week followed by amoxicillin 500mg three times a day for 4 months. The patient recovered and was kept on follow up.

Discussion:

Actinomyces are gram positive, non-acid fast, anaerobic or microaerophilic filamentous branched bacteria, living as commensals in the human oral cavity, respiratory and digestive tracts. They are very difficult to grow in culture, with < 30% of cultures being positive. In humans, the pathogenic actinomyces most frequently isolated is A. israelii, less commonly, infection is caused by A. propionica, A. naeslundii, A. viscosus and A. odontolyticus. In cervicofacial actinomycosis, which is the most frequent manifestation, infection is frequently the result of oromaxillofacial trauma, dental manipulation or dental caries. In the present case, the patient did not come out with a history of oromaxillofacial trauma with a toothpick but it was only after histopathological examination of excised hard palate swelling. The source of infection in the present case could be actinomyces in the tonsils. Patient showed no signs of immunodeficiency. Various sites of cervicofacial actinomycosis have been described including the scalp, forehead, nose, paranasal sinuses, palate, parotid gland, temporal bone, lacrimal glands, minor salivary glands, cheeks, lower jaw, tongue, lips, larynx and the lower pharynx. Patnayak et al described reactive actinomycotic tonsillar lesion in a young male, Ratnaprabhu V et al described palatal actinomycosis in a 5 years old
male. Actinomycosis produces a massive fibrotic reaction surrounding the necrotic center of the lesion, and thus palpation often reveals a swelling of woody consistency. Because the clinical symptoms are non-specific, actinomycosis can be misdiagnosed as tumor or other granulomatous disease as happened in our case in which the initial diagnosis of hard palate swelling was minor salivary gland neoplasm. The strict anaerobic qualities of this microorganism may prevent growth and it is very difficult to obtain positive laboratory culture. Even on appropriate anaerobic media recovery rates from culture are very less. Due to difficulties in diagnosing actinomycosis, it is also referred to as a great masquerader with special reference to head and neck disease.

For a definite diagnosis, incisional biopsy and histopathological examination are necessary. Typical microscopic findings show an outer zone of granulation and a central zone with multiple granules representing colonies of actinomyces. Treatment consists of surgery and prolonged antibiotic therapy.

**Conclusion:**

As actinomycosis is known as a “great masquerade” of head and neck lesions, high index of suspicion must be exercised for correct diagnosis to prevent complications and for timely and adequate treatment.

**References:**

Management of severely resorbed mandibular ridges with modified Impression techniques: A case series

Mudgil S.1

Abstract:

Prosthodontics rehabilitation of a patient with severely resorbed edentulous ridges in a conventional manner is quite a difficult task. Extreme resorption of the ridge will lead to a reduced denture bearing area which in turn will affect retention, stability and support for the complete denture. Managing a severely resorbed mandibular ridge requires special considerations due to anatomical differences between maxilla and mandible. This article consists of a series of case reports in which complete denture fabrication on severely resorbed mandibular ridges was done using different techniques to improve retention, stability and support.

Key words: All-green technique, Cocktail technique, Admixed technique, Neutral zone.

Introduction:

The fabrication of complete denture prosthesis for a geriatric patient with grossly resorbed mandibular ridge has always been a challenge to our profession. The key to successful denture therapy lies in precise execution of the treatment plan formulated by evaluation of a complete comprehensive history and thorough examination. Such a treatment plan must be based on DeVan’s principles concerned with rehabilitation that is, preservation of what already exists than the mere replacement of what is missing.

Extreme resorption of the ridge whether maxilla or mandible will lead to a reduced denture bearing area which in turn will affect retention, stability and support for the complete denture. Severly atrophied ridges are a more common finding with the mandibular residual ridge than the maxilla due to the anatomical differences between maxilla and mandible, as well as the difference in primary and secondary load bearing areas, impressions of resorbed mandibular ridges require special considerations.1

When other forms of treatment, such as implants are not viable, it is imperative to record the existing supportive structures that support the prosthesis and preserve the remaining tissues. Several techniques for resorbed mandibular ridge have been suggested by various authors such as admixed2, functional3, all-green4 and cocktail technique5. All these techniques capture the primary and secondary load-bearing areas without distortion of the residual ridge. Also the arrangement of teeth in neutral zone aids in retention of the denture. This article presents a series of case reports where mandibular complete denture in resorbed mandibular ridges is fabricated using different techniques to improve retention, stability and support.

Case reports:

Case no 1

Technique – All-green and Neutral zone

A 65-year-old male patient reported with a completely edentulous and severely resorbed mandibular ridge (fig 1(a)).

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Primary impression of the maxillary ridge was made in impression compound (Y-Dents Impression, Compound, MDM Corp, Delhi) and the mandibular ridge was made by using admixed technique i.e. impression compound and low fusing compound (DPI Pinnacle tracing sticks, Mumbai) were kneaded in hot water bowl in a ratio of 3:7 respectively with vaselined gloved fingers (McCord and Tyson’s Technique)² [fig 1(b)]. Border molding was done by low fusing compound by sectional method and then secondary impression was recorded using low fusing compound [fig 1(c)]. Jaw relations and neutral zone (NZ) was recorded. The wire loops were attached on the denture base and neutral zone was recorded by mixing impression compound and low fusing compound in the ratio of 3:7,⁴[fig 1(d), fig 1(g)]

Advantages of All-green and Neutral zone technique:

- It is easy to handle chair-side
- It is economical
- More material can be added if required
- It removes any soft tissue folds and smoothes them over the mandibular bone
Disadvantages of All-green and Neutral zone technique:

- Thermal injury can be caused to oral tissues of the patient

**Case report 2**

**Technique: Single Stage Border Molding Using Putty Silicone Material**

A 62-year-old patient reported with loose lower denture and completely resorbed mandibular ridge on examination.

Primary impression made by using impression compound(Y-Dents, MDM Corp, Delhi). Single-step border molding was done using putty consistency of addition silicone impression material(Aquasil Soft Putty, Dentsply De Trey, Germany) and secondary impression(Aquasil LV, Dentsply DeTrey, Germany) was made by using light body addition silicone. ![fig 2(a)-(d)]

**Advantages of this technique are:**

- Time saving
- Accomplished in one step
- Patient’s functional movements used
- Less discomfort and inconvenience to the patient

**Disadvantages of this technique:**

- Costly
- More material can not be added

**Case report 3**

**Technique: Dynamic functional impression technique**

A 50-year-old female patient reported with missing teeth which on oral examination found to be completely resorbed mandibular ridge and raised floor of mouth.

Primary impression was made using impression compound(Y-Dents, MDM Corp, Mumbai). Border moulding was done with tissue conditioner(Visco-gel, Dentsply DeTrey, Germany) using closed mouth technique. Tentative vertical height at occlusion(VDO) was established and border moulding was done using tissue conditioner. The patient was instructed to
border-mold the material physiologically by producing “OOO” and "EEE" sounds while biting on the occlusal rim. Secondary impression was recorded with polyether impression material(Permadyne, 3M ESPE).8[fig 3(a)-(e)]

Fig 3(a) Border molding done using tissue conditioner

Fig 3(b) Tentative VDO

Fig 3(c) Tissue conditioner.

Fig 3(d) Secondary impression made in polyether impression material.

Advantages of this technique:
- It is time saving
- Interference due to tray handle is eliminated
- Less chances of under- or overextension as movements are performed by the patient
- Less discomfort and inconvenience to the patient

Disadvantages of this technique:
- There is no control over patient movement which may result in under- or overextended borders
- The tongue is restricted to move anteriorly which may alter the anatomy of lingual border

Case report 4

**Technique: Controlled Pressure Impression Technique for Knife-edge Ridges**

A 50-year-old female patient reported with a chief complaint of missing teeth and difficulty in chewing food past 1 yr which on examination was found to be completely edentulous knife edged ridge posteriorly and high well rounded anteriorly.

Primary impression was recorded in impression compound(Y-Dents, MDM Corp, Mumbai). Border moulding was done using green stick compound(DPI Pinnacle tracing sticks) and a medium bodied silicone impression material(Aquasil Monophase, Dentsply,DeTrey, Germany) was used to make a fully muscle trimmed secondary impression. The area of the impression over the sharp ridge was cut away using a scalpel blade and the tray was perforated over the sharp ridge. Complete impression was made using light bodied
impression material. (Aquasil LV, Dentsply, DeTrey, Germany) [fig 4(a)-(e)]

Fig 4(a) Completely edentulous knife edged ridge.

Fig 4(b) Border molding done with green stick

Fig 4(c) Impression in Aquasil monophasic.

Fig 4(d) Area of impression over sharp ridge.

Advantages of this technique:
- It is time saving
- Controlled loading of mucosa
- Conservative preservation of ridge height without overloading the underlined mucosa
- Less discomfort and inconvenience to the patient

Disadvantages of this technique:
- Costly
- More material cannot be added

Case report 5

Technique: Cocktail technique

A 55-year-old male patient reported with missing teeth and difficulty in chewing food. On examination, the mandibular ridge was completely resorbed.

Primary impression was made using impression compound (Y-Dents, MDM Corp, Delhi). Then custom tray was fabricated with high-fusing impression compound as mandibular rests with maxillary ridge indentation. Border molding was done using low fusing compound. Secondary impression was recorded by admixed technique. 3:7 by ratio impression compound and low fusing compound was mixed respectively. Patient was asked to perform functional movements with custom tray in position. This technique is called Cocktail technique as it is a combination of 3 techniques: custom tray fabricated using dynamic impression technique, impression material recommended by McCord and Tyson’s technique and finally functional impression as in closed mouth impression technique. [fig 5(a)-(d)]
Advantages of this technique:

- Avoidance of dislocating effect of the muscles on improperly extended denture borders
- Complete utilization of the possibilities of active and passive tissue fixation of the denture
- Mandibular rests offer the advantage to stabilize the custom tray by preventing horizontal displacement of the tray during definitive impression
- Less chair side time and economical

Disadvantages of this technique:

- Thermal injury can be caused to oral tissues of the patient

**Conclusion**

In today’s world, implant is considered as panacea but still if we modify the secondary impression techniques, we can rehabilitate and maintain the oral function, comfort, appearance and health of the complete edentulous patient. No doubt implants are ruling the world of dentistry, but there are ways to rehabilitate the completely edentulous patients with compromised residual ridges which are far more economical than implants. Prosthodontic rehabilitation of patients with resorbed mandibular ridges is quite difficult but by following the above mentioned modified impression techniques to obtain a definitive impression, it is possible to rehabilitate a patient with flat, atrophic, depressed, mandibular ridge economically and effectively and thus improving the function. This article highlights the conservative prosthodontic option that includes modified impression techniques to achieve effective retention, stability and support for severely resorbed mandibular ridges.

**References**


Aggressive periodontitis- A review

Lochab A.1

Abstract:
Periodontitis is an inflammatory condition, which leads to destruction of supporting tissues of teeth. Aggressive Periodontitis comprises a group of rare, often severe, rapidly progressive forms of periodontitis often characterized by an early age of clinical manifestation and a distinctive tendency for cases to aggregate in families. The disease which includes both localized and generalized forms was previously known as “early onset periodontitis” and finally named as “aggressive periodontitis” in 1999.

Key words: Periodontitis, Aggressive Periodontitis, Juvenile Periodontitis.

Introduction:
Periodontitis is an inflammatory condition of supporting tissues of teeth, for which several risk and susceptibility factors are proposed. Periodontal disease leads to the destruction of supporting tissues of the teeth as the result of an inflammatory response in a susceptible host triggered by specific bacteria from a dental biofilm. Aggressive periodontitis, as the name implies is a type of periodontitis where there is rapid destruction of periodontal ligament and alveolar bone which occurs in otherwise systemically healthy individuals generally of a younger age group but patients may be older. Aggressive periodontitis, first described in 1923 as “diffuse atrophy of the alveolar bone”, has undergone a series of terminology changes over the years to be finally named as “aggressive periodontitis” in 1999.

Historical Background:
The signs and symptoms from the periodontium were discovered from more than 2,000 years ago, but more comprehensive written accounts did not appear until the 18th century. Black in the year 1886, used the terms phagedenicpericementitis and chronic suppurativepericementitis to describe patients who suffered from a rapid destruction of alveolar bone. This condition shared many features with “calcic inflammation of the peridental membrane” but there was an irregular pattern of destruction and not much dental calculus11. Destruction of the alveolar bone can occur slowly or rapidly. In a later publication Black replaced the term “phagedenicpericementitis” with “chronic suppurative pericementitis”2.

In 1928, Gottlieb termed the disease as “deep cementopathia”. Gottlieb hypothesized that deep cementopathia was a “disease of eruption” and that cementum initiated a foreign body response3. In 1940 Thoma and Goldman used the term paradontosis and reported that the initial abnormality was located in the alveolar bone rather than in the cementum. In the year 1942, Orban and Weinmann also used the term periodontosis to describe the periodontal destruction in young individuals4. Waerhaug (1977) suggested that subgingival dental plaque does play a role as a cause of periodontosis and replaced the name periodontosis with highly destructive juvenile periodontitis5. AAP in 1986 classified periodontitis as Juvenile periodontitis (localized juvenile periodontitis and generalized juvenile periodontitis), Adult periodontitis, Necrotizing ulcerative gingivo-periodontitis and Refractory periodontitis.

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In 1989, the World Workshop in Clinical Periodontics categorized this disease as Localized juvenile periodontitis (LJP) a subset of the broad classification of early-onset periodontitis (EOP). In the 1999 Classification Workshop of the American Academy of Periodontology, a consensus report adopted the term aggressive periodontitis as a new name for this unique disease classification, replacing the term early-onset periodontitis.

Classification:
Aggressive periodontitis is classified as Localized aggressive periodontitis (LAP) and Generalized aggressive periodontitis (GAP). LAP has circumpubertal (around the time of puberty) onset and has localized first molar/incisor presentation with interproximal attachment loss on at least two permanent teeth, one of which is a first molar, and involving no more than two teeth other than first molars and incisors. LAP has robust serum antibody response to infective agents: the dominant serotype antibody is IgG2. Secondary clinical features like distolabial migration of incisors with diastema formation, mobility of the involved teeth, sensitivity of the denuded root, deep dull radiating pain to the jaw, and periodontal abscess, lymph node enlargement may occur[6]. Radiographic findings may include an "arc-shaped" loss of alveolar bone extending from the distal surface of the second premolar to the mesial surface of the second molar[7].

Generalized AgP (GAP) usually affects patients under 30 years of age, but patient may be older and is characterized by “generalized interproximal attachment loss affecting at least 3 permanent teeth other than first molars and incisors”. GAP has poor serum antibody response to infective agents. Generalized AgP (GAP) is a rapidly progressing disease that affects otherwise healthy individuals and is characterized by a pronounced episodic and rapid destruction of periodontal tissues, which may result in early tooth loss[6]. In generalized aggressive periodontitis, radiographs may show generalized bone destruction ranging from mild crestal bone resorption to severe extensive alveolar bone destruction depending on the severity of the disease.

Risk factors:
Risk is defined as the likelihood that a person will get a disease in a specified time period. The characteristics of individuals that place them at increased risk for getting a disease are called Risk Factors. Removal of a risk factor or a reduction in exposure should reduce an individual’s risk of getting the disease, but once a person has the disease, removal of the risk factor may not make the disease disappear. Risk factors for aggressive periodontitis includes microbiological factors, immunological factors, genetic factors, environmental factors and viral factors. Microbiologic studies of localized aggressive periodontitis have provided clear evidence of a strong association between disease and a unique bacterial microbiota predominated by A. a. Other organisms that have been associated with localized aggressive periodontitis include P. gingivalis, E.corrodens, E. rectus, F.nucleatum, B. capillus and Capnocytophaga species and spirochetes. The prevalence of A.a. is 6 times greater in localized aggressive periodontitis than in healthy patients. Incidence of A.a. is greater in younger localized aggressive periodontitis patients than in older patients with more destructive activity. The presence of this organism correlates with disease activity[9]

The human leukocyte antigens (HLA), which regulate immune responses, have been evaluated as candidate markers for aggressive periodontitis. Although the findings with many HLA antigens have been inconsistent, HLA-A9 and B15 antigens are consistently associated with aggressive periodontitis. Patients with aggressive periodontitis display functional defects of polymorphonuclear leukocytes (PMNs), monocytes, or both. These defects can impair either the chemotactic attraction of PMN to the site of infection or their ability to phagocytose and kill microorganisms. Patients with localized aggressive periodontitis show a hyper-responsiveness of monocytes with respect to the production of PGE2 in response to lipopolysaccharide (LPS)[10].

According to the 1999 American Academy of Periodontology Consensus Report, aggressive periodontitis has a strong genetic component and it is more prevalent within families. Familial aggregation was adopted as one of the major criteria for the diagnosis of aggressive periodontitis. In 1986, Boughman et al reported that a major gene located on chromosome 4q was responsible for autosomal dominant
transmission of Localised Aggressive Periodontitis in an extended family that also exhibited Dentinogenesis Imperfecta[11].

Michalowicz BS et al (2006) used segregation analyses to determine the likely mode of inheritance for aggressive periodontal disease which support the hypothesis that genetic factors play a role in Aggressive Periodontitis and a few loci, each with relatively small effects contribute to aggressive Periodontitis, with or without interaction with environmental factor[12].

Environmental/Modifiable factors include oral hygiene or bacterial plaque, smoking and stress that may exacerbate the inflammatory pathology associated with periodontitis. According to a study by Schenkein et al. (1995), smoking was associated with an increase in disease extent and severity in patients with generalized aggressive periodontitis[13]. Kamma et al (2004) examined the effect of smoking on the cytokine profiles of patients with aggressive periodontitis and found that smoking disturbed the host–parasite relationship, leading to worse periodontal parameters among aggressive periodontitis patients who smoked compared with nonsmokers, despite similar levels of plaque in the two groups[14]. Slots J et al (2010) demonstrated that herpetic viruses, Human Cytomegalovirus (HCMV) and Epstein-Barr Virus type 1 (EBV-1) are frequently associated with the pathogenicity of aggressive periodontitis[15].

Diagnosis:

Diagnosis is made according to the criteria set by the American Academy of periodontology, 1999 classification of periodontal diseases and conditions using history, clinical features, and radiographic features aided by microbial examination if needed. Early detection is critically important in the treatment of aggressive periodontitis because preventing destruction is often more predictable than attempting to regenerate lost supporting tissue.

Fig 1. Schematic illustration showing key stages of diagnosis

Prognosis:

When aggressive periodontitis is diagnosed early, it can be treated conservatively with oral hygiene instruction and systemic antibiotic therapy, resulting in an excellent prognosis. When more advanced disease occurs, the prognosis can still be good if the lesions are treated with debridement, local and systemic antibiotics, and regenerative therapy. Sometimes secondary contributing factors such as cigarette smoking are often present along with aggressive periodontitis. These factors, coupled with the alterations in host defense seen in many of these patients, may result in a case that does not respond well to conventional periodontal therapy (scaling with root planing, oral hygiene instruction, and surgical intervention). Therefore these patients often have a fair, poor, or questionable prognosis, and the use of systemic antibiotics should be considered to help control the disease[16].

Treatment:

One of the most important aspects of treatment success is to educate the patient about the disease, including the causes and the risk factors for disease, and to stress the importance of the patient’s role in the success of treatment. Essential therapeutic considerations for the clinician are to control the infection, arrest disease progression, correct anatomic defects, replace missing teeth, and ultimately help the patient maintain periodontal health with frequent periodontal maintenance care. Educating family members is another important factor because aggressive periodontitis is known to have familial aggregation. In general, treatment methods for the aggressive periodontal diseases include oral hygiene
instruction and reinforcement and evaluation of the patient’s plaque control; supra- and subgingival scaling and root planing to remove microbial plaque and calculus; control of other local factors; occlusal therapy as necessary; periodontal surgery as necessary; and periodontal maintenance.

Oliveira RRD, Filho HOS, Novaes AB, Taba M (2007) evaluated the effectiveness of Antimicrobial Photodynamic Therapy in the Non-Surgical Treatment of Aggressive Periodontitis in 10 patients and concluded that PDT and SRP showed similar clinical results in the non-surgical treatment of aggressive periodontitis. Yek EC, Cintan S, Topcuoglu N, Kulekci G, Issever H, Kantarci A (2010) performed a study to evaluate the effects of metronidazole–amoxicillin combination on clinical and microbiologic parameters in patients with generalized aggressive periodontitis in 28 patients and concluded that combined amoxicillin and metronidazole use as an adjunct to scaling and root planing leads to better clinical healing compared to mechanical treatment alone.

Conclusion:
Aggressive Periodontitis is a multifactorial, genetically complex disease affecting systemically healthy individuals which occurs as a result of many accumulative susceptibility factors. Bacteria of probable etiologic importance for aggressive periodontitis include highly virulent strains of Aggregatibacter actinomycetemcomitans in combination with P.gingivalis, E.corrodens, E.rectus, F.nucleatum, B.capillus and Capnocytophaga species and spirochetes. Treatment plan essentially includes conventional approach, surgical therapy, regenerative therapy, antimicrobial and photodynamic therapy etc. Implant treatment in patients with generalized aggressive periodontitis is also indicated provided that adequate infection control and an individualized maintenance program are assured. The goals of periodontal therapy are to alter or eliminate the microbial etiology and contributing risk factors for periodontitis, thereby arresting the progression of disease and preserving the dentition in comfort, function, and appropriate esthetics and to prevent the recurrence of disease. Adjunctive host modulation with conventional treatment and antimicrobial therapy may prove to be promising in treatment of patients with aggressive periodontitis. With all these treatment modalities, successful long-term maintenance of the dentition in a healthy and functional state can be achieved.

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Intrerdisciplinary orthodontics- A review

Kumar A.1, Walia P.S.2, Kaur R.3

Abstract:
Understanding interdisciplinary orthodontics is very important in today’s world where specialist treatment is the order of the day. The orthodontic treatment of adult patients is most frequently just one component of a more complex treatment involving several dental disciplines. A combined interdisciplinary treatment approach will yield a result best suited for the patient as well as the clinicians. The role of orthodontist in such an interdisciplinary treatment approach can be primary or secondary.

Key words: Interdisciplinary Orthodontics, Adult Orthodontics

Introduction:
In the seventies most patients were children and adolescents between the ages of 8 and 16. As time passed, and we entered the 1980s, the orthodontist began to examine more adult patients. These adult patients had abraded or worn teeth, old failing restorations, tipped teeth, multiple edentulous spaces from previous tooth extraction, periodontal breakdown, recession, and many other periodontal and restorative problems that compromised our ability to achieve an ideal orthodontic result[1].

An increasing number of adult patients are becoming aware of the possibilities for orthodontic treatment. They present with a need for treatment related to one or a few symptoms, which have worsened over time, but the patient’s chief complaint is often only the tip of the dental iceberg[2].

Interdisciplinary approach is indispensable for patients with mutilated dentition. Also patients with congenital defects can be best treated with such a team work only[3].

Need for interdisciplinary Orthodontics
The first visit to the orthodontist may result in a number of conflicts, which may develop between the orthodontist and the general dentist, between the patient and the orthodontist, or even between the patient and the general dentist. The orthodontist may approach the general dentist for information on the patient and the general dental care, and enter into a diplomatic discussion as to the aetiology of the orthodontic problem. The general dentists may be unaware that orthodontic solutions to many malocclusions are available. The patient may react negatively to the information about the problem and may consider accepting the situation. Patients may also wonder why no one explained what was happening with their dentition and reproach the general dentist. In fact, the general dentist may have earlier broached the subject, but the patient does not wish to remember the details of the discussion[4].

The initial phase of any treatment is the work up of a problem list combining the findings of a functional, extraoral and an intra-oral clinical examination. The contents of the problem list depend upon the knowledge and the diligence of the clinician. A general dentist may well overlook a malocclusion and the orthodontist may likewise underestimate the periodontal problems of the patient. The co-operation of the patient depends on the insight and understanding the patient has of their dental status, and the prognosis depends on the meticulousness of both the examination and also the communication of the problems to the patient.

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The general dental practitioner may have failed to explain consequences of tooth extraction clearly to the patient. As a result, the missing tooth may not be replaced and collapse of the bite develops. Migration of teeth due to progressive periodontal breakdown and the additive effect of my functional habits (lip trap) to the teeth should also be explained to the patient. To overcome this mutual lack of knowledge, a need arose to form a framework of an interdisciplinary study group to discuss interdisciplinary treatment planning where an orthodontist can learn about other aspects of dentistry. The other advantage was to educate one another about the latest developments in our respective specialties.

Establishment of an interdisciplinary team

The establishment of an interdisciplinary approach requires not only close communication between colleagues but also mutual respect and confidence. Usually the team includes a periodontist, a prosthodontist, an orthodontist, a gnathologist and a maxillofacial surgeon. In relation to the diagnosis a radiologist may be needed and if parafunctions or muscular tensions cannot be managed satisfactorily, a physiotherapist may be needed. In addition, the collaboration of medical specialties may be needed.

The collaboration starts when the problems are listed. The patient’s chief complaint will often be of an aesthetic nature. The problem list is developed by dentists from the different disciplines involved and includes, in addition to the orthodontic findings, necessary features from the patient’s general physical and psychological health profile, findings related to function, the periodontium and the dental status. The materials used for the interdisciplinary discussion comprise the results of the clinical examination, analysis of photographs and X-rays, and if relevant the results of other special investigations such as the bite force, jaw tracking and electromyography (EMG).

Once a problem-list is achieved the treatment goals have to be agreed by all the dentists involved in the case. In defining the treatment goal, the limitations of the individual case should be taken into consideration to avoid unrealistic expectations. The orthodontic treatment goal can be simulated three-dimensionally on a combination of a cephalogram and an occlusogram. This image can serve as the basis upon which the necessary force systems can be expressed in mathematical terms, and then the selection and design of the appliance can be formulated.

Fig 1. Disciplines frequently involved in interdisciplinary treatments.

Fig 2. Combination of Occlusogram and cephalogram.
tentative time schedule worked out and added to the patient’s file\[4\].

**Essential and optional treatment procedures:**

**Essential treatment:**

The procedures involved when treating adult patients with a deteriorating dentition can be divided into two categories: essential and optional procedures. The pre-decided sequence of procedures must be followed since the next step can only be followed if the previous one was successful.

<table>
<thead>
<tr>
<th>Essential procedures:</th>
<th>Optional procedures:</th>
</tr>
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<tbody>
<tr>
<td>Oral prophylaxis</td>
<td>Periodontal surgery</td>
</tr>
<tr>
<td>Restorative treatment</td>
<td>Gnathological splint</td>
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<tr>
<td>Endodontics</td>
<td>Orthodontic therapy: major/minor</td>
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<tr>
<td>Extractions</td>
<td>Prosthetic rehabilitation</td>
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<tr>
<td>Provisional restorations</td>
<td>Implants</td>
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Table 1. Overview of essential and optional procedures

Since a healthy periodontium is essential, the first part of every treatment should be professional cleansing and scaling, oral hygiene instruction and motivation. Motivation is most important during treatment and for the maintenance of the result following orthodontic treatment. No periodontal surgery should be carried out if the oral hygiene is not absolutely perfect. Periodontal surgery may result in iatrogenic damage if it is not followed by maintenance of good oral hygiene. There should not be any attempt to influence the mandibular position with a splint before the essential procedures are carried out. The final treatment depends on the effect of the oral prophylaxis. A healthy periodontium is important and active pathological processes such as caries and endodontic problems should be all treated before orthodontics is commenced. Extraction of teeth should only be done if the oral hygiene is such that we can anticipate that space closure can be achieved without any iatrogenic damage and that the teeth to be extracted cannot serve as temporary anchorage. Major orthodontic work should be planned only if the necessary pre-conditions are present: a healthy periodontium; healthy general metabolism and the willingness to undergo the necessary post orthodontic prosthodontic restorations and maintenance. Before the orthodontic treatment only provisional restorations, e.g. to serve as anchorage, should be done.

**Optional procedures:**

These procedures should only be performed following successful finishing of the essential procedures, i.e. the establishment of a healthy oral environment. Absence of pathological pockets may be perceived as controversial seen in the light of the tendency towards conservative treatment and the demonstration of maintenance of deep pockets over many years\[7\]. This more conservative approach to periodontal treatment is well recognized but does not apply to teeth that should be moved orthodontically. The tissue reaction generated by the orthodontic force systems is basically comparable with that of inflammation in a sterile environment and it is crucial that it does not develop into a bacterial-induced inflammation, which would lead to loss of attachment and alveolar bone. Inflammation even on a subclinical level is not acceptable, and the periodontium cannot be 100% healthy in the presence of necrotic cementum. The periodontal surgery needed to reduce the pocket depth in the case of horizontal bone loss may include apical repositioning of the marginal gingiva. This may be unacceptable to the patient as the surgical procedure results in elongation of the clinical crowns. However, further mucogingival surgery may reduce this problem. Vertical bone loss leading to pockets can successfully be treated by the application of the principles of GTR or with the addition of growth factors such as Emdogain\[8\].

In relation to periodontal treatment, several opinions are presented in the literature on whether the grafting should be done before or after orthodontics. Free grafting, which is now less popular, will often lead to a patch with a different colour since the palatal mucosa is paler than the mucosa in the area where it is grafted.

Another example of how the interaction between the periodontist and the orthodontists can be of benefit for the patient is that the tissue reaction generated by the orthodontist in relation to tooth movement can be utilized by the periodontist in the generation of new attachment\[9\]. Within prosthodontics, lost teeth that were usually replaced by dentures or bridges are nowadays more frequently being replaced by intraosseous implants. In the
presence of a malocclusion, orthodontics is a necessary component of the total treatment, which involve collaboration between different specialties.

The solution to the patient’s problem may include either major or minor orthodontic therapy. Major orthodontic therapy leads to less need for restorative/prosthodontic treatment whereas minor orthodontics result in the need for more extensive prosthodontic rehabilitation. It is important to consider the patient’s expectations when determining the treatment strategy. Based on the explanation of the advantages and disadvantages of the different alternatives, the patient has to make the final decision. In patients where implants can serve as anchorage, these can be inserted at the beginning of treatment but the position of the implants should be carefully planned bearing in mind the planned tooth movements. In some cases, space has to be created and the alveolar process developed to allow insertion of a dental implant. In patients in whom orthognathic surgery is anticipated, the necessary orthodontic treatment should be planned in collaboration with the maxillofacial surgeon.

Following the orthodontic treatment phase, further periodontal surgery may be needed before prosthodontic rehabilitation can be done. The orthodontist needs to know the patient’s expectations regarding treatment time, discomfort and cost and it is important to define the treatment goal according to the patient’s expectations. Patient satisfaction will be highest if the patient’s expectations are slightly lower than the delivered result [6].

Conclusion:

Many a times in modern dentistry, the complete patient care may involve interdisciplinary treatment approach. After the evaluation of chief complaint and treatment demands it becomes very important that the orthodontist together with the other specialists frame a treatment objectives which are realistic and meet the needs of the patient. Constant interaction and communication among the team members and the patient at all level of treatment are the keys to the success of the interdisciplinary treatment. With the interdisciplinary interaction, it will not only become clear how each discipline can contribute to the solution of a problem, but also expand the capacity of each discipline and thereby often make the impossible possible.

References:

Rushton bodies – An insight

Pandey A.1, Chaudhary A.2

Abstract:
Rushton bodies are peculiar, eosinophilic, linear, curved or straight, polycyclic, glassy structures occurring with variable frequency in the epithelial lining of odontogenic cysts, whose presence occasionally contributes to the diagnosis. The most common inflammatory odontogenic cyst is radicular cyst. Rushton bodies may be seen as irregular structures on the surface epithelium of odontogenic cysts. It has two different histo-morphological appearances; granular and homogenous. Presence of these structures depend upon sectioning plane of specimen. They are easily identified by their peculiar morphological and staining patterns. There is considerably ambiguity about nature and epithelial, vascular, odontogenic or keratinous origin of these hyaline bodies.

Key words: Rushton bodies, odontogenic cyst, radicular cyst.

Introduction:
Rushton bodies are seen exclusively in odontogenic cysts and are most commonly observed in radicular cysts with reported frequency of 10% followed by dentigerous cyst (4-10%) and odontogenic keratocyst (OKC) (7%) Rushton bodies or hyaline bodies have been observed in the histopathological sections of odontogenic cysts. In majority of cases encountered, hyaline bodies are confined to the cystic epithelium only, which appears as small, white smooth dome shaped swellings protruding into the cystic cavity.

These hyaline bodies were first noted by Dewey in 1918 and were mentioned in early literature by Lund in 1924. But they were described in detail by Martin A Rushton in 1955. Hence they are named as Rushton hyaline bodies or Rushton bodies. There has been hot debate about origin and nature of Rushton Bodies[1,2].

The question that puzzles many researchers is association of Rushton bodies with cystic epithelium despite being hematogenous in origin. They are seen in all inflammatory cysts or secondarily infected dental cysts. It appears as inflammation plays important part in development of Rushton bodies. Though they are of little diagnostic use, their specific association with the epithelial lining of odontogenic cysts strongly implicates the role of odontogenic epithelium in the genesis of these structures. Very little is known about what stimulates their production and their low incidence suggests some rare local events to be the cause.

Morphology:
According to Rushton they are eosinophilic bodies measuring 0.1 mm in length and having certain characteristic shapes which may occur singly or admixed. He described three morphological patterns. One is linear, straight or curved into various types sometimes like a hairpin. The second type of appearance is like broken up pieces of plate and third is circular or polycyclic agglomerations, sometimes laminated. Later a fourth pattern of morphology was described by Morgan and Johnson as an elongated type, lining cleft like spaces which are probably cholesterol clefts.

Importance of knowing the morphology of these structures lies in differentiating them from other bodies with considerable histological similarity, especially Russell bodies[2,3].

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Ultrastructurally, two types of hyaline bodies can be identified that are lamellated and homogenous types. The lamellated type shows alternating electron dense and electron lucent areas which may be straight, curved, irregular or polycyclic. The peripheral band is always electron dense. The number of bands a between different bodies and the thickness varies between band of different bodies as well as in different areas in the same body. The homogenous type presents as electron dense homogenous bands surrounding various structures such as granular material, mineralized masses and cholesterol clefts.

Hyaline bodies are attached to the plasma membrane of adjacent epithelial cells via hemidesmosomes and show a homogeneous electron dense layer (35nm thick) resembling lamina densa of basement membrane.

Electron dense fine granules, resembling ferritin granules are frequently seen in cytoplasm of epithelial cells near hyaline bodies[3,4].

**Staining:**

Hyaline bodies are eosinophilic and take up gram negative staining. They give positive reaction with various stains. They give negative results for von Kossa’s method for calcium and Periodic Acid Schiff method for mucopolysaccharides. On immune histochemical staining they show positivity for hair keratin, keratin 17 and hemoglobin alpha chain. They appear blackish brown and refractile on staining with CD44[5,6].

**Origin:**

**Odontogenic Epithelial Origin:**

Rushton believed that hyaline bodies resembled, in appearance and the susceptibility to fracture, the keratinized secondary enamel cuticle. Special stains and histochemical studies indicated that they contain cystine and it was suggested that they were of odontogenic epithelial origin and probably a form of keratin. Wertheimer et al and Wertheimer also found histochemical similarities to keratin but pointed out that the correspondence was not complete. They supported the view that bodies were secretory product of odontogenic epithelial cells formed in the same way as the secondary enamel cuticle[7,8,9].

Morgan and Johnson concluded that hyaline bodies are a secretory product of odontogenic epithelium deposited on the surface of particulate matter, such as cell debris or cholesterol crystals, in a manner analogous to the formation of dental cuticle on the unerupted portions of enamel surfaces. This supports the fact that hyaline bodies are probably unrelated to keratin production although the participation of odontogenic epithelium in their formation remained likely because they were not found in non-odontogenic cysts[6,7,8,9].

**Hemagenous origin:**

Browne and Matthews stained RBs for keratin, factor VIII related antigen, haemoglobin and fibrinogen using immunoperoxidase techniques. All the tested antigens were negative for all the sections excepting fibrinogen, which was detected in the cores of some circular and polycyclic forms. Their observations neither supported the keratinous nature nor the haematogenous origin of the hyaline bodies. However they proposed that core staining for fibrinogen supports that these bodies are produced by cellular reaction to extravasated serum[6,7,8,9].

**Neither odontogenic or epithelial origin:**

Observations following ultrastructural studies by Jensen and Erickson did not support either the epithelial cell production or haematogenous origin of hyaline bodies and they also demonstrated that the hyaline bodies are not composed of keratin and neither do they bear any structure similarity to secondary enamel cuticle[9,10,11].

Both odontogenic and epithelial origin:

Sakamoto et al demonstrated that hyaline bodies are amyloids that are formed as a consequence of two independent biological events; one being the unusual alteration of the epithelial differentiation so as to provide hair keratin and the other is haemorrhage so as to provide haemoglobin. Their results hence reconciled the long standing debate between two theories i.e. keratinous nature vs. the haematogenous origin, thus concluding that both the substances are required for genesis of hyaline bodies[9,10,11].

**Conclusions:**
Rushton hyaline bodies are eosinophilic bodies of various shapes seen in the epithelium of odontogenic cysts and are believed to represent a secretory product of odontogenic epithelium. Though many histological, histochemical and ultrastructural studies have been conducted, since the discovery of these bodies almost seven decades ago, to confirm the origin of Rushton bodies, till date their histogenesis has not been elucidated.

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HERBAL WISDOM: Curative role of herbs in dentistry

Kumar A.¹

Abstract:
The knowledge on medicinal plants has been accumulated in the course of many centuries, based on different medicinal systems such as Ayurveda, Unani and Siddha. In the developed countries, 25% of the medical drugs are based on herbs and their derivatives. Herbal extracts have been successfully used in dentistry as tooth cleaning and antimicrobial plaque agents. Herbs may be good alternative to current treatment for oral health problems but it is clear that we need more research.

Key words: Herbal, Periodontal disease, Plaque, Gingivitis, Ayurveda

Introduction:

Herbs are one of remedial agents which God has created for afflicted humans. Herbal medicine rests on the usage of preparations and medications derived from botanical components such as roots, leaves, and flowers to promote healing.¹

In Indian culture, the knowledge regarding medicinal plants has been assimilated in the due course of many centuries.² The Rigveda has been source of evidence of 67 medicinal plants and the Sushruta Samhita has been the source of 1,270 species of medicinal plants and these descriptions form the basis of the classical formulations till date.³

Herbs are staging a comeback and herbal ‘renaissance’ is happening all over the globe.⁴ According to the World Health Organization (WHO), as many as 80% of the world’s people depend on traditional medicine (herbal) for their primary healthcare needs. The development of indigenous medicines and the use of medicinal plants carry considerable economic benefits in the treatment of various diseases.⁵

In India, the use of neem twigs is centuries old, they used to call it, Datun. These primitive twig ‘brushes’ actually work quite well and they provide natural-bristle, disposable brushes with healing ingredients which have already. In spite of all the benefits, care must be taken in selecting herbs, with consideration about the effect of herbs in oral tissues, the mechanism of action, and side effects. For this, one must have adequate knowledge regarding the same. Thus, this paper is aimed at reviewing some of the common herbs used in dentistry.

Blood root (Sanguinaia Canadensis):
The main bioactive components of bloodroot are alkaloids, primarily sanguinarine. Sanguinarine has antiseptic and anti-inflammatory properties. Blood root is also approved by FDA as toothpaste ingredient. It helps in reducing plaque accumulation and helps in preventing Gingivitis, dental caries and periodontal diseases. The Sanguinaria extract tooth paste and oral rinse when used together has shown to control and reduce plaque and gingivitis.⁸,⁹

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Aloe Vera:

Aloe Vera plant is a member of Liliaceae family. The most beneficial species of the genus Aloe vera is Aloe vera barbadensis. The name Aloe vera or “True Aloe” probably stems from the Arabic word “Alloeh” meaning “shining bitter substance”. The gel is a good source of vitamins, minerals, enzymes, sugars, lignin, sapnins, salicyclic acids, and amino acids. The antibacterial efficacy of Aloe vera is attributed to its property of inhibiting protein synthesis in bacterial cells. It also has moisturizing actions, wound healing, and anti-inflammatory effects. S. pyogenes and S. faecalis have been inhibited by aloe vera gel. It is bactericidal against Pseudomonas aeruginosa. It has been used to apply to the sites of periodontal surgery, the gum tissues when they have been traumatized or scratched and for relief from accidental burns with aspirin. Acute mouth lesions are improved by the direct application such as on herpetic viral lesions, aphthous ulcers, and canker sores. Denture patients with sore ridges and ill-fitting dentures can benefit as fungal contamination and bacterial contamination are reduced as is the irritation from inflammation. The anti-inflammatory property of Aloe vera can be used to control inflammation around dental implants caused by bacterial contamination.  

Propolis:

Propolis is a naturally occurring bee product. It is a hard, resinous substance consisting chiefly of wax and plant extracts. In general, it is composed of 50% resin and vegetable balsam, 30% wax, 10% essential and aromatic oils, 5% pollen and 5% other constituents which are amino acids, minerals, vitamins A, B complex, E and a highly active bio-chemical substance known as bioflavonoid (Vitamin P), phenols, aromatic compounds and various other organic substances including debris. Flavonoids are biologically active ingredients which account for most of the well-known plant compounds and have been reported to have antibacterial, antifungal, antiviral, anti-oxidant and anti-inflammatory properties. 

Cranberry:

Cranberry or Vaccinium macrocarpon is a shrub available in markets mainly as fresh juice, dried fruit, and encapsulated powder. The therapeutic use of cranberry can be traced back to the 17th century, when it was used mainly as a remedy to solve stomach and liver problems and also to relieve scurvy. A non-dialysable cranberry fraction enriched in high molecular weight polyphenols has very promising properties with respect to cariogenic and periodontopathogenic bacteria, as well as to the host inflammatory response and enzymes that degrade the extracellular matrix. Cranberry components are potential anti-carries agents since they inhibit acid production, attachment, and biofilm formation by Streptococcus mutans. Glucan-binding proteins, extracellular enzymes, carbohydrate production, and bacterial hydrophobicity, are all affected by cranberry components. Regarding periodontal diseases, the same cranberry fraction inhibits host inflammatory responses, production, and activity of enzymes that cause the destruction of the extracellular matrix, biofilm formation, and adherence of Porphyromonas gingivalis, and proteolytic activities and coaggregation of periodontopathogens. 

Chamomile:

Chamomile (Matricaria chamomilla L.) is a well-known medicinal plant species from the Asteraceae family often referred to as the "star among medicinal species. The dried flowers of chamomile contain many terpenoids and flavonoids contributing to its medicinal properties. Chamomile preparations are commonly used for many human ailments such as hay fever, inflammation, muscle spasms, menstrual disorders, insomnia, ulcers, wounds, gastrointestinal disorders, rheumatic pain, and hemorrhoids. Chamomile, when used as a constituent of mouthwash, was effective in reducing infections of the gingivae and oral cavity. It was also incorporated in some toothpastes. Chamomile was also effective in removing the smear layer significantly when compared to distilled water and tea tree oil. Chamomile mouthwash has been shown to relieve mucositis; also, it has helped to prevent, delay, or lessen the occurrence of the lesion. 

Tea Tree oil:

Melaleuca alternifolia is commonly known as tea tree oil, and is derived from the paper bark tea tree, which is a native plant of Australia. The main active ingredients of TTO are 1, 8-cineole and terpinen-4-ol. 1, 8-cineole has anti-inflammatory properties and is able to penetrate
human skin. Terpinen-4-ol has similar anti-inflammatory activities as 1, 8-cineol but also has anti-bacterial activity. It has the potential to be a therapeutic agent in chronic gingivitis and periodontitis, conditions that have both bacterial and inflammatory components.\textsuperscript{17}

**Triphala:**

‘Triphala’ is a well-known powdered preparation in the Indian system of medicine (ISM), being used in Ayurveda since ancient time. Triphala consists of equal parts of the Emblica officinalis, Terminalia chebula, and Terminalia belerica. Terminalia chebula is valuable in the prevention and treatment of several diseases of the mouth such as dental caries, spongy and bleeding gums, gingivitis, and stomatitis. The extract could successfully prevent plaque formation on the surface of the tooth, as it inhibited the sucrose-induced adherence and the glucan-induced aggregation, the two processes which foster the colonization of the organism on the surface of the tooth. Triphala when used as root canal irrigant has shown significant anti-bacterial activity against three and six week biofilms. Triphala has strong inhibitory activity against PMN-type collagenase/gelatinase inhibition in periodontal destruction. Anti-microbial and anti-oxidant effect of Triphala has been proven in-vitro as it has been shown to inhibit Streptococcus mutans at concentrations as low as 50 g/ml. 0.6% Triphala mouthwash has shown to have significant anti-caries activity, which is comparable to that of chlorhexidine without possessing disadvantages as staining of teeth and at much less cost although there was no evidence of re-mineralization of tooth structure.\textsuperscript{18}

**Curcumin:**

Curcumin (diferuloyl methane) a yellow pigment in turmeric powder exhibits anti-inflammatory, antioxidant, anti-carcinogenic and pro-apoptotic activities.\textsuperscript{15} It has been linked with the suppression of mutagenesis and used as a chemo preventive agent in variety of cancers including oral cavity. Previous studies using turmeric in the treatment of leukoplakia have shown good results. It has a wide spectrum of biological actions which include anti-inflammatory, antioxidant, anti-carcinogenic, immunomodulatory, and antifibrotic activity. Turmeric acts by increasing the number of micronuclei in the circulating lymphocytes and by acting as an excellent scavenger of free radicals. Due to its anticancer and anti-inflammatory properties, curcumin is useful in the treatment of oral Leukoplakia. It shows immunomodulatory effect and provide symptomatic relief and helps in decreasing the size of the lesion in cases of oral lichen planus. Treatment with curcumin helps in reducing the burning sensation and in improving the mouth opening in the patients with oral submucous fibrosis.\textsuperscript{19, 20}

**Psidium guajava**

Psidium guajava is one which has an enormous wealth of medicinal value. It for long has been known for its anti-inflammatory, antimicrobial, antioxidant, antidiarrheal, antimutagenic properties. The paste of tender leaves of guava has been traditionally used to maintain oral hygiene. Guava has shown antibacterial activity against both Gram-positive and Gram-negative bacteria. The antimicrobial activity of guava is mainly attributed to flavonoids, guaijaverin and quercetin. The bark has exhibited antibacterial properties due to the presence of tannins. Quercetin has shown excellent antibacterial actions against periodontal pathogens. Aggregatibacter actinomycetemcomitans (Aa), Porphyromonas gingivalis (Pg), Prevotella intermedia (Pi), Fusobacterium nucleatum (Fn). It has shown inhibitory actions against Streptococcus mutans (S. mutans), Streptococcus sanguinis (S. sanguinis) and Actinomyces species. Mouthwash containing aqueous extract of the leaves was highly active against S. aureus and Escherichia coli (E. coli) which could be contributed to the presence of bioactive compounds. Mouthrinse containing guava leaf extract had a profound effect on gingivitis.\textsuperscript{21}

**Garlic:**

Garlic (Allium sativum) has long been known to have antibacterial, antifungal and antiviral properties. Today, it is used as a natural antibiotic that is good for fighting infections caused by fungi or bacteria. It helps strengthen the immune system and is used to lower blood pressure. Garlic is also used to treat arteriosclerosis, asthma, arthritis, and digestive and circulatory problems. Garlic contains calcium, copper, germanium, iron, magnesium, manganese, phosphorus, vitamins A, B1, B2, and C, and a variety of other chemicals. The
garlic extract inhibits the growth of oral pathogens and certain proteases and so may have therapeutic value, particularly for periodontitis. But there are few data on its effects against oral bacterial species particularly putative periodontal pathogens or their enzymes.\textsuperscript{22}

**Eucalyptus**

(Eucalyptus globulus) A tall tree native to Australia, the eucalyptus yields a powerfully antiseptic essential oil that has long been used medicinally. As its leaves have commonly been used to lower fevers, the eucalyptus is sometimes known as the “fever tree.” Eucalyptus oil is used on sore, inflamed gums for temporary relief.

**Conclusion:**

The use of herbal medicines continues to expand rapidly across the world. Many people take herbal medicines or herbal products now for their health care in different national healthcare settings. Since herbal therapies aids in effectiveness, safety, accessibility and control over treatment hence can be tried in Dentistry as they are used in medical disorders. Herbal products can vary in their potency. Therefore, care must be taken in selecting herbs, even so, herbal medicines have dramatically fewer side effects and are safer to use than conventional medications.

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Local drug delivery in periodontics

Nagpal M.¹, Gupta P.²

Abstract:
Periodontitis is a multifactorial disease which results in inflammation of gingival and adjacent supporting periodontal tissue resulting in hard and soft tissue destruction and tooth loss. The effectiveness of mechanical therapy along with local delivery of antimicrobials has been investigated to overcome the limitation of conventional therapy. These control release antimicrobials are available in various forms like gels, films, fibers etc. The main aim of these local delivery devices is to establish a drug reservoir that maintains effective concentration of the drug at the site of action for longer period of time. The present review approaches the various drugs used for periodontal therapy.

Key words: Periodontitis, antimicrobials, delivery devices.

Introduction:

Periodontal diseases are bacterial infections characterized by inflammation and destruction of the attachment apparatus, often leading to tooth loss. Periodontitis is defined as "An inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both."¹

Elevated proportions of some subgingival microbial species have been associated with destructive periodontal disease activity. So, elimination or suppression of periodontopathogenic microorganisms in the subgingival microbiota is important for periodontal healing.² Periodontal therapy is helpful in altering the periodontal environment to the one, which is less conducive to retention of bacterial plaque in the vicinity of gingival tissue.³

The aim of current periodontal therapy is to remove the bacterial flora from the tooth surface and to shift the pathogenic microbiota to one which is compatible with periodontal health. Therapeutic approaches include mechanical scaling and root planing sometime surgery. As a result of treatment, there is a decrease in the gingival inflammation as well as clinical probing depth. Unfortunately, in some instances, the complex anatomy of the root and the contours of the lesion prevent sufficient reduction of the bacterial load to make the tooth surface biologically acceptable⁴.

The local delivery of antimicrobials to periodontal pockets has the benefit of administering more drugs to the target site while minimizing the exposure of total body to the drug and the sustained release of antimicrobial in the periodontal disease. Natural herbs are also known to affect the progression of periodontal disease.⁵

Classification²:
Classification of local delivery system

Based on type of therapy

A) Personally applied (patient home care)
   1. Non Sustained (Oral irrigation)
   2. Sustained (not developed till now)

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B) Professionally applied (in dental office)

1. Non Sustained (Supra and subgingival irrigation)

2. Sustained (Controlled release device)

Based on degradability of the device

A) Biodegradable

B) Non-Biodegradable

Based on duration of action

A) Sustained released devices - These are the devices that last for less than 24 hours therefore require multiple applications. It follows the first order kinetics.

B) Controlled delivery devices – These are the devices which follow whose actions last longer than 24 hours and follow zero order kinetics, thereby decreasing the number of applications.

**Pharmacokinetic parameters for local application:**

In order to achieve the pharmacological objectives of a locally delivered agent, Greenstein and Tonetti (2000) have proposed following three pharmacokinetic parameters for the local drug delivery.

1. **Site of Action**

   The drug must reach the intended site of action. Local application of drug targets bacteria in the periodontal pocket, soft tissue wall of the pocket, exposed cementum or radicular dentin. Presence of subgingival calculus, anatomic anomalies, deep pockets and furcation lesions may result in physical difficulty in placing the drug at intended site, thereby impeding the drug efficacy at the site e.g. agents in mouth rinses and those used during supragingival irrigation do not predictably reach beyond 5mm into the periodontal pocket. However, irrigating solutions delivered intracrevicularly, via a cannula or other device can be projected into deep periodontal pockets.

2. **Adequate Concentration**

   Biofilm experiments have shown that the minimum inhibitory concentrations of antimicrobial agents are around 50 time higher than for bacteria growing under planktonic conditions, as highly organized aggregates of adherent bacteria (biofilms) may impair diffusion or inactivate pharmacologic agents. Therefore, adequate drug concentration must be maintained at the local site to achieve the desired results.

3. **Sufficient duration of Time**

   Once a drug reaches the site of action at an adequate concentration, it must remain at the site long enough for the pharmacological effect(s) to occur. The duration of action required is dependent upon the mechanism by which the antimicrobial agent inhibits or destroys target bacteria, e.g. chlorhexidine, a bactericidal agent, kills microorganisms by destroying the cell membrane and requires a shorter exposure time than a bacteriostatic agent.

**Drug Delivery Devices:**

There are two possible approaches to improve the drug action:

(i) sustained and controlled drug release to reduce or eliminate side effects by improving the therapeutic index;

(ii) site-specific drug delivery to minimize systemic effects.

Non-biodegradable systems must be removed after complete drug release, which may cause irritation and inflammation of the treated site. Conversely, a biodegradable sustained release drug delivery system which can be placed into the periodontal pocket and maintain therapeutic concentrations for prolonged periods of time would be effective.

**Drugs used for local delivery:**

**Tetracycline**

Goodson et al in 1979 first proposed the concept of controlled drug delivery in the treatment of periodontitis. The first delivery devices involved hollow fibers of cellulose acetate filled with tetracycline. Tetracyclines are a group of bacteriostatic antimicrobials. They have been frequently used in treating refractory periodontitis, including localized aggressive periodontitis.

Fibers: The ACTISITE tetracycline fibres have been approved for the treatment of adult periodontitis both by the United States Food and Drug Administration (FDA) and by the European Union’s regulatory agencies.
maintains constant concentrations of active drug in the crevicular fluid in excess of 1000 µg/mL for a period of 10 days. Following application of tetracycline fibres a explicit reduction in the subgingival microbiota has been observed. Recently bioresorable tetracycline fiber has been formed with base of collagen film, which is commercially available as PERIODONTAL PLUS AB. It has the advantage of no second appointment for removal as it biodegrades within 7 days.

2) Subgingival Doxycycline: Doxycycline is a bacteriostatic agent which has the ability to downregulate MMP’s a family of zinc dependent The only FDA approved 10% doxycycline in a gel system ATRIDOXY (42.5 mg doxycycline) is a subgingival controlled-release product composed of a 2 syringe mixing system. Doxycycline levels in GCF spiked to 1,500 - 2000 µg/mL in 2 hours following treatment with ATRIDOXY. In the first 18 hours, these levels remained above 1000 µg/mL after which time the levels began to decline gradually. Local concentration of doxycycline have been found to remain well above the minimum inhibitory concentration for periodontal pathogens (6.0 µg/mL) at the end of seventh day. Approximately 95% of the polymer is bio absorbed or expelled from the pocket naturally within 28 days.

3) Subgingival Minocycline: Local delivery of minocycline, a bacteriostatic antibiotic has been tried clinically via in three different modes i.e. film, microspheres, and ointment.

4. Subgingival Chlorhexidine: The use of chlorhexidine as an antifungal and antibacterial agent is well known. Chlorhexidine is used as mouth rinses and is highly recommended in the hygiene phase of treatment as an adjunct to tooth brush. The major application is for the control of dental plaque and gingivitis. Its mechanism of action is to reduce pellicle formation, alteration of bacterial adherence to teeth and an alteration of bacterial cell walls causing lysis. Its antibacterial action is due to an increase of the cellular membrane permeability followed by the coagulation of intracellular cytoplasmic macromolecules. As the chlorhexidine is highly cationic, it exhibits high substantivity. The long term efficacy of chlorhexidine on the periodontal pocket flora is dependent on the duration of exposure. However, intracrevicular irrigation of the periodontal pocket with chlorhexidine has only a short lived effect on the pocket flora.

Chlorhexidine is available in the form of mouthrinses, Gels, varnishes, and chip to be used as a local drug delivery agent for the treatment of periodontal diseases.

5. Subgingival Metronidazole: Among the antibiotics that have been considered for periodontal treatment, Metronidazole has often been chosen because of its selective efficacy against obligate anaerobes. It acts by inhibiting DNA synthesis. It is known to convert into a reactive reduced form and affects specifically anaerobic rods and spirochetes in subgingival microflora. After application of Elyzol 25% dental gel, Metronidazole concentrations of above 100 µ/ml were measurable in the periodontal pocket for at least 8 hours and concentrations above 1 µ/ml were found at 36 hours. A topical medication ELYZOL contains an oil-based metronidazole 25% dental gel (glyceryl mono-oleate and sesame oil). It is applied in viscous consistency to the pocket, where it is liquidized by the body heat and then hardens again, forming crystals in contact with water.

Conclusion:

There are various drugs such as tetracycline, doxycycline, minocycline, chlorhexidine and metronidazole as well as herbal products like neem that are used and are under further trial for their administration as local drug into the periodontal pocket. Local Drug Delivery system with controlled release has the potential to be used as a therapeutic agent. There is ample evidence to show that locally delivered antimicrobials can reduce clinical and microbial parameters. These devices are proving to be more convienent and more effective than the drugs used systemically.

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The complete overview of treatment modalities of Myofacial Pain Dysfunction Syndrome

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Abstract:
Myofacial pain dysfunction syndrome is a syndrome which has become a topic over the decade. It has become one of the most common cause of orofacial pains, as every 5 out of 10 patients are suffering from MPDS. There are variable of symptoms present for a typical TMJ dysfunctioning including pain, reduced or limited mouth opening, tender muscles, clicking or crepitus and irregular mandibular movements. The MPDS patient gradually adapts to the symptoms even if he has been exposed to various invasive and non-invasive treatments. Since MPDS covers a wide range of symptoms, it might be difficult to diagnose and provide definitive treatment. Hence the specialist should extend his knowledge about the disorder to provide definitive treatment to the patient.

Key words: Myofacial pain dysfunction syndrome, surgical management, recent trends.

Introduction:
Myofacial pain dysfunction syndrome is defined as the pain and tenderness of the muscles of mastications and others along with the development of a “trigger zone”¹. It is characterized by limited mouth opening, pain and tenderness in the muscles along with clicking and crepitus sound and varied TMJ movement, pain in the preauricular area radiating to head causing headache but due to its wide symptom variability it is often difficult to diagnose or remain undiagnosed. A “trigger zone” is a local zone of palpable hyperirritability in a tissue which when compressed leads to local pain and if, hypersensitive can lead to radiating pain in other regions of the face.² The definitive treatment of MPDS depends upon the symptoms of the patient. Some require relief of symptoms while in some patient the treatment of causative factor is necessary. This article deals solely with the treatment modalities available for MPDS.

Management of MPDS:
The treatment modalities of MPDS is broadly classified in non-surgical and surgical treatment:

Non-Surgical Management:
The non-surgical treatment or the non-invasive management deals with the early symptoms of MPDS. Majority of the patients gets relief from the non-invasive therapy only as it aims to bring the joint back in healthy condition. The non-surgical treatments are further grouped into:

1) Initial therapy
2) Pharmacological therapy
3) Physiotherapy
4) Occlusal therapy
5) Other therapies

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Initial therapy:

i) **Reassurance:** It is very important to make the patient aware about the condition, its treatment options available and the prognosis. Reassurance of the patient is very necessary that no serious problem is there and can be managed, for early recovery of patient and prevents him from any psychogenic trauma.

ii) **Diet:** Diet play a very major role in the management of MPDS. Hard and sticky food should be eliminated from patient’s diet to prevent the stress or stain over the masticatory muscles. The patient should be put on soft and liquid diet.

iii) **Rest:** Rest is very important to relieve the strain on the muscles. It is possible by making the patient aware of the condition, unconscious postural, swallowing and grinding habits.

Pharmacological Therapy:

i) **Analgesics:**- Opiode and non opioide analgesics are used depending upon the degree of pain. The opioide analgesics acts on the central nervous system and induces sleep, whereas, non opioide analgesics like NSAIDS do not interact with CNS and help in reducing mild to moderate pain.

ii) **Anti-Inflammatory:**- it helps in reducing the inflammations in muscles by preventing the release of arachidonic acids.

iii) **Muscle relaxants:**- reduces muscle strains, for eg-thiocholchicine.

iv) **Anxiolytics:**- it acts as a supportive therapy. Anxiolytics do not have any direct effect in reducing muscle pain but it may help in eliminating patient’s stress produced due to the disorder.

v) **Local anesthetics:**- reduces the pain immediately thus providing relief to the patient allowing complete muscular movement. Apart from therapeutic it also acts like a diagnostic tool. Once the area is anesthetized, it is easy to diagnose the trigger zone and its radiating path

Physiotherapy:

i) **Thermodynometry:**- hot and cold fermentation is best and first advised to patient. It is based on premise that heat increases the circulation and reduces inflammation. Moist heat is better then dry heat. The patient is advised to keep a moist towel over the skin surface for approximately 10-15 min for continuous fermentation.

ii) **Trans-cutaneous electro galvanic stimulation:**- utilizes the principle of muscle contraction by electrical stimulations. It is based on the premise that continuous electric contraction and relaxation of the muscle helps to break the myospasm. It is effective on the peripheral large A-delta fibers to reduce the muscle pain. Tens as an adjunctive conventional therapy proves to give very good results in patients.

iii) **Infra-Red Rays:**- infra red rays have a synergistic effect on the muscle. It increases the blood flow and induces mild anti-inflammatory reactions mediated through the histamine and prostaglandin promoting vasodilatation, changing enzymatic activity and metabolic rate.

Occlusal therapy:

Even small occlusal disturbance can lead to the pain in the muscles and joint.

i) Occlusal splints are given to the patient to relieve the occlusal disharmony.

ii) Provides equal contact of all the tooth hence providing an equal load distribution on all the teeth and prevent the jaws from adverse mechanism of bruxism,clenching and other habits.

iii) The various appliances used are bite planes, occlusal appliance, night guard, mouth guards.

Other modalities:

Apart from these various other modalities are also available to treat MPDS conservatively

i) **Dry needling:**- acts as an therapeutic agent to release the intracellular potassium to block nerve conduction temporarily.

ii) **Stripping massage:**- it is a specific stroking massage opn the skin to lubricate the muscle by putting the digital pressure on the muscle in milking motion. The
pressure is light on the first pass hence increasing gradually to reduce the bumpiness in the muscle.

iii) **Accupuncture** :- it is body’s own anti-nociceptive mechanism to reduce the level of pain. Stimulation of acupuncture areas causes release of endorphin molecules by blocking the transmission of noxious impulses, hence reducing the pain sensation.[3]

**Surgical Management:**

Many patients get relieve from the conservative therapy, therefore surgery is considered to be the last resort.

i) **Condylotomy**:- deliberate displacement of the head of condyle, which moves slightly mediially and forward. This procedure do not disturb the internal structure and the joint capsule.

ii) **High condylectomy**:- only performed when there is radiographic evidence of proliferative changes and erosion of the conylar head.

iii) **Meninsectomy**:- it is the removal of the articular disc of the joint. The procedure relieves the pain in patient by cutting the nerve supply of the disc. Hence it is only indicated when there is actual damage to the disc.

iv) **Myotomy**:- if the conservative treatment fails, removal of the muscle fibers of the trigger zone helps in reducing pain. Myotomy of temporalis and masseter muscle is indicated.

v) **Arthroscopy**:- it includes the lysis and lavage of the joint. This helps in reducing inflammation and increase in the range of motion[4].

**Recent Trends in management of MPDS:**

- **Botulinum Toxin A injection**:- Injection of BTX-A in the masseter and temporalis muscle fibers extraorally under electromyography guidance serves to prove effective in 9 out of 10 patients. These muscles are most commonly involved and radiates the pain to ear and temporal headache respectively, which leads to the limitation of the mandibular motion and develop MPDS.[5]

- **Ultrasound**:- ultrasound therapy uses the transmission of the sound waves through conducting gel into the tissue leads to the breakdown of scar tissue. It increases the cell membrane permeability by altering the sodium potassium ion gradient. It increases the exchange of gases which promotes healing and reduces inflammation.

- **Iontophoresis**:- it is a procedure of passing low amperage current to the tissue of the area involved. A pad is placed over the skin of patient and electric current is passed through it into the tissue.

- **Cold and soft laser therapy**:- application of the low level laser therapy has been sought to promote healing, reduce inflammation. It accelerates collagen synthesis, increases vascularity, and decreases the no of microorganism and pain.[6]

**Conclusion:**

The management of MPDS can be done properly if diagnosed early and the causative factor have been removed. Surgical treatments should be considered only when the conservative treatment fails. Additional management like drug therapy provides reassurance to the patient. Even after so many modalities available researches in the field is still going on to treat the patient more effectively.

**References:**


Oral pigmented lesions: review of the literature

Dahiya N. 1, Nagpal A. 2, Malik M. 3, Laller S. 4, Sheokhand P. 5

Abstract:
Oral pigmentation can be physiological or pathological, and exogenous or endogenous. Color, location, distribution, and duration as well as drugs use, family history, and change in pattern are important for the differential diagnosis. Dark or black pigmented lesions can be focal, multifocal or diffuse macules, including entities such as racial pigmentation, melanotic macule, melanocytic nevus, blue nevus, smoker’s melanosis, oral melanoacanthoma, pigmentation by foreign bodies or induced by drugs, Peutz-Jeghers syndrome, Addison’s disease and oral melanoma. Change in color of oral mucosa reflects the underlying health status, which is either local or systemic. Pigmentation in pathological conditions range from localized anomalies of to potentially life-threatening conditions.

Key words: Pigmentation, melanin, melanoma.

Introduction:
Healthy oral mucous membrane normally has various shades of red. The color of the oral mucosa can be attributed to the vascular supply, the thickness and degree of keratinization of the epithelium and the presence of pigment containing cells. The color of the oral mucosa varies among persons and appears to be correlated with the cutaneous pigmentation[1].

The vascular supply of the oral mucosa is from a subepithelial capillary network present in the papillary portion of the lamina propria. The network is formed from smaller branches of the large arteries present in the submucosa. The color imparted to the mucosa by the blood supply depends on the presence or absence of retenege. As a result attached and marginal gingiva appear pink while the alveolar mucosa is red.

Three types of epithelial surface layers have been described based on the degree of keratinization[2]:

1. Keratinized epithelium, in which the superficial cells form scales of keratin and lose their nuclei. Examples include masticatory mucosa namely attached gingiva, hard palate, and vermilion border of the lip.

2. Parakeratinized epithelium, in which the superficial cells retain pyknotic nuclei and show some signs of being keratinized, Example is marginal gingiva.

3. Non-keratinized epithelium, in which the surface cells are nucleated and show no signs of keratinization. Examples are lining mucosa, which includes labial and buccal mucosa, alveolar mucosa, ventral surface of the tongue, soft palate and dorsum of the tongue.

But, in many instances, the oral mucosa may show coloration other than the shades of red. Any coloring matter of the body is called pigment. These pigmentation may be classified as physiological pigmentation and pathological pigmentation.
Melanin, a non-hemoglobin derived brown pigment, is normally present in the oral mucosa. The pigmentation of the oral mucosa due to the presence of melanin is classified as physiological pigmentation. The amount of melanin pigmentation varies among persons of different races and appears to be correlated with the cutaneous pigmentation; the incidence of melanin pigmentation of the oral mucosa is more among dark-skinned individuals than in fair skinned individuals. Various factors, both endogenous and exogenous influence the amount melanin synthesis. These factors range from tobacco smoke to hormones. There may be excessive melanin production or increase in the number of melanocytes (melanin containing cells). Pigmentation of the oral mucosa can also be pathological, ranging from benign to malignant lesions. These pigmentation are due to the accumulation of colored materials other than melanin. The endogenous materials that produce pigmentation are derived from the blood pigments or abnormal aggregations of metals that are usually produced in the body. The exogenous substances that produce pigmentation include heavy metals not normally produced in the body ie: commercial dyes, vegetable pigments or various other stains that are ingested or introduced directly into the tissues [3].

The color imparted may range between blue, brown to black. This color depends not only on the amount of pigment but also on the depth at which the pigments are deposited in the tissues. The greater the amount of pigment and deeper the pigment is lodged, darker is the color imparted through the mucosa [4].

Physiologic pigmentation or melanoplakia:
All people except albinos have some degree of physiologic pigmentation distributed throughout the epidermis. Physiologic pigmentation is characterized by an increase in melanocytic activity rather than by an increase in the number of melanocytes, and is prevalent in dark-skinned populations. Physiologic or racial pigmentation of the oral mucosa is clinically manifested as multifocal and diffuse melanin pigmentation with variable prevalence in different ethnic groups [4]. This pigmentation is genetically acquired. The quantity and distribution of the pigment granules are thought to be determined by several genes. Physical, chemical and hormonal factors can increase the amount of melanin activated in the melanocytes.

This type of pigmentation is symmetric and persistent and does not alter normal architecture, such as gingival stippling. This pigmentation may be seen in any age and is without gender predilection. Physiologic pigmentation may be found in any location, although the attached gingiva is the most commonly affected intraoral tissue, but physiological pigmentation can be noted anywhere in the oral cavity, including the tips of the fungiform papillae on the dorsal surface of tongue [5]. (fig. 1)

Based on the localisation of the pigmentation, Anders Hedin has described various degrees of pigmentation [8]:

i. Degree I- Central part of one or two solitary interdental papillae

ii. Degree II- Pigmentation of more numerous solitary interdental papillae

iii. Degree III- Isolated pigmented areas converged into short continuous ribbons
iv. Degree IV- One long continuous ribbon including the greater part of the gingiva in front of the canines and incisors.

Melanoplakia is a benign variation of the melanin pigment and is not associated with aggressive change. Macules of pigmentation of various configurations and sizes of the oral mucosa is called Melanoplakia. It is present frequently in dark-complexed people, especially blacks. The clinical appearance varies from light brown through blue to black, depending on the amount and the depth in the tissues. The deeper and heavier the deposit of melanin in the skin or mucosa, the darker it appears.

**Ephelis or freckle:**

An ephelis is a common small hyperpigmented macule up to 5mm of the skin that represents a region of increased melanin production. The name ephelis (plural-ephelides) is derived from the Greek epi (upon) and helios (sun) and implies the obligatory etiologic role of sunlight. Ephelides are seen most often on the face, arms and back of fair-skinned, blue-eyed persons; they may be associated with a strong genetic predilection. The skin discoloration is produced by a relative excess of melanin deposition in the epidermis, not by a local increase in the number of melanocytes. This increased melanogenesis can be attributed to actinic exposure. It is a self-limiting condition depending on the amount of exposure to the sun. There have been no reports on malignant transformation.

Ephelides become noticeable during the first decade of life, and new macules seldom arise after the teenage years. During adult life, the macules typically become less prominent. The lesions become more pronounced after sun exposure (fig. 2).

They are usually asymptomatic, uniform, multiple, light tan in color and less than 5 mm. with regularly defined borders. They often appear on the vermilion border of the lips, with greater frequency on the lower lip, since it receives more solar exposure than the upper lip. Since ephelides require sun exposure, they do not occur intraorally. When freckles are seen in excess in an oral and perioral distribution, Peutz-Jeghers syndrome and Addison's disease should be considered, which will be dealt with in section of pigmented lesions related to the underlying endocrine disorders.

Perioral pigmented macules have been described in association with two syndromes, namely Myxoma syndrome and Laugier-Hunziker syndrome.

**Lentigo:**

A lentigo (plural - lenitigines) is a small, sharply circumscribed, pigmented macule surrounded by normal-appearing skin. There is hyperplasia of the epidermis, increased pigmentation of the basal layer and elongation of rete pegs. Unlike ephelides where there is just increase in local melanin production, lentigines show increase in the number of productive melanocytes(fig. 3).
Lentigines are more common in adults and persist indefinitely. They are common on the face and in the perioral region. They are related to chronic sun damage, although they do not change in color in response to sun exposure. Lentigines are more common in men than in women. Depending on the type of lentigo present, the manifestation may be a solitary lesion or multiple lesions. They are tan to dark brown in color and range in size from 2 mm to 2 cm. Lentigines are more irregular in color and outline than ephelides.

There are a number of types of lentigines based on the physical appearance and morphology of the lesions. It includes lentigo simplex, solar lentigo, ink-spot lentigo, PUVA lentigo, radiation lentigo, tanning-bed lentigines, and lentigines profusa, lentigo maligna. Lentigo simplex is the most common form of lentigo. It usually occurs on skin that is not exposed to sunlight, but it may occur on any skin surface and at any age. Its color does not change with variations in sun exposure. Clinically, the lesions are round or oval asymptomatic macules that are 3-15 mm in diameter. Pigmentation is evenly distributed, with a color ranging from brown to black. Lentigo simplex is darker in color than the common ephelis.

Lentigo maligna also known as melanotic freckle of Hutchinson, lentigo maligna is a slow-growing, precancerous, pigmented lesion composed of melanocytes. It generally arises on the face, primarily in elderly persons; a few cases have been reported in the oral cavity, half of which became malignant.

Nevus of Ota (oculodermal melanocytosis) should not be confuse with lentigo maligna, Nevus of Ota involves the eye, facial skin, and oral cavity. Although it resembles lentigo maligna, it rarely becomes malignant. The diagnosis of nevus of Ota is confirmed by the clinical picture; it occurs principally in Japanese persons, and onset is generally in infancy and childhood.

Melanotic macule:
Oral melanotic macule is a term used clinically to describe brown or black melanotic macules of the oral mucosa that are not a manifestation of racial pigmentation and are not associated with any systemic disease or syndrome. The lesion is characterized histologically by an increased amount of melanin in, or subjacent to, the basal-cell layer. These melanotic macules have been variously termed ephelis, melanosis, lentigo, solitary labial lentigo, labial melanotic macule and oral melanotic macule. Ephelides are not found on the skin that is never exposed to sunlight. Thus, the term ephelis is a misnomer for oral melanotic macule although the histologic appearance of the two lesions are similar. Lentigo exhibits significant increase in the number of melanocytes which is not so marked in melanotic macule. So, the term lentigo is not appropriate for this lesion. Focal melanosis is used as a histologic designation when hyper pigmentation of the basal cell layer and/or the lamina propria is associated with clinically non-pigmented pathologic condition.

Hence, the term oral melanotic macule is more appropriate for lesions in which there is a clinicopathologic correlation between the clinical feature of a discrete pigmented macule and the histologic features of the hyper pigmentation of the basal cell layer and/or the lamina propria.

Oral melanotic macules are discrete, macular areas of hyper pigmentation and are present in about 3% of the population. These lesions are usually noted in patients over the age of 40 years and the female to male ratio is 2.2:1. The most common location of the melanotic macule is the vermilion border of the lip, followed by the gingiva and the buccal mucosa. The lesions are usually solitary, flat and are typically dark brown to tan in color and can be up to 1 cm. in diameter. They are asymptomatic and apparently have no malignant potential (fig. 4).

Histologically, there is increased basal pigmentation at the tips of the rete pegs. There is also extravasated pigment and pigment-laden macrophages in the upper portions of
the connective tissue without atypia. They usually have a negative immunohistochemical staining with HMB-45 antibody (a melanocyte-specific antibody) and electron microscopy shows normal number and morphology of melanocytes.

Varicosity:
Pathological dilatations of veins of venules are varices or varicosities. Varicosities become progressively prominent with age; thus, lingual varicosities are encountered in elderly individuals. They represent a degenerative change in the adventitia of the venous wall. It may also result from partial blockage of the vein proximal to the distension, either by a stricture causing external pressure or from a plaque that has formed on the luminal side of the vessel wall because of an injury.

The varicosities are commonly seen in the floor of the mouth and ventral surface of the tongue. The varicosities most frequently observed are superficial, painless and bluish. Lingual varicosities appear as tortuous serpentine blue, red, and purple elevations that course over the ventrolateral surface of the tongue, with extension anteriorly. They are of no clinical significance and are not subject to rupture and hemorrhage (fig. 5).

Petechiae secondary to platelet deficiencies or aggregation disorders are usually not limited to the oral mucosa but occur concomitantly on skin. Autoimmune or idiopathic thrombocytopenic purpura (ITP), HIV-related ITP, disorders of platelet aggregation, aspirin toxicity, myelophthisic lesions, and myelosuppressive chemotherapy all will lead to purpura, with petechiae being the major lesions. Alternatively, most oral petechiae are not associated with thrombocytopenia or thrombocytopenia; rather, they are usually confined to the soft palate, where 10 to 30 petechial lesions may be seen and can be attributed to suction. Excessive suction of the

Purpura, petechia and ecchymosis:

Petechia is a reddish to purple flat lesion caused by leaking of blood from vessels into the subcutaneous tissue. Purpuric lesions measuring 1-2 mm in diameter are called petechiae while larger purpuric lesions are called ecchymoses. These lesions result from a slow hemorrhage where there is insufficient blood flow to create swelling. They are initially red and change to a blue-brown color within hours. They do not blanch with pressure. A hemorrhage that has sufficient

blood flow to produce swelling is clinically observable as a hematoma.

Trauma and perhaps more frequently disorders of the hemostatic mechanisms or other systemic diseases may be the causative factors, particularly if the petechiae are generalized in distribution. It is important to obtain a complete history from a patient who has these lesions. The types of traumatic injuries are related to cheek biting, coughing, fellatio, trauma from prosthetic appliances, injudicious hygiene procedures, and iatrogenic dental injuries.

On clinical examination, petechiae and ecchymoses begin as reddish macules of varying shapes and outlines. Soft tissue hemorrhagic lesions usually appear in areas accessible to trauma, such as the buccal mucosa, lateral aspect of tongue, lips, and junction of the hard and soft palate. On palpation, their consistency is similar to that of the normal mucosa. They do not blanch on pressure, but within a few days, their color changes from red to blue to greenish-blue to yellowish-green to yellow, and then they disappear as the hemoglobin is degraded to hemosiderin and is removed. (Figure 6)
soft palate against the posterior tongue is self-inflicted by many patients who have a pruritic palate at the onset of the viral or an allergic pharyngitis; they simply "click" their palate. Palatal petechiae can also appear following fellatio\(^{[13]}\). When traumatic or suction petechiae are suspected, the patient is instructed to cease whatever activity may be contributing to the presence of the lesions. By 2 weeks, the lesions should have disappeared. Failure to do so should arouse a suspicion of a hemorrhagic diathesis, and a platelet count and platelet aggregation studies must be ordered.

**Hematoma:**

A hematoma is a pool of effused blood confined within the tissues. When it is superficial, it appears as an elevated, bluish swelling in the mucosa.

The early hematoma is fluctuant, rubbery, and distinct in outline, and the overlying mucosa is readily movable. The temperature of the overlying mucosa may be elevated slightly. Digital pressure on the surface may induce a stinging sensation because pressure on the contained pool of blood causes further separation of tissues.

The early hematoma is usually a solitary lesion that yields dark blue blood on aspiration (fig. 7).

If a hematoma becomes infected, it is painful. Although the clot initially is firm, if the infection is a pyogenic type, the firm clot softens and becomes fluctuant as pus accumulates.

**Telangiectasia:**

A telangiectasia is a small, red, macular lesion that is composed of permanently dilated capillaries under the epithelium.

Telangiectasias are red or violaceous threads in different patterns, seldom over 5 mm in diameter and blanch on digital pressure, which easily differentiates them from red petechiae. They may occur as solitary or multiple lesions. They are only cosmetic problems, and bleeding occurs very rarely.

Telangiectasias occur in many cutaneous and systemic conditions. Some of these include actinic-damaged skin, basal cell carcinoma, hereditary hemorrhagic telangiectasia, lupus erythematosus, CREST syndrome, Ataxia-telangiectasia, rosacea, cirrhosis and pregnancy.

**Mucocele:**

Mucocele is a clinical term that describes swelling caused by the accumulation of saliva at the site of a traumatized or obstructed minor salivary gland duct. Mucoceles are classified as extravasation types and retention types. A large form of mucocele located in the floor of the mouth is known as a ranula.

The formation of an extravasation mucocele is believed to be the result of trauma to a minor salivary gland excretory duct. Laceration of the duct results in the pooling of saliva in the adjacent submucosal tissue and consequent swelling. The blockage of salivary flow causes the accumulation of saliva and dilation of the duct. This is termed as mucus retention cyst, since the mucus-filled cavity is lined with epithelium\(^{[15]}\).

Extravasation mucoceles most frequently occur on the lower lip where trauma is common. The buccal mucosa, ventral surface of the tongue (where the glands of Blandin-Nuhn are located), floor of the mouth, and retromolar region are other commonly traumatized areas where mucous extravasation may be found. Mucous retention cysts are more commonly located on the palate or the floor of the mouth (fig. 8).
Mucoceles appear suddenly and reach a maximum size within several days. The lesion may lie fairly deep in the tissue or be exceptionally superficial and, depending on the location, will present a variable clinical appearance. The superficial lesion appears as an elevated, circumscribed vesicular or bullous lesion, which often has a slightly bluish or translucent appearance. The deeper lesion is manifested also as a swelling but because of the thickness of the overlying tissue, the color and surface appearance are those of normal mucosa. It is usually painless, smooth surfaced and range from a few millimeters to a few centimeters in diameter. The lesion is soft on palpation and often fluctuant. The mucocele is movable over the submucosa but is attached to the overlying mucosa. They do not blanch with pressure.

The lesions may vary in size over time. Patients will frequently traumatize a superficial mucocele, allowing it to drain and deflate. In these circumstances, the mucocele will recur.

Mucous retention cyst presents as an asymptomatic swelling, usually without antecedent trauma. The lesions vary in size from 3-10 mm and on palpation are mobile, nontender and without peripheral inflammatory change. The overlying mucosa is intact and of normal color.

**Ranula:**

Ranula is a clinical term that includes mucus retention cyst and mucus extravasation phenomenon. This lesion specifically is present in the floor of the mouth. The ranula is associated with sublingual glands or the submandibular glands.

Ranulas arise as a result of either trauma or ductal obstruction. Ductal obstruction can be due to the presence of a sialolith. Trauma to the floor of the mouth may be accidental or surgical.

Ranula presents a fluctuant, unilateral, painless, slow growing, soft and movable mass in the floor of the mouth. The term "Ranula" derived from latin word "rana" means frog and it is used because this lesion as it resembles the swollen belly of a frog. If the lesion is superficial, then it has a bluish hue but if the lesion is deep, then the overlying mucosa is normal in color. The term "plunging ranula" and "cervical ranula" refer to mucoceles that extend below the mylohyoid muscle, beyond the sublingual space, and involve the submandibular space and adjacent structures (fig. 9).

**Melanoma:**

Malignant melanoma (MM) is a malignant neoplasm of melanocytic origin that arises from a benign melanocytic lesion or de novo from melanocytes within otherwise normal skin or mucosa. Melanoma is the third most common skin cancer and represents from 3% to 5% of cutaneous malignancies. Oral MMs are extremely rare and represent less than 2% of all reported melanomas. In 1856 in Germany, Weber described the first melanoma of the mucosa. Unlike cutaneous melanoma, mucosal melanomas do not have precursor lesions and risk factors, making them difficult to diagnose. Melanoma of the oral cavity is more prevalent in Whites than non-Whites and Japanese have the highest incidence than any other groups.

Oral MM is largely a disease of those older than 40 years, and it is rare in patients younger than 20 years. A male predilection exists, with a male-to-female ratio of almost 2:1 and is diagnosed approximately a decade earlier than in females. There is a definite site predilection for maxillary gingival and palatal mucosa representing 80% of the cases. But buccal
mucosa, tongue and mandibular gingiva lesion are identified.

The clinical color of oral melanomas ranged from black to grey to purple to red to white. Some lesions are uniform in color; others exhibited marked variations in color. The lesions are asymmetric, irregular in outline, and occasionally multiple. The oral lesion typically begins as a brown to black macule with irregular borders. The macule extends laterally, and a lobulated exophytic mass develops once the vertical growth is initiated. Pre-existing melanocytic lesions are noted in about one third of cases of mucosal melanoma in the head and neck region.

Unfortunately, oral melanomas usually remain asymptomatic with recognition of the lesion occurring when there is breakdown of the overlying epithelium or hemorrhage. The ulcerated epithelium lacks both the induration and rolled borders that are features characteristic of squamous cell epithelium, which makes clinical detection more difficult.

Clinical characteristics of cutaneous melanoma are best described by ABCDE criteria: asymmetry, orders are irregular, color variegation, diameter greater than 6mm, evolution or surface elevation (fig.10)\(^5\).

Melanomas are characterized by three growth phases: a macular phase, a pigmented plaque phase, and a nodular phase. The histopathological classification of oral melanomas is different from that of cutaneous melanoma. Classification of oral mucosal melanomas is difficult because most are detected late, when they are large and aggressive masses. At the 1995 Western Society of Teachers of Oral Pathology Banff Workshop, a classification was proposed based on histologic pattern: in situ, invasive and combined in situ and invasive type.

The Breslow classification system is the preferred staging system for cutaneous melanomas. The clinical staging system has been devised with three stages: Stage I: Clinically localized disease Stage II: Regional lymph node disease Stage III: Distant disease\(^6\)

**Hemangioma:**

A hemangioma is a benign tumor of patent blood vessels that can be either congenital or traumatic in origin and are characterized by a rapid growth phase with endothelial cell proliferation, followed by gradual involution\(^6\).

Hemangiomas occur early in life but can develop at any time, and various types are distinguished. They are much more common in females than males with a ratio of 3:1, and they occur more frequently in whites than in other racial groups. The most common location is the head and neck, which accounts for 60% of all cases. The lesions are painless and vary from a few millimeters to several centimeters in diameter. The lesions occur most frequently on the tongue, vermilion border of lip, or buccal mucosa\(^13\). Whereas most hemangiomas are raised and nodular, some may be flat, macular and diffuse, particularly on the facial skin where they are referred to as port-wine stains. Oral hemangiomas are red or blue, reflecting both the venous character of the blood within them and their frequent, deep mucosal position.

**Amalgam tattoo (Focal Argyrosis):**

Amalgam tattoo are asymptomatic, distinct macules that usually have poorly defined borders. Deposition of amalgam restorative material into the oral mucosa is the most common reason for pigmentation in the oral cavity. These deposits are twice as common as melanotic macules and 10 times as common as oral nevi.

Amalgam tattoos result from the accidental implantation of dental amalgam into the soft tissues, during routine dental treatment. The clinical discoloration is due to the subsequent precipitation and dispersion of silver ions with sulfur and thus silver sulfide corrosion product causes the tissue pigmentation\(^16\).

**Drug-induced pigmentation:**

An expanding number of medications have been implicated as a cause of oral mucosal pigmentation. Although many medications
stimulate melanin production by melanocytes, deposition of drug metabolites is responsible for the color change in others. These pigmentary alterations have been associated with the use of phenolphthalein, minocycline, tranquilizers, antimalarial medications, estrogens, chemotherapeutic agents, and some medications used in the treatment of acquired immunodeficiency syndrome (AIDS) [6].

The antimalarial agents that are most frequently implicated are chloroquine, quinidine, and quinacrine; chlorpromazine represents the most frequently implicated tranquilizer. Oral mucosal pigmentation associated with chemotherapeutic medications is most commonly reported with use of doxorubicin, busulfan, cyclophosphamide, or 5-fluorouracil and particularly busulfan causes oral pigmentation. Although idiopathic hyperpigmentation may also occur; AIDS patients receiving zidovudine, clofazimine or ketoconazole have demonstrated increased melanin pigmentation.

Conclusion:
Oral pigmentation may be focal, diffuse or multifocal. They may be blue, purple, grey or black. They may be flat or tumefactive. The etiology of these pigmented lesions also vary. The etiology may either due to local factors or due to underlying systemic diseases. The pigmented lesions of the oral mucosa range from the extremely common and harmless such as the racial pigmentation or amalgam tattoo to the rare and deadly as in case of malignant melanoma. The prognosis of these lesions also vary.

But, many lesions have similar clinical presentation making it difficult to differentiate one from the other. As a result, they pose a diagnostic dilemma in the dental offices.

A thorough knowledge of the various pigmented lesions of the oral cavity, obtaining a detailed history of the lesion, careful clinical examination, and a biopsy may all help in arriving at a more definitive diagnosis. This further helps in correct management and assessing the prognosis of the lesion.

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Role of pediatric dentist in cleft lip and palate

Jha P.¹

Abstract:
The management of cleft lip and palate presents many challenges. Their effective management requires a multidisciplinary approach. The involvement of a pediatric dentist with these children and their families often begins before birth and can extend into late adulthood. This article reviews the role of a pediatric dentist in the multidisciplinary craniofacial team.

Key words: Cleft lip and palate, cleft lip and palate team, management of CLCP.

Introduction:

Cleft lip and palate are the most prevalent malformations in mankind and are considered a relevant public health problem by the World Health Organization.¹ According to various studies carried out, the incidence of CL/P worldwide is 1 in 500-1500 live births, and it is nearly 1 in 500 in India.²

The treatment of cleft lip and palate should be initiated soon after birth and continues up to adulthood, requiring the participation of an interdisciplinary team. The morphological rehabilitation of clefts involves plastic lip surgery at 3 months of age and palate surgery around 1 year of age, as well as secondary alveolar bone graft performed between 9 and 12 years of age. Besides the primary plastic surgeries, the rehabilitation requires an interdisciplinary protocol involving different specialities as speech therapy, maxillofacial surgery and oral rehabilitation and the therapeutic procedures should be standardized.³

In dental rehabilitation, the pediatric dentist provides oral health information and should be able to follow the child with cleft lip and palate of the mixed dentition, craniofacial growth and dentition development. This evidences the fundamental role of the maxillofacial surgeon working together with the pediatric dentist.⁴

The baby with a cleft lip and palate and the pre-mixed dentition years:

Within the first few days after the birth, parents of babies born with a cleft lip and palate should receive advice in hospital from the surgeon and pediatric dentist on the immediate and long-term management of their child. The Pediatric dentist is usually the first dental specialist whom the family will encounter. Reassurance information, preventive advice and acclimatization are the important aspects of these early visits. Establishing the correct dental habits from an early age will help to ensure the health of the primary and permanent dentition. Pain, sepsis, or the need for dental extractions as a result of caries is unacceptable for all children. However, early removal of primary teeth in children with a cleft is particularly contraindicated because of possible space loss, especially in the upper arch, making orthodontic treatment more difficult. An intact dentition will allow for the best possible results from later orthodontic intervention if required.⁵

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Behavior Management:

In some cases the young patient with a repaired cleft may be shy, nervous, or have a behavioral problem. The reasons are usually multifactorial but frequent hospital visits and previous hospitalization may play a part. Children may also be influenced by their parents’ behavior, which is sometimes anxious and overprotective. The pediatric dentist needs patience to establish good communication, especially in the early years. Speech and hearing difficulties are a common occurrence in patients with a cleft palate. Problems with speech and hearing may present a possible barrier to satisfactory communication with the child.5

The Dental Examination:

The easiest way to examine a baby is with its head gently lowered onto the dentist’s lap and the parent sitting facing the dentist, supporting and controlling the child’s arms and legs. The use of a small dental mirror is helpful in tiny mouths, especially in the patient with a cleft. Particular care is needed when examining the palatal cleft area as teeth are easily missed in this region.5

Preventive Management:

Feeding & Diet:

Cleft patients have great difficulty in feeding, thus maintaining the nutrition is the first priority, and finding a feeding technique as close to normal as possible is second.6 The mother may experience some difficulties depending on the type and extent of the cleft, yet breastfeeding should always be encouraged, because the child and mother may develop mechanisms to adapt to the presence of the cleft and allow the breastfeeding, which is important for child in the first months of life.4 Specialised feeding bottles can act as effective substitutes. Parents need to appreciate the importance of good dental health before the teeth erupt.

They should be given the correct advice regarding dietary control of sugar-containing food and drinks, and know how to implement it. They need to understand fully the relationship between the frequency of sugar in the diet and tooth decay, in simple terms. Snacks should be free from sugars, and foods containing non-milk extrinsic sugars should be kept as an occasional ‘pudding’ after a meal reflex.5

Tooth brushing:

Parents may be nervous to brush in the region of the cleft, especially following the primary lip and palate surgery. They often think that bleeding from gingival inflammation is caused by damage from tooth brushing or the breakdown of the surgical repair.7 The use of the dental mirror with the child supine will aid demonstration of difficult access regions to the parent by indirect vision. Where the upper lip has been repaired, parents should be shown how to lift it, stretching the lip carefully by sliding an index finger along the labial gingivae, without doing any damage to the scar. This helps to give them a clear view of the cleft region with good access to the crowns of the anterior teeth and the gingival margins for plaque removal.5

A small baby brush or a finger brush with a small head is advised as the first toothbrush. For many children with clefts, this size of brush can be used up until the eruption of the first permanent molars and beyond. An interspace brush is a useful additional aid where there is overlap and crowding of teeth, or in the case of the bilateral cleft where the upper anteriors can be very retroclined. For the toddler, parents are advised to stand or kneel behind the child when brushing, with the chin supported and head resting against the parents’ chest. It may help if the child is in their baby seat or pushchair, or even lying on the carpet.5

A low fluoride children’s toothpaste containing no more than 600 ppm fluoride is recommended for children under 6 years of age in order to reduce the likelihood of enamel opacities in the permanent teeth.8 Children with a high risk of developing caries should use a standard toothpaste (1,000 ppm fluoride). Parents are advised to use just a trace on the brush initially, and to brush with water rather than not brushing at all if the child cannot tolerate the taste. The eventual goal is to establish a twice-daily tooth brushing regime with the recommendation of no more than a small pea-sized amount of toothpaste on the brush. Parental help and supervision continues to be important at least until 7 or 8 years of age.9

Restorative care:
As for all children, the aim for the child with a cleft lip and palate is a caries-free dentition. If carious lesions have developed, it is essential that they are restored as soon as possible with the most suitable material. Initially interim therapeutic restorations in a non-cooperative child by using Glass ionomer cement can be beneficial in such patients. Also, pit and fissure sealants can be applied on indicated tooth as preventive measure.

Impressions and models:

Impression procedures in cleft infants pose a unique set of challenges in infants, including the size constraints imposed by the infant’s oral cavity, anatomical variations associated with the severity of clefts and a lack of ability of the infant to cooperate and respond to commands.

A set of perforated custom acrylic trays of different shapes and sizes, both unilateral and bilateral, can be easily made from different size casts, or size and shape can be roughly estimated and trays individually trimmed and perforated with a large round bur. As an alternative, manufactured metal trays of different shapes and sizes may be modified as required.

The use of fast setting color-timed alginate has been suggested in cleft infants, which has the advantages to record the details even in the presence of saliva, is comfortable to the patient, easy to manipulate, relatively inexpensive, and prevents respiratory arrest. In addition to this, the elastomeric putty, can be used which does not extrude deep into the undercut areas in the region of cleft and also resist tearing during removal.

The filled tray should be inserted while the infant is lying back in a horizontal position, to allow best view and access. The baby should be raised to a sitting position once the tray has been seated properly. The baby should start crying actively which is the best indicator that the airway is clear. As the impression sets, the child is seated upright, with the weight of the head supported on the finger of the operator beneath the tray. In this position the mandible is free to move as the child cries and the airway is kept open. If the child is tripped too forward, the mandible may be forced against the chest, making breathing through the mouth impossible. At this point, since the nasal passage exposed by the cleft is blocked by the impression material, the child may become slightly cyanotic. In the 15-20 seconds that the try is in place it should cause no serious problem other than the apprehension in the operators.

Withdrawal of the impression should be by the fast snapping action typically used for impression removal, followed by checking for any areas where portions of the impression may have been torn away. Next the cleft areas should be examined for any small fragments of the impression material, which should be removed with the help of a suction tip.

Ravichandra KS et al described a new technique for impression making for the fabrication of an obturator for a 5 day old infant. Pani SC and Hedge AM described a novel two stage technique utilizing greenstick compound and addition silicone impression material for recording impressions in children with cleft lip and palate.

Before 4 years of age impressions are obtained only for the maxillary dental arch. Impressions of the mandibular arch are only obtained in the complete deciduous dentition. Knowledge on these aspects is important for the rehabilitative treatment to be performed at this stage, which comprises the onset of orthodontic intervention and accomplishment of secondary surgeries, including alveolar bone graft.

Nasoalveolar Moulding:

NAM is a non surgical method in which reshaping the gums, lip and nostrils is undertaken to lessen the severity of the cleft before cleft lip and palate surgery. It is used mainly for children with large clefts. NAM is employed in early management of both unilateral & bilateral cleft anomalies in newborns. Therapy is started at the age of 2 weeks. It gives excellent early results but there are no long term results. Surgery is performed after the moulding of alveolus is achieved, approximately 3-6 months after birth.

Purpose of NAM:

- Minimal tension in soft tissue during surgical repair.
- Obtaining optimal scar.
- Increases symmetry of nose.
Reduction in number of revision surgeries.

Reduction in overall cost of therapy.

The mixed dentition stage:
As in the early years, the main emphasis throughout the mixed dentition stage should be on the prevention of dental disease. This is the period when the child should be encouraged to start accepting responsibility for his own dental health and learn how to look after his mouth. Accepting the appearance of the cleft and the teeth in this region is often a big hurdle for some patients and their parents. By working together closely with the parent and child, any anxieties can be more readily identified and overcome. In general, society reacts negatively to facial disfigurement and many patients with a cleft lip and palate experience problems with teasing at school. Psychological counseling arranged by the cleft team is sometimes required to help the child and support the family.

Preventive management:
Dietary counseling is best achieved with a three-day diet diary. This is a procedure that can be carried out at any stage of the child’s dental development, especially when there is a caries problem. Difficulties with tooth brushing often arise as the upper permanent incisors erupt, due to lack of sulcus depth and tightness of the repaired lip. As in the primary dentition, the upper permanent central incisors in the patient with a bilateral cleft lip and palate may be severely retroclined. Simple measures such as showing the child and parent the cleft region in a hand mirror and disclosing the plaque deposits, especially on the teeth around the cleft, will assist with tooth brushing instruction. This will also help the child to come to terms with the appearance of the cleft and the associated teeth. Oral hygiene prior to bone grafting must be of a very high standard as gingival inflammation can cause loss of the new bone. A 0.2% chlorhexidine gluconate mouthwash is useful for short periods following surgery or to help stabilize gingival health in severe cases of gingival inflammation, where the patient is anxious about the bleeding gingival tissues and is nervous to brush. However, there is no substitute for good tooth brushing and this should be re-established as soon as possible.

Access to the teeth in the cleft region is often difficult and a baby-sized toothbrush is still useful even at this age, especially where the upper lip is tight. This can be supplemented with an interspace brush. Home use of disclosing tablets and the importance of a hand-held or bathroom mirror to aid toothbrushing should be discussed. Parental support with toothbrushing is helpful throughout the mixed dentition period and supervision is advised until at least 7–8 years of age. A powered toothbrush can also be helpful when the child learns to access the teeth in and around the cleft areas.

Fissure sealants are an important consideration for this group of patients. The procedure is advisable for first and second permanent molars and premolars where indicated. Fissure sealing should be carried out as soon as the teeth have erupted sufficiently to allow adequate moisture control of the occlusal surfaces.

Local Anaesthesia:
Dental anesthesia in individuals with cleft is not different for most regions in the oral cavity, except for the cleft area. At this region, the maxilla is divided in different segments by the bone defect, with individual innervation. Even though the clinical aspect is improved after surgical repair, the alveolar separation is maintained. This is important when teeth at this region must be anesthetized, because the malpositioning may complicate determination of the site of tooth implantation.

The surgical lip repair usually causes a secondary scar fibrosis at the region, making the mucosa more resistant and consequently the puncture is more painful. The initial puncture with anesthetic infiltration should be parallel to the tooth long axis. Because of the bone defect that separates the innervation of the two cleft segments, the adjacent region must also be anesthetized to avoid pain or discomfort during treatment, using the same puncture as the initial infiltration, yet directing the needle to this region. Anesthesia of the palatal region is always necessary.

Restorative care:
Rubber dam isolation is recommended for dental treatment whenever possible, especially in cases of un repaired cleft palate. The rubber dam isolates the constant water flow of the high speed handpiece, dental caries or restorative material remnants, avoiding their penetration in
the airway, which communicates with the oral cavity in these individuals. The dental clasp should be 83 carefully placed using dental floss ligatures to minimize the risk of aspiration. This also applies when dental clasps are placed in supernumerary, rotated or malpositioned teeth.4

The permanent dentition — adolescence to adulthood:
The presence of the permanent dentition usually heralds the start of definitive orthodontic treatment. Patients with a cleft lip and palate often undergo a long course of appliance therapy, sometimes in conjunction with orthognathic surgery to correct the jaw relationship. Once again the main role of the pediatric dentist is to help the patient maintain good oral health and prevent dental disease.14

Preventive management:
Positive reinforcement should be given to encourage the patient to maintain or improve their motivation. Dietary counseling continues to be of paramount importance. The patient needs to be made aware of the potential problem of decalcification around the orthodontic brackets and other dental caries problems if the frequency and amount of sugar intake is not controlled. Acidic foods and beverages need to be regulated to avoid the possibility of erosion. A three-day diet diary may again be indicated. Patient-applied topical fluoride in the form of a mouthrinse (daily or weekly) is worthwhile especially during orthodontic treatment. It is essential that the patient with a cleft is monitored closely and that regular dental care is maintained at all times. During the transition from teenage years to adulthood the patient will need to be encouraged to accept responsibility for his own dental health, with prevention playing a key role.14

Restorative care:
Restorations required as a result of caries should be carried out prior to the start of orthodontic treatment, and regularly reviewed and maintained throughout this period. Adhesive restorative techniques for the remodeling of tooth form, composite or porcelain veneers and resin bonded bridges are used to achieve aesthetic improvements after the completion of orthodontic treatment.19 Conventional crowns and bridges or the provision of a chrome-cobalt partial denture (possibly combined with an upper retainer) are sometimes necessary. The patient’s dental health needs to be stable before advanced restorative techniques can be considered. The dentist needs to make the patient aware of the importance of long term preventive care and regular dental checkups.14

Conclusion:
Patients with a cleft lip and palate are a priority group. The pediatric dentist follows the cleft patients from growth to adolescence and aims to maintain a high level of oral hygiene. Additionally, the pediatric dentistry team helps in diagnosing the malocclusions and referring for orthodontic treatment in adequate timing. The pediatric dentist has a key role to play in providing continuing, high-quality, preventive-based dental care, thorough treatment-planning, feeding appliances, patient support and skilful behavior management. Good communication on a regular basis between the pediatric dentist and relevant members of the cleft team helps to achieve the best oral health outcome for the patients. Now it is an era when we can have isolated clinics/setups for cleft lip and palate because it is one deformity which can be corrected to a level so that there is no postsurgical morbidity and deficiency with help of a multidisciplinary team.

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Diagnostic imaging in periodontics

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Abstract:
A proper periodontal diagnosis is very much essential for treatment and preventive strategy and for identifying risk factors in periodontal patients. Radiographs play an important role in the diagnosis and management of the disease although opinions as to the most appropriate form of the assessment may vary. There are traditional as well as modern radiographic diagnostic modalities; however the former are inadequate for determining the sites of active tissue destruction and monitoring response to the therapy. Various modalities have been evolved to overcome these limitations. This article aims to review the different diagnostic techniques used in periodontics.

Key words: Radio-graphic, periodontal disease, periodontics

Introduction:
A diagnosis, can be defined as an attempt at classification of an individual's condition into separate and distinct categories that allow decisions about treatment and prognosis to be made. It may be regarded as identifying disease from an evaluation of the history, signs and symptoms, laboratory tests and finally progressing towards intervention procedures¹. Demographic information of the patient additional to rationale concerning the source of referral, chief complaint, symptoms and medical and dental history are imperative for correct diagnosis. The radiograph is a valuable aid in diagnosis of periodontal disease. It is an adjunct of clinical examination and not a substitute. Radiographs provide an estimate of amount of bone present and serve as a record for future comparison to assess bone loss/gain. They are used effectively in patients having periodontal lesions to determine the extent and severity of the disease. Recommendations for initial assessment include full mouth intra-oral radiography, including bitewings, to the panoramic radiograph supplemented by appropriate peri-apical or pre molar bitewing views².

Evolution of Traditional Modalities and their limitations:
Traditional analog imaging modalities are the radiographic systems that use image receptors like radiographic films or intensifying screens. Periapical views, panoramic, occlusal and cephalometric radiography are included in it³. Though two-dimensional radiographic modalities are very useful, there are certain limitations as well. They could not determine three-dimensional architecture of bony defects. Additionally, traditional radiographic aids were found to be unsuitable for determining the sites exhibiting active tissue destruction as well as monitoring the response to therapy and measure the susceptibility to future periodontal disease. Various modalities were developed to overcome these limitations.⁴ Current clinical techniques to detect initial and established pathological changes in the periodontium focuses on clinical and radiographic signs.⁵

The proper approach to diagnosis of a periodontal disease is the clinical one with the use of radiographs either to support some clinical finding or to yield some additional evidence whenever required ⁶. The Principle of ALARA (As Low As Reasonably Achievable) philosophy recognizes that, no matter how small the radiation dose, some adverse effect may result. Consequently, any dose that can be reduced without difficulty should be reduced⁷.

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The credit of finding X-rays goes to Wilhelm Roentgen, a professor of experimental physics in Germany in 1895 while working on emissions from electric current in vacuum. Over the years, many significant refinements were made in the techniques and the equipment. Within a year of the first dental application of x-rays (1897), Dr. Frank Van Woert replaced the glass photographic plate with Kodak film. He developed the concept of bisecting angulation to improve image quality. Dr. Howard Raper authored the first dental textbook entitled “Elementary and Dental Radiology” and popularized the bitewing image. X-Rays traditionally are produced by bombarding a metal target by high energy electrons. In conventional radiography, x-rays which pass through the human body are absorbed, causing attenuation of the incident beam. It is still used more widely than digital radiography. The reasons behind the declining popularity are—fixed dose latitude, fixed non-linear grey scale response, and limited potential for reducing dose to the patient.

Modern Radiographic Techniques:
The very first system that was introduced in digital radiography in dentistry was Radiovisio-graphy by Trophy in France in 1987. Digital radiography refers to a method of capturing a radiographic image using a solid-state technology sensor, transforming into electronic pieces and the image is stored in computer. The ideal imaging system permits a high quality image with minimal radiation exposure. Digital Radiography has the potential to achieve this and further advances will possibly lead to lowering the radiation dose and using higher sensitivity plates to give good resolution and sharpness of images. Various recent advances in the field include Digital Radiography, Xeroradiography, Computed Tomography, Magnetic Resonance Imaging, Cone Beam Computed Tomography, Digital Substraction Radiography etc. The main advantages offered include good accessibility and easy handling in addition to a real-size data set with multiplanar cross-sectional and 3D reconstructions based on a single scan at low-dose radiation exposure. These show better accuracy in the detection of periodontal bone loss as compared to conventional periapical and interproximal radiographs of posterior teeth; digital radiography provides better outcomes regarding contrast, bone quality, and details of lamina dura.

Thus, these help in determining a patient’s anatomy better and can be helpful in before and after treatment planning. The important advantage of digital imaging is cost and access. The large scale hospitals save money from lower film cost, reduced requirement for storage space, and lesser staff required to run the services and archiving sections. The images are instantly available for distribution to the clinical services without the time and physical effort needed to retrieve film packets and reviewing previous imaging on a patient is much easier.

Drawbacks in modern radiographic modalities:
The drawbacks include mainly the cost of equipment for the individual set up in clinics; Image artifacts, difficulty in determining actual color of skin and soft tissues, image disorder by unwanted patient’s movements. Limitations also include medico legal issues pertaining to acquisition and interpretation of data. Thus, thorough investigation and comparison should be done before these modalities can be widely embraced in dental practice.

Conclusion:
Although many modalities are available for imaging the periodontal disease, the correct and required technique should be adopted depending on the case and the clinician’s judgment to interpret the image desired. The choice of radiographic imaging must be considered carefully due to the radiation dose, the cost of each examination and the anticipated information that may be provided by the imaging study. The risk-to-benefit ratio should be determined on an individual basis so as to maximize success.

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Glass ionomer cement in pediatric dentistry

Nain S.¹

Abstract:
Glass ionomer cement systems have become important dental restorative and luting materials for use in preschoolers, children and teenagers. These materials form chemical bonds to tooth structure, are biocompatible, release fluoride ions for uptake by enamel and dentin, and are able to take up fluoride ions from dentifrices, mouthwashes, and topically applied solutions. Unlike early glass ionomers, the new cement systems are easy and practical to use. Resin-modified glass ionomer cements not only have improved physical characteristics, but the photopolymerizable resin component reduces initial hardening time substantially. This article reviews the development and history of glass polyalkenoate cement systems and their ongoing role in dentistry for children.

Key words: Luting, restorative material, resin modified.

Introduction:

Dental caries is the most common disease afflicting mankind. The lack of oral health awareness, particularly in pediatric patients makes the carious lesion go unnoticed, is one of the major cause of premature loss of primary teeth resulting in development of malocclusion. Improved awareness and availability of professionals have relatively made people more particular about oral health and are going for restorative treatment to prevent early tooth loss. When it comes to restorative objectives for children, one must consider several general categorical objectives such as sealing the cavity, preventing further tooth destruction, rendering the tooth and the tooth-restoration interface caries resistant, and ease of use in a clinical scenario. In addition, the material selected for the procedure must endure the grueling environment of the mouth for the period in which it is intended to be effective.

Glass ionomer were invented in 1969 and reported by Wilson and Kent¹ ¹ ¹ ¹ ¹ ¹ ¹ in the early 1970s. Glass ionomer cement components, when mixed together, undergo a setting reaction involving neutralization of the acid groups by the powdered solid glass base.

Glass ionomer cement has had a significant impact on restorative dentistry, as it bonds chemically to the tooth and release fluoride, which prevents the secondary caries.

Kent³ called such materials “glass ionomer” cements, and that name has become part of the dental vernacular.

Glass ionomers have several properties like chemical bonding to both enamel and dentin, thermal expansion similar to that of tooth structure, uptake and release of fluoride, decreased moisture sensitivity when compared to resins and biocompatibility, which make it more favorable for children.⁴

Glass Ionomer Use in Pedodontics:
Glass ionomer has been used as a dental material since its introduction in the 1970s.² When GIC was introduction as a restorative material there were some limitations to the material. The handling characteristics were less than ideal, it tended to wash out of the restoration over time, and the material was not highly polishable. Since their introduction, glass ionomers have evolved and have been improved immensely. Today’s glass ionomers are easier to handle, have better wear resistance, and have better esthetics than the original glass ionomers.⁵ ⁶ ⁷

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Glass ionomers have many advantages as a restorative material. These include: the ability to bond chemically to dentin and enamel, biocompatibility, favorable thermal expansion, decreased moisture sensitivity and the ability to act as a fluoride release and then as a reservoir. As a result of these qualities, glass ionomer is ideal for the uncooperative child as well as the “high caries risk” child.

The ability to bond chemically in a moist environment is critical in some of the techniques employed in pediatric dentistry. Moisture control in an uncooperative child is often a challenge. It can be difficult at best to maintain a dry field. Composite materials require a dry field in order to be successful in their bond and set. Glass ionomers allow some moisture in the field of operation and still form a reliable bond and therefore a successful restoration.

**Atraumatic restorative techniques (ART),** or intermediate restorative techniques are techniques used in very young, uncooperative, or otherwise compromised patients. They are useful in those patients in which traditional preparation of the affected tooth is not possible. In these techniques, hand instrumentation or slow speed rotary instruments are used to remove decay. Glass ionomer is used as the restorative material of choice. A preparation with a solid periphery, no pulpal exposure and a complete seal is imperative for clinical success. There is little evidence that affected dentin must be removed prior to sealing a tooth. It is, in fact, acceptable to leave affected dentin behind, provided that it is sealed properly. Dentin has the ability to remineralize when in contact with glass ionomer. In a recent study, it has been shown that there is a decrease in the bacteria in a lesion restored with a glass ionomer material thereby improving the healing process of the tooth. Given these properties, glass ionomers are often used as dentin replacement materials.

**The fluoride release of glass ionomer** makes it an ideal choice for those patients at “moderate to high risk” for dental caries.

**Glass ionomers display a cariostatic quality** in their ability to act as a reservoir for fluoride. Not only are glass ionomers a source of fluoride when they are initially placed, but in addition to this quality, glass ionomers are absorbent and act as a sponge in the uptake and subsequent release of fluoride. This “recharge” of fluoride can occur from exposure of the glass ionomer restoration to fluoridated dentifrice and mouth rinses, and professionally applied fluoride treatments. Fluoride has long been recognized as a powerful tool in the battle against caries. It is effective as an antibacterial, in remineralizing enamel and in creating more acid resistant enamel by the formation of fluorapatite.

**The future for glass ionomers in pediatric dentistry**

Clinical research is producing scientific evidence that certain resin-modified glass ionomer restorative cement systems can give long-term reliability in dentistry for children. One might believe that self-hardening glass ionomer restorative cements are now impractical in comparison to their light-hardened counterparts. However, two encapsulated glass ionomer restorative cements have been introduced that harden by the conventional acid/base neutralization reaction, but have much improved physical properties compared to any other self-hardening glass ionomer restorative cement. Ketac-Molar (3M ESPE) and Fuji IX GP (GC) have a rapid set which significantly reduces early moisture sensitivity. Faster hardening has been achieved by altering the particle size and particle size distribution of the glass powder. Even newer versions of these cements are now available (Ketac Molar Quick and Fuji IX Fast) that require only about 120 seconds for significant initial hardening.

Such materials are ideal for certain uses in primary teeth, interim restorations in permanent teeth, long-term non stress bearing restorations in permanent teeth, and in the “atraumatic restorative technique” (ART). ART has gained much interest internationally for patient populations who lack the advantages of modern dentistry. In recent years, the ability of glass ionomers to release ions apart from fluoride, notably calcium and aluminum, has been studied, and there is evidence to show that they promote remineralization of the tooth. This seems to be related to their ability to buffer lactic acid, an effect that was originally thought to be negative, because of its association with loss of cement by erosion. Lactic acid at the pH of
active caries (4.5) can be buffered to the pH of arrested caries (5.5) within less than 30 seconds, and with negligible erosion. This effect is likely to be beneficial, and would inhibit the development of secondary caries around a glass ionomers restoration.

In the last 15 years, manufacturers have worked diligently to produce glass ionomer cement systems that have overcome the 3 chief disadvantages of this class of materials:

(1) Difficult handling properties,
(2) Poor resistance to surface wear, and
(3) Poor resistance to fracture.

They have produced products that are improved to the point that these major disadvantages have either been eliminated or reduced to acceptable levels.

**Summary**

In the last 15 years, manufacturers have worked diligently to produce glass ionomer cement systems that have overcome the 3 chief disadvantages of this class of materials: (1) difficult handling properties, (2) poor resistance to surface wear, and (3) poor resistance to fracture. They have produced products that are improved to the point that these major disadvantages have either been eliminated or reduced to acceptable levels. The authors expect that improvements will continue and that glass ionomer cement systems will gain even more importance in restorative dentistry, preventive dentistry and orthodontics for young patients.

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Accelerated orthodontics- A Review

Kundal S.1, Walia P.S.2

Abstract:
The orthodontic treatment is, perhaps, in terms of duration, the longest-performed dental procedure. It is universally accepted that if the duration of the orthodontic treatment is reduced, there will be an increased favourable attitude towards the orthodontic therapy. Unfortunately, long orthodontic treatment time also poses several disadvantages like higher predisposition to dental caries, gingival recession and root resorption. Accelerating orthodontic tooth movement can notably reduce treatment duration and risks of side effects. Many methods are available to accelerate tooth movement, such as surgical methods (corticotomy, piezosurgery, etc), mechanical/ physical stimulation methods (vibration, lasers), drugs, magnets etc. These methods have been successfully proven to reduce treatment times by up to 70%. Hence, this review encapsulates the current knowledge on the accelerated orthodontic tooth movement.

Key words: Accelerated orthodontic tooth movement, Corticotomy, Lasers, Piezosurgery, Vibration.

Introduction:

Orthodontic tooth movement is possible due to the remodelling ability of the surrounding bone and soft tissue. Without this remarkable biological phenomenon, the practice- indeed, the very concept of orthodontics would not be possible. Yet, orthodontic appliances are not intentionally built to activate or inhibit specific remodelling pathways and specific cells. Rather, they are built to generate biomechanical force systems that produce the desired tooth and jaw movements needed to establish an ideal occlusion— regardless of the cellular mediators of the response. This begs the question, should we be designing orthodontic appliances to target specific remodelling pathways to move teeth and jaws into an ideal occlusion faster?1

A number of attempts have been made to create different approaches both pre-clinically and clinically in order to achieve quicker results, but still there are a lot of uncertainties and unanswered questions towards most of these techniques. Most attempts can broadly be categorized into biological, physical, biomechanical, and surgical approaches. Before going into details of these attempts, we need to understand the basics of orthodontic tooth movements and the factors that initiate inhibition and delayed tooth movement.

Orthodontic tooth movement occurs in the presence of a mechanical stimuli sequenced by remodelling of the alveolar bone and periodontal ligament (PDL). Bone remodelling is a process of both bone resorption on the pressure site and bone formation on the tension site. Orthodontic tooth movement can be controlled by the size of the applied force and the biological responses from the PDL. The force applied on the teeth will cause changes in the microenvironment around the PDL due to alterations of blood flow, leading to the secretion of different inflammatory mediators such as cytokines, growth factors, neurotransmitters, colony-stimulating factors, and arachidonic acid metabolites. As a result of these secretions, remodeling of the bone occurs.2

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**Methods of accelerating tooth movement:**

Methods to accelerate orthodontic tooth movement can be studied under following categories:

1. Drugs.
2. Surgical Methods.
3. Physical/ Mechanical stimulation methods

**1. Drugs:**

Various experiments have been done using these molecules exogenously to enhance tooth movement both in animal experiments and humans. A series of experiments with rat tooth model demonstrated that injection of PGs increased osteoclasts numbers. The human studies depict clearly that almost twice faster orthodontic tooth movement can be accomplished by local injection of prostaglandins.

**A. Prostaglandins:** A series of experiments with rat tooth model demonstrated that injection of PGs increased osteoclasts numbers. The human studies depict clearly that almost twice faster orthodontic tooth movement can be accomplished by local injection of prostaglandins.

**B. Vitamin D:** Vitamin D and especially its most active metabolite which is 1,25-dihydroxyvitamin D3 (1,25(OH)2D3) together with parathyroid hormone and calcitonin, regulates the amount of calcium and phosphorus in humans. Vitamin D is more effective in modulating bone turnover during orthodontic tooth movement because its effects on bone resorption and formation are balanced.

**C. Parathormone:** PTH affects osteoblasts cellular metabolic activity, gene transcriptional activity, and multiple protease secretions. PTH effects on osteoclasts occur through the production of RANKL, a protein that plays critical role in osteoclast formation and its activity. Uninterrupted raise of PTH leads to bone loss; intermittent short elevations of the hormone level can be anabolic for bone.

**II. SURGICAL METHODS**

The various surgical methods available are [Figure 1]:

**1. Osteotomy and corticotomy**

Osteotomy is a procedure in which a segment of the bone is cut into the medullary bone and is separated and then moved as a unit.

Corticotomy is one of the surgical procedures in which only the cortical bone is cut and perforated but not the medullary bone, suggesting that this will reduce the resistance of the cortical bone and accelerate tooth movements

**Figure 1 Different surgical techniques:** A, Periodontally accelerated osteogenic orthodontics or Wilckodontics. B, Corticotomy modifications 1: monocortical piezosurgery 2: monocortical perforations 3: piezocision); C, PDL distraction D, Dentoalveolar distraction

**Advantages**

- a) It has been proven successfully by many authors, to accelerate tooth movement.
- b) Bone can be augmented, thereby preventing periodontal defects, which might arise, as a result of thin alveolar bone.

**Disadvantages**

- a) High morbidity associated with the procedure.
- b) Invasive procedure.
- c) Chances of damage to adjacent vital structures.
- d) Post-operative pain, swelling, chances of infection, avascular necrosis.
- e) Low acceptance by the patient.

**2. Wilckodontics**

It was reported by Wilcko in 2001 that the acceleration of tooth movement is not due to the bony block movement as postulated by Kole; rather it was a process of bone remodeling at the surgical site, which was called regional acceleratory phenomenon (RAP) [Fig 2]. This technique is reported to have postoperative stability and improved retention but more studies are still needed to be done. The drawbacks of these surgical techniques are their invasiveness and the acceleration was only in the first 3 to 4 months and declines with time to the same level of the controls.

**Clinical Considerations of RAP**
Clinical indications according to Wilcko brothers\textsuperscript{9}, a) to accelerate or fasten corrective orthodontic treatment, b) to facilitate the mechanically challenging orthodontic movements, c) to facilitate correction of moderate to severe skeletal malocclusions.

PAOO is contraindicated in certain conditions like a) in patients with active periodontal disease, b) inadequately performed endodontic treatment, c) patients with history of prolonged corticosteroid usage, d) Patients on medication which interfere bone metabolism such as bisphosphonates or non-steroidal anti-inflammatory drugs (NSAIDs).

Figure 2: Regional acceleratory phenomenon

3. Piezocision

Dibart et al in 2009, introduced a flapless method of corticotomy, using piezosurgery to reduce the morbidity associated with conventional corticotomy.\textsuperscript{10} Piezocision is a minimally-invasive surgical technique designed to accelerate orthodontic tooth movement (OTM) in combination with orthodontic therapy.\textsuperscript{10} Piezocision is made without the need of a flap and perforations on the cortical bone are performed with a piezoelectric knife instead of a bur. The vibrations of the piezotome are also claimed to contribute to a faster movement. Because of this, it represents a less aggressive surgical approach than corticotomy.\textsuperscript{11}

Advantages

a) Minimally invasive.

b) Better patient acceptance.

Disadvantages

a) Risk of root damage, as incisions and corticotomies are “blindly” done.

4. Micro-osteoperforations

Micro-osteoperforation (MOP) is the only micro-invasive choice capable to speed up orthodontics. The procedure can be finished on chairside in very less time and does not need any advanced training procedures; hence, any trained clinician can perform it. In addition there is zero recovery time. MOP can be used in conjunction with other treatment modalities including but not restricted to, TADs, Invisalign (Align Technology), SureSmile (OraMetrix), and conventional braces.\textsuperscript{3}

III. PHYSICAL/MECHANICAL STIMULATION

Surgical methods, regardless of technique, are still invasive to some degree, and hence have their associated complications. Hence, non-invasive methods have come to the fore. These modalities include lasers, vibration, direct electric current etc.

1. Lasers

One of the most promising approaches today is photobiomodulation or low-level laser therapy (LLLT) is. Laser has a biostimulatory effect on bone regeneration, which has been shown in the midpalatal suture during rapid palatal expansion, and also stimulates bone regeneration after bone fractures and extraction site. It has been found that laser light stimulates the proliferation of osteoclast, osteoblast, and fibroblasts, and thereby affects bone remodeling and accelerates tooth movement. The mechanism involved in the acceleration of tooth movement is by the production of ATP and activation of cytochrome C, that low-energy laser irradiation enhanced the velocity of tooth movement via RANK/RANKL and the macrophage colony-stimulating factor and its receptor expression.\textsuperscript{2}

2. Vibrations

Nishimura\textsuperscript{12} in 2008, used a Ni-Ti expansion spring on the 1st molar of Wistar rats, and applied a vibration of 60 Hz, 1 m/s\textsuperscript{2}. They stated that the rats that received the vibration showed increased orthodontic tooth movement. Recently, a product by the name Acceledent has arrived at the market, which makes use of this technology. This device consists of an activator, which is the active part of the appliance that delivers the vibration impulses with a USB interface through which it can be connected to a computer to review the patient.
usage of the appliance, a mouthpiece that contacts the teeth. It is a portable device that can be charged similar to any other electronic device, and has to be worn for 20 minutes a day. Various case studies using this device have shown the treatment times to be reduced by up to 30-40%.\(^3\)

**Fig 3.** Summary of cellular and molecular mechanisms underlying accelerated orthodontic tooth movement. Methods to accelerate orthodontic tooth movement are shown in red. Blue arrow, Stimulation; red blunted arrow, inhibition; MSC, mesenchymal stem cell; HSC, hematopoietic stem cell; HIF, hypoxia inducible factor; FGF, fibroblast growth factor.

**Conclusion**

The cellular and molecular mechanisms underlying accelerated orthodontic tooth movement have been summarized in Figure 3.\(^3\)

Since long, orthodontic patients have been asking for shorter treatment times, and today, we do have methods that can accelerate orthodontic tooth movement safely. The current methods such as piezocision, microosteoperforations, lasers and vibration have reduced or eliminated the invasive nature of previous procedures used to achieve the Regional Acceleratory Phenomenon. [Fig 3] Also, they come with additional advantages such as reduced rates of relapse, reduced orthodontic pain and reduced root resorption.

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CBCT applications in orthodontics: A review

Shokeen T.1, Jain S.2, Walia P.S.3

Abstract:
With the introduction of three-dimensional imaging in the field of dentistry, cone beam computed tomography (CBCT) has generated great interest in various applications in orthodontics and is being rapidly integrating in orthodontic armamentarium to visualize the craniofacial complex in three dimensions. This article aims to shed a light on the current practices and use of CBCT in orthodontics, its advantages to the orthodontist and the patient.

Key words: CBCT, orthodontic applications.

Introduction:

Malocclusion is a three-dimensional problem resulting from vertical, transverse and anterior-posterior discrepancies in the teeth, maxilla and / or mandible. Orthodontics has relied on 2D X-rays to assess 3D structures even though many orthodontic treatment procedures are geared toward resolving conditions that cannot be appraised adequately by using conventional two-dimensional (2-D) radiographs. However, CBCT provides a 3D visualization of the craniofacial skeleton and thus it comes as little surprise that orthodontists immediately welcomed the 3-D rendering capacity of cone beam computed tomography (CBCT) as a means to optimize diagnosis and treatment planning malocclusion.1

Orthodontic applications of CBCT2:

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|                         | 3D evaluation of impacted tooth position and anatomy |
|                         | Growth assessment |
|                         | Pharyngeal airway analysis |
|                         | Assessment of the TMJ complex in three dimensions |
|                         | Cleft palate assessment |

| Treatment planning      | Orthognathic surgery treatment planning in true 1:1 imaging |
|                         | Planning for placement of temporary anchorage devices (TADS) |
|                         | Accurate estimation to space requirement for unerupted/impacted teeth |
|                         | Used in association with CAD/ CAM technology for construction of custom appliances. (Lingual orthodontic appliance) |

| Treatment progress      | Assessment of dentofacial orthopedics |
|                         | Outcomes of alveolar bone grafts in cleft palate cases |
|                         | Orthognathic Surgery superimposition |

| Risk assessment         | Investigation of orthodontic associated paraesthesia |
|                         | Assessment of orthodontics induced root resorption |
|                         | Post treatment TMD |

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1Lecturer, Deptt. of General Pathology, PDM Dental College and Research Institute, Bahadurgarh, Haryana, India.
Practical Applications of CBCT in Orthodontics:

**Assessment of skeletal and dental structures**

CBCT is an excellent tool to assess skeletal and dental structures as it provides the real-size 3D images, and absence of distortion or overlapping structures. The reproducibility of measurements on cephalometric radiographs obtained from CBCT scans was even better than that achieved with conventional cephalograms. Bilateral landmarks such as condylion, gonion, and orbitale, which are frequently superimposed in conventional radiographs, can be easily visualized in multiplanar views.

**3D evaluation of impacted teeth:**

One of the most recognized need for CBCT imaging in orthodontics is that of impacted canine evaluation. CBCT imaging is precise in determining not only the labial/lingual relationship but also a more exact angulation of the impacted canine. These 3D images are beneficial in determining the proximity of adjacent incisor and premolar roots (Fig 1), which can be invaluable in determining the ease of uncovering and bonding. It also helps in deciding the vector of force that should be used to move the tooth into the arch with a lesser chance of adjacent root resorption.

**Growth assessment:**

CBCT scans provide a consistent evaluation of skeletal maturity as cervical vertebral maturity can be reliably assessed with them.

**Pharyngeal airway analysis:**

Airway analysis has conventionally been carried out by using lateral cephalograms. The CBCT technology provides a major improvement in the airway analysis, allowing for its 3D and volumetric analysis (Fig. 2). Three-dimensional airway analysis will be an extremely useful tool in diagnosis and management of complex clinical conditions like sleep apnea and enlarged adenoids.

**Assessment of the temporomandibular joint (TMJ) complex in three dimensions**

CBCT images are more accurate and show superior reliability in diagnosing condylar morphology disturbances and erosion as compared to panoramic radiography and linear tomographic views. Presence of temporomandibular dysfunction can complicate orthodontic treatment and hence requires careful assessment of TMJ anatomy, before, during and after orthodontic treatment.

**Cleft lip and palate assessment**

Cleft lip and palate (CLP) is a true three-dimensional facial deformity and it could be assumed that 3D imaging would provide a better insight into the anatomical condition and the treatment options. Albuquerque et al. found CBCT to be equivalent to multi-slice CT in both volumetric assessment of bone defects in alveolar and palatal regions and in establishing donor area and the volume of the bone graft to be used in the rehabilitation of cleft patients. 3D reconstructions of images and 3D navigation systems allow preoperative evaluations of the cleft palate regarding the volume of the bone defect, the location of the bone defect, the presence of supernumerary teeth, and an evaluation of permanent teeth and alveolar bone morphology.
Orthognathic surgical planning

Virtual anatomical models can be generated from CBCT volumes used to recreate or check treatment options, to create anatomically correct substitute grafts, and can be a critical aid during the surgical procedure. CBCT scans can be used for evaluations of surgically assisted rapid maxillary expansion, voxel-based superimposition of pre- and post-treatment volumetric CBCT-derived models, and changes in condylar position after orthodontic-surgical treatment.

Planning for placement of temporary anchorage devices (TADs)

CBCT greatly enhances the information available for TAD placement (Fig.5). With this single diagnostic imaging method, information about surrounding structures, root proximity, and the morphology of maxillary sinuses and the inferior alveolar nerve canal can be obtained, all of which are important in determining TAD stability and success.

Figure 3. CBCT image of a patient with unilateral cleft palate.

Figure 4. Surgical simulation to plan displacement of colored segments.

Accurate estimation of the space requirement for unerupted/impacted teeth

Accurate localization of impacted and transposed teeth can be done with CBCT scans which helps determine the best method for surgical access and bond placement and the ideal and most efficient path for extrusion into the oral cavity to reduce collateral damage. Estimation of the exact necessary space required to accommodate the tooth within the arch is easily possible with CBCT.

Fabrication of custom orthodontic appliances

CBCT image data provides the opportunity of effective patient-specific treatments as it can be used for fabrication of custom lingual orthodontic appliances to virtually plan a patient’s treatment and the manufacturing of custom appliances with 3D printing technology. Orametrix (Richardson, TX) has been using CBCT technology for the last several years to provide the data necessary for planning and executing technology-assisted treatment through its SureSmile system (Larson, 2012).

Orthognathic surgery superimposition

The introduction of CBCT allows clinicians to perform superimpositions in three-dimensions and has eliminated some of the errors that occur with traditional lateral cephalometric superimposition. These 3D superimpositions help in better assessment of treatment outcomes. CBCT volume-derived virtual facial models have been used to evaluate post-surgical changes in the soft tissue overlying the mandible in response to mandibular advancement surgery. The virtual models were superimposed at the cranial base and color maps were used to qualitatively evaluate surgical and postsurgical changes.
Figure 6 Orthognathic superimposition with CBCT imaging.

Investigation of orthodontic-associated sensory disturbances

Reports of sensory disturbances occurring secondary to regular orthodontic treatment are extremely rare. However, when they do occur, they can only be diagnosed by CBCT. The importance of CBCT scans as the sole aid in obtaining a definitive diagnosis of the clinical condition has been demonstrated in a report of orthodontic treatment-induced transient mental nerve paresthesia.  

Assessment of orthodontics-induced root resorption and periodontal tissues

CBCT can be a valuable method for evaluating pre-orthodontic or post-orthodontic root resorption. CBCT imaging provides a significant advantage over conventional radiographs for periodontal assessment since it allows buccal and lingual defects to be measured, as well as interproximal defects. The accuracy of CBCT in the detection of surface defects, while higher than conventional imaging modalities, is not perfect and appears to increase with increasing voxel resolution of the volumetric dataset. CBCT has also been shown to have particular application in the assessment of the post orthodontic apical root resorption and, in particular, of the roots of lateral maxillary incisors by impacted maxillary canines.

Incidental findings and medicolegal implications

There is a high incidence of incidental findings—findings that appear unrelated to the scan’s original purpose—in the orthodontic population, with one study reporting it to be as high as 25%. They include developmental findings, normal anatomic variants, age related findings and pathological findings. These might raise concern about other diagnoses and the need for additional diagnostic tests. A lack of identification of accompanying lesions can have significant medicolegal implications and thus the entire CBCT scan is to be studied, regardless of the region of interest. CBCT scans obtained for orthodontic purposes should be further reviewed by an oral maxillofacial radiologist.

Conclusion:

The long awaited incorporation of the 3D to our radiographic records is soon becoming a reality. CBCT is the future of orthodontics and the applications in orthodontics seem almost limitless. Future developments in this field offer promises of even greater benefits in orthodontic diagnosis and treatment.

References:

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Clinical presentation & pathogenesis of odontogenic Keratocyst

Jain V.\(^1\), Garg S.\(^2\), Bhandari P.P.\(^3\), Rani P.\(^4\)

**Abstract:**
The odontogenic keratocyst (OKC) is one of the most prevalent odontogenic lesion. OKC is known for its rapid growth and its tendency to invade the adjacent tissues including bone. It has a high recurrence rate of 16 to 30\%. Since its initial description, a number of studies had focused on different aspects of this lesion, attempting to explain its distinctive biological and clinical behaviour. In this review the authors address the Clinical features and pathogenesis of odontogenic keratocyst.

**Key words:** Odontogenic keratocyst; OKC; Primordial cyst; Cysts; KCOT

**Introduction:**
The odontogenic keratocyst (OKC) is an epithelial developmental cyst. The first case of OKC was presented by Mikulicz\(^1\) as "dermoid cyst". Philipsen\(^2\) coined the term "odontogenic keratocyst" in 1956. This term has created some confusion, because other odontogenic cysts, such as lateral periodontal cysts, radicular cysts and follicular cysts, are morphologically similar to OKCs. "Primordial cyst" is a synonymous term for OKC\(^3\).

From a clinical point of view, the OKC is one of the most aggressive odontogenic cysts due to its relatively high recurrence rate\(^4\), its relatively fast growth\(^5\) and its tendency to invade adjacent tissues\(^6\). Because of the higher mitotic activity shown by the epithelial surface of OKC, WHO classified this lesion as a benign neoplasm & termed it as “Keratocystic Odontogenic Tumor” (KCOT)\(^7\).

**Clinical Features:**

**Frequency:**
In a sample of 2616 jaw cysts diagnosed over a period of 32 years, Shear found that 292 (11.2\%) were odontogenic keratocysts that occurred in 255 patients\(^3\). This frequency cannot be compared usefully with that of other studies, in which some investigators have recorded number of keratocysts in relation to all odontogenic cysts, and others to all the jaw cysts. The age-standardized incidence rates, standardized against a world standard population, per million per year, were 0.61, 0, 4.86 and 3.5 for black men and women, respectively, in the Withwatersrand region of South Africa, with Johannesburg as its center (Table-1)\(^8\).

**Age:**
Keratocysts occur over a wide age range, and cases have been recorded as early as the first decade to as late as the ninth. In most series there has been a pronounced peak frequency in the second and third decades, with figures ranging from 40\% to 60\% of patients in this age group. Many workers have demonstrated a bimodal age distribution with a peak in second and fifth decades of life (Table-2)\(^3\).

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Peak age incidence is approximately a decade younger in women than in men, a factor also discussed in a study of 430 cases of OKC in the north-western USA. In the hospital sample of 256 cases in South Korea, however, this gender difference was not found, which illustrated the importance of acknowledging regional and institutional differences.

<table>
<thead>
<tr>
<th></th>
<th>European</th>
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<tr>
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<td>White female</td>
<td>3.64</td>
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</table>

Table 1 = Age-standardized incidence rates of keratocysts on the Witwatersrand, South Africa, 1965 to 1974, standardized against standard European, World, and South African populations per million per year.

A series of publications by Woolgar et al., compared the ages of patients with single keratocysts and those that occurred in the nevoid basal cell carcinoma syndrome. The mean ages were significantly different in the groups (P<0.001). In the group without the syndrome, the mean age at removal of the cyst was 40.4 years (SDF 19.2) Log linear modelling of the variables showed that in their sample there was nonsyndrome patients before the age of 36 years and that in both group of patients women were more likely to be seen in the younger age group. Their findings indicated that female patients with keratocysts who are younger than 36 are the group most likely to have the syndrome. In a later article, this group compared the age distribution at the removal of large sample of 379 nonsyndrome patients with the age at the removal of keratocysts in 60 percent patients with the nevoid basal cell carcinoma syndrome. Their histogram demonstrated that patients with nonsyndrome cysts accounted predominantly for the second peak.

Gender

Keratocysts generally are found more frequently in men than women (P<0.05), and this gender predilection was more pronounced in black than white patients in Shear’s South African sample. In a series of 119 patients, there were approximately twice as many men as women. Of these patients, 53 were white men and 36 were white women (1.5:1); 25 were black men and 5 were black women (5:1). In another series, the gender distribution of patients with single keratocysts, in which there was a preponderance of men (62% men and 38% women; n=377), was significantly different (P<0.025) from the syndrome in which women were preponderance (45% men and 55% women; n=60).

These figures confirmed the observation that the incidence of keratocysts was higher in men than women, that they were considerably more common in whites than in blacks, and that they were particularly rare in black women, so rare that they translated to a zero average annual incidence in all age decades. In some studies, however, an equal gender distribution has been observed, yet in a selected sample of 20 patients with multiple keratocysts, of whom 10 had the nevoid basal cell carcinoma syndrome, a female preponderance of 17:1 was observed.

Site

The mandible is involved far more frequently than the maxilla. According to Shear, 94 of 125 cysts (75%) occurred in the mandible. The high frequency of mandibular involvement is borne out in other series, with figure ranging from 69% to 83%. Approximately one half of all keratocysts occur at an angle of the mandible and extend for varying distances into the ascending ramus and forward into the body. As to the site distribution of the other cases, reports of several studies indicated that they can occur anywhere in the jaws, including the midline of the mandible and maxilla and the ‘globulomaxillary area’ in the maxilla. Studies also have shown that keratocysts occurred with much greater frequency in the maxilla after the average age of 50.7

With regard to location within the jaws, there was a higher frequency of cysts unassociated with the syndrome in the mandibular molar-ramus area (60%) than cysts associated with the syndrome (44%). More syndrome related
(21%) than nonsyndrome-related cysts (11%) occurred in the maxillary molar region. Eighteen patients with the syndrome initially had only one cysts. Of 24 syndrome patients with cysts in two quadrants, 13 had bilateral mandibular cysts related to third molar teeth. Five patients had cysts in three quadrants, and 13 patients had cysts in all four quadrants. The time interval at which subsequent cysts were diagnosed varied from 1 to 23 years[12].

Clinical presentation:
Patients with keratocysts may complain of pain, swelling, or discharge. Occasionally they experience paraesthesia of the lower lip or teeth. Some are unaware of the lesions until they develop pathologic fractures. Other cysts have been discovered fortuitously during dental examination when radiographs were taken. In many instances, patients were remarkably free of symptoms until the cysts reached a large size and involved the maxillary sinus and the entire ascending ramus, including the condylar and coronoid processes. This occurred because the keratocysts tended to extend in the medullary cavity and clinically observable expansion of the bone occurred late[3,13].

Although the cysts vary considerably in size, Forssell has shown that approximately one half of his cases were 40 mm or more in greatest diameter, which was particularly the case with cysts of the ascending ramus and angle of the mandible compared with the cysts of the maxilla or body of the mandible. He suggested that the maxillary cysts were more likely than in the mandible to become infected even when small and would probably be diagnosed at an earlier stage in their development[13].

As with other intraosseous jaw lesion, the enlarging cyst may lead to displacement of the teeth, and cases have been reported of large keratocysts involving the maxillary sinus, which led to displacement and destruction of the floor of the orbit with proptosis of the eyeballs[14]. Other authors have reported on aggressive behaviour of keratocysts to the extent that they penetrated cortical bone and involved surrounding soft tissues[15]. Another reported a case that had extended from the maxilla eventually involved the base of the skull, ‘behaving rather like a low grade squamous cell carcinoma’, whereas others extended from the maxilla into the orbit and infratemporal fossa or from mandible into infratemporal fossa[16].

Shear[12] suggested the term ‘peripheral odontogenic keratocyst’ for this rare presentation of the lesion. An analysis of the location and frequency of bony expansion has shown expansion in approximately 60% of cases. One third of maxillary cyst caused buccal expansion, but palatal expansion was rarely seen. Approximately one half of the mandibular lesion produced buccal expansion, and one third produced lingual expansion. Most of the latter group were in the third molar or ascending ramus regions. In another study, perforation of bone, as observed in orthopantomograms, also were demonstrated in 39% of cases[13]. Multiple keratocysts are found in a proportion of patients. Of 122 patients in shear’s series, 113 had single cysts and 9 (7%) had more than one. In 3 of the patients with more than one cyst, the cysts were part of nevoid basal cell carcinoma syndrome[3]. Figures indicated that approximately 12.5% of patients with keratocysts had multiple cysts and other features of syndrome, whereas another 1% had the syndrome with only single cysts at the time of diagnosis.

Enlargement of cyst[17]
The following mechanisms may be involved in the enlargement of cysts:-

I. Increased hydrostatic pressure.

II. Increased osmotic pressure.

III. Increase in surface area of the lining - "mural factor".

IV. Displacement of surrounding soft tissue or resorption of bone.

Depending upon the type of cyst, these mechanisms play their relative roles for the enlargement which ultimately define the characteristics clinical features, post-operative behaviour and prognosis of all the cysts[17].

Enlargement of OKC[3]:
The basic factors as discussed earlier remain the same. There are certain points which are different in OKC. These are:-
a) High mitotic activity of keratocyst lining results in enlargement of OKC at an unremitting pace.

b) High osmolarity of OKC fluid plays an important role in expansion.

c) Mural growth in the form of epithelial proliferation is an essential process in the enlargement of keratocyst.

d) Presence of glycosaminoglucons & proteoglycans in connective tissue capsule.

e) Some enzymatic processes such as PMN collagenease & leucine aminopeptidase activity may influence expansion of cyst within bone.

f) Generally cyst growth is considered to be due to hydraulic expansion. Cysts often display a thin radiopaque border surrounding an area of radiolucency. This is an area of new bone formation in response to lesional expansion.

g) The increased activity of pentose shunt and ribonucleoprotein synthesis produces increased epithelial formation in the entrapped environment of the jaws or in dense connective tissue, cyst formation eventually occurs. Once a solid epithelial sphere has been formed it eventually outgrows its vascular nourishments and the central area degenerates to form a lumen. Following this transepithelial flow of fluid is sustained by osmotic forces. Thus hydrostatic pressure play a role in the development of classic unilocular appearance of most cysts.

h) Inflammatory cells, fibrin, serum and desquamated epithelial cells enter the cystic cavity and it is the accumulation of these intraluminal products that spurs the continued expansion of the cyst wall. If the expansion of the cyst is spurred by the inherent mitotic activity of the cyst wall itself rather than intraluminal forces, the cyst may be considered a cystic neoplasm rather than a simple cyst.

i) Cyst which are derived from more neoplastic dental lamina, are thought to spring form self- induced or unregulated mitotic activity. The epithelium which is mitotically active, produce a spheroid mass. The center of this mass degenerates creating a cystic enclosure. Cyst growth is supported not only by hydrostatic and intraluminal debris accumulation but also by mitotic activity of the cyst lining cells. In this case, there are chances that the cyst becomes multilocular and behaves more aggressively.

j) If the mitotic activity is not the sole answer, the ability of epithelium to break down the elements of connective tissue wall may be a factor.

Pathogenesis:

In the past, Odontogenic keratocysts (OKCs) were considered to originate from the primordium of a tooth before mineralization had taken place. This is why they were also called primordial cysts. As the years passed, the thought gained ground that remnants of dental lamina played a role, particularly because many OKCs seemed to have an atypical relation to teeth when presenting in the dentate area. Their frequent presentation in the ascending ramus of the mandible was explained by the hypothesis that offshoots of the dental lamina were probably responsible for the development of keratocysts in this region. The term ‘laminal cysts’ was even suggested by Toller. The likelihood that investigations of the basal layer of the oral epithelium play a role in the etiology of some OKCs is emphasized.

It is tempting to point to the dental lamina as the most likely epithelial origin of keratocysts, but there is little actual proof for this hypothesis. The dental lamina begins as an invagination of the basal layer of the epithelium overlying the future mandibular and maxillary alveolar processes after approximately 6 weeks of gestation. It is a band of epithelium that develops from anterior to posterior and maintains its connection with the overlying epithelium until the formation of the tooth buds of the deciduous dentition. Thereafter, it loosens this connection by disintegration. Epithelial remnants, however, may persist and are most likely to be found in the gingiva or even the periodontium, because
when the teeth erupt, they pass the area where the dental lamina was located. They fail to show the characteristic features, however, which are typical to the OKC. Some of them appear as visible lumps on the gingiva of newborns and are then called pearls of Epstein or Bohn’s nodules.

Possible offshoots of the dental lamina could be located distal to the crypt of the third molar. The course of such an offshoot probably follows the same pathway as the dental lamina that forms the third molars. The occasional presence of fourth molars attests to the validity of this hypothesis. It is likely that when no fourth molars are formed, these offshoots are located distal to the third molars and most likely in a bony crypt. Ostrowsky\textsuperscript{[22]} has found epithelial residues posterior to the third molars and discussed their possible relationship to the formation of OKC.

Histological examinations of the wall of keratocysts have revealed the presence of epithelial islands and microcysts in these cysts (fig.1), and the rate varies from approximately 25% to 60%.\textsuperscript{[10]} Investigators drew the conclusion that they represent activated remnants of the dental lamina. The belief that the dental lamina is the main epithelial sources for the formation of OKCs probably stems from the fact that no other epithelial investigations are known in this area.

Stoelinga\textsuperscript{[21]}, however, was not convinced that the dental lamina is the main source for the epithelial islands found in the wall of OKCs and is the main origin of OKCs. There are three reasons for this doubt. First, a prospective study performed on recurrent OKCs and on primary OKCs has shown that most of these clusters of epithelial islands and microcysts are found where the wall of the cyst is attached to the overlying mucosa.\textsuperscript{23} Solitary islands in other parts of the cyst wall were only seen sporadically. Because more than half of the OKCs are located in the ascending ramus are often found high in the ascending ramus, it is hard to explain that offshoots of the dental lamina play a role in these cases, because there should be a cyst wall (fig. 2). The pathologists reports their presence without knowing that their topographic relationship is with the mucosa. These two factors contribute to the on-going confusion and reflect ignorance of the importance of taking away the overlying mucosa.

The second cause for doubt is that Stoelinga occasionally had saw a dropping-off phenomenon of the basal layer of the epithelium overlying an OKC. This phenomenon is often seen in patients who suffer from the basal cell nevus syndrome.\textsuperscript{24} It seems likely that the basal layer of the oral epithelium in some parts maintains the capacity to form new invaginations, such as the dental lamina. When they have lost their connection with the overlying epithelium, they appear as epithelial islands or microcysts.

The third reason for doubt is that there are at the least four reports in the literature of OKCs recurring in bone grafts after partial resection of the mandible in which a keratocyst was present, this recurrence implies that the recurrent cysts are derived from a source outside the bone graft and most likely from the soft tissues that cover the bone graft. When studying these case reports, one has difficulty understanding that the dental lamina could

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Fig1.png}
\caption{Satellite microcyst in the wall of OKC that appear to be arising directly from an active dental lamina.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Fig2.png}
\caption{Several microcysts can be seen in the section in (higher magnification) between the surface epithelium and cyst.}
\end{figure}
have been the cause of these newly formed cysts. A wide partial resection, including the teeth, would have eradicated possible remnants of the dental lamina located on top of the third molar or immediately posterior to it and close to the bone or even in the bone.

Whatever the truth may be regarding the origin of the epithelial islands found, remnants of the dental lamina or offshoots of the basal layer of the overlying mucosa are clearly found mainly where the OKCs are attached to the mucosa. This was unequivocally proven in prospective studies on recurrent OKCs and primary OKCs.[10,24]

The intriguing question remains: what causes one or two of these microcysts to suddenly be triggered and start to grow? In the basal cell nevus syndrome, a gene has been located that seems to be responsible for the development of this syndrome. It is unlikely, however, that this gene also plays a role in the pathogenesis of solitary keratocysts.[24]. Basal cell nevi are also often found as solitary lesions in patients who do not suffer from this syndrome. The similarity with the presence of solitary OKCs as opposed to the multiple presentations in the syndrome is striking. Basal cell nevi can be considered as hamartias, as can clusters of epithelial islands in the mucosa of some patients. It seems reasonable to put the hypothesis forward that some individuals who do not suffer from the basal cell nevus syndrome also have these mucosal hamartias, and in some of those persons microcysts develop, of which only one or two form rapidly growing OKCs. The reason for this phenomenon is still unknown.[25].

Conclusion:
The odontogenic keratocyst (OKC) is an epithelial developmental cyst. WHO classified this lesion as a benign neoplasm & termed it as “Keratocystic Odontogenic Tumor”. It occurs most commonly in second and third decades of life with more predilection towards women. The mandible is involved far more frequently than the maxilla. In many instances, patients were remarkably free of symptoms until the cysts reached a large size and involved the maxillary sinus and the entire ascending ramus, including the condylar and coronoid processes or they may be diagnosed accidentally on taking dental radiographs. The treatment of OKC is difficult because of its aggressive nature and high recurrence rate and general dental practitioners should be aware of the clinical presentation, sign and symptoms and biologic behavior of this lesion.

References:


Periodontal disease and osteoporosis

Datta V.1

Abstract:
Osteoporosis and periodontitis are the diseases that affect a large number of men and women worldwide with incidence increasing with advancing age. Both these diseases present bone loss as a common hallmark. Periodontitis has long been defined as an infection mediated destruction of the alveolar bone and soft tissue attachment to the tooth, responsible for most tooth loss in adult populations. Current evidences including several studies support an association of osteoporosis with the onset and progression of periodontal disease in humans. Systemic loss of bone density in osteoporosis including that of the oral cavity may provide a host system that is increasingly susceptible to infectious destruction of periodontal tissue. Understanding the association between these common diseases and the mechanisms underlying these associations will aid health professionals to provide improved means to prevent, diagnose and treat these very common diseases. The paper reviews the current evidence on the association between periodontal disease and osteoporosis.

Key words: Bone Loss, Osteoporosis, and Periodontal Disease.

Introduction:
Osteoporosis is a medical disorder characterized by a generalized low bone mass and fragility with a consequent increase in fracture risk, particularly of vertebrae, hip and wrist. It is a physiological, gender and age related condition resulting from bone mineral content loss and structural changes in bones1.

The World Health Organization considers osteoporosis to be second only to cardiovascular disease as a public-health concern1,2. Osteoporosis was once thought as a natural process of ageing in women, much the same way as tooth loss was thought to be related to age rather than chronic periodontal infection3. Women at peak attainment achieve less bone mineral content (BMC) and bone mineral density (BMD) than males and the rate of bone mineral loss with ageing is approximately twice as high in women than men1.

Osteoporosis has been categorized into primary osteoporosis and secondary osteoporosis. Primary osteoporosis is associated with menopause, advancing age, and idiopathic osteoporosis that may be seen in premenopausal and middle aged men. Secondary osteoporosis is caused by certain medical conditions or treatment that prevents either attainment of peak bone mass or enhances bone loss.

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It is commonly associated with endocrine disorders (Cushing syndrome, hyperparathyroidism, IDDM, adrenal insufficiency), rheumatoid arthritis, hematologic disorders and malignancies (leukaemia, lymphoma), immobilization, pregnancy, lactation, environmental factors including cigarette smoking, sedentary lifestyle and probably alcoholism.

As per WHO, osteoporosis is bone density 2.5 standard deviation below the average peak bone density achieved in young adults matched by gender and race (Table no.1).

### Risk Factors:

Several risk factors will predispose a person to osteoporosis. Osteoporosis is usually asymptomatic until a fracture occurs; therefore, it is important to identify risk factors and appropriate methods and timing for screening. Risk factors for osteoporosis can be divided into:

- Non-Modifiable
- Modifiable Risk Factor

<table>
<thead>
<tr>
<th>Non-modifiable risk factors</th>
<th>Modifiable risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Sex hormone insufficiency</td>
</tr>
<tr>
<td>Race</td>
<td>Calcium intake</td>
</tr>
<tr>
<td>Sex</td>
<td>Vitmain D intake</td>
</tr>
<tr>
<td>Family history of osteoporosis/fracture</td>
<td>Weight</td>
</tr>
<tr>
<td>Early menopause</td>
<td>Physical activity</td>
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<td></td>
<td>Cigarette smoking</td>
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<td></td>
<td>Chronic glucocorticoid use</td>
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</table>

Genetic factors can explain about 80% of the variability in peak bone mass and the rate of boneless. Other risk factors include hormonal factors, nutritional factors, vitamin D levels, physical inactivity, and low body weight.

### Age:

According to data from the NHANES III, 52% of Caucasian women older than 80 years of age had osteoporosis compared with approximately 1% of Caucasian women younger than 30 years. The proportion of women with normal bone mineral density declines sharply with increasing age.

### Genetics:

Genetic factors play an important role in regulating bone density, skeletal geometry, and bone turnover as well as contributing to the pathogenesis of osteoporotic fracture itself as evidenced by heredity studies. Measurement of bone density in twins has shown that there is a greater concordance of bone mass between monozygotic pairs rather than dizygotic pairs, indicating the significance of genetic influence. There is a familial tendency for lower bone mass in young women whose mothers have sustained osteoporotic fractures. Racial differences in skeletal size, with black people having larger, heavier bones and a lower fracture risk, may also point to genetic influence.

### Hormones:

Gonadal hormones are the most important influence on bone loss in women. The onset of menopause and subsequent estrogen deficiency can affect the rate of bone loss. Rapid bone loss in women after the menopause can be effectively prevented by hormone replacement therapy. However, when hormone replacement therapy is discontinued bone loss rates similar to the rates before hormone replacement occur.

For the regulation of bone mineral density in men, testosterone is considered to be of primary importance. Estrogen also appears to play a role in the establishment of peak
bone mass and maintenance of bone mineral density at a later age\textsuperscript{7,8}.

**Nutrition:**

Nutrition is a modifiable factor and is important to bone health. Calcium intake is important during skeletal growth and peak bone mass development\textsuperscript{9}. Increasing the milk intake of adolescents has been shown to improve bone mineralization\textsuperscript{9}. Therefore, adolescents must maintain a dietary balance among calcium, protein, other calories sources and phosphorus. Calcium supplementation may be effective in reducing bone loss in late postmenopausal women, particularly in those with low habitual dietary calcium intake\textsuperscript{9,10}. However, because other nutrients in addition to calcium are essential for bone health, calcium alone may be insufficient to combat osteoporosis. Vitamin D is essential for optimal absorption of calcium. Vitamin D deficiency contributes to osteoporosis and fractures through its effects on bone fragility and impaired muscle strength\textsuperscript{9}. The risk of vitamin D deficiency is increased with reduced sunlight exposure, as a result of strict dress codes where most of the body is covered.

In a comparison of the risk factors associated with osteoporosis and periodontal diseases, it seems clear that there are multiple similarities between the 2 disease processes. The diseases are associated in general with advancing age, with the vast majority of patients being over the age of 35, and a higher incidence in the later decades. A patient with a history of loss of alveolar bone support is at risk for future progression of periodontitis. Likewise, a patient with systemic bone loss or osteoporosis is at risk for periodontitis. Some of the common risk factors shared by both osteoporosis and periodontal disease are shown in table 3\textsuperscript{1}.

<table>
<thead>
<tr>
<th>OSTEOPOROSIS</th>
<th>COMMON RISK FACTORS</th>
<th>PERIODONTITIS</th>
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<tbody>
<tr>
<td>Female gender</td>
<td>Cigarette smoking</td>
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<td>Caucasian or Asian race</td>
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<td>Low skeletal mass</td>
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</tbody>
</table>

Table 3

**Osteoporosis and Periodontitis**

Periodontitis and osteoporosis are two diseases found in both male and female population worldwide. Bone loss is a central, common feature of both periodontal disease and osteoporosis\textsuperscript{9,10}. Periodontitis is an inflammation of the supporting tissue of the teeth, usually leading to loss of bone and periodontal ligament and is a major cause of tooth loss and edentulousness. Periodontal diseases are associated with a number of chronic diseases including osteoporosis.\textsuperscript{9,10}

Osteoporosis has the highest degree of osteopenia, characterized by bone loss leading to structural bone transformation. A number of studies have been presented and have generally suggested that osteopenia does play a role in the establishment of periodontal disease. The etiology of periodontal disease as a bacterial infection is well established. However, loss of alveolar bone as a result of osteopenia is probably important in the creation of a
susceptible host. In addition, osteopenia and periodontal disease may share common etiologic agents which may either directly influence or modulate both disease processes.\textsuperscript{11}

Mechanisms by which osteoporosis bone loss may be associated with periodontal attachment loss, loss of alveolar bone height and tooth loss have been proposed by Bartold et al. (2000) as follows\textsuperscript{11}:

- Low bone density in the oral bone associated with low systemic bone: This low bone density or loss of bone density may lead to more rapid resorption of alveolar bone following insult by periodontal bacteria.

- Modification of local tissue response to periodontal infections due to systemic factors affecting the boneremodeling: Persons with systemic bone loss are known to have increased systemic production of cytokines (interleukins (IL) 1 and 6 that may have effect on the bone throughout the body including bone of oral cavity. Periodontal infections have been shown to increase local cytokine production that in turn increases local osteoclast activity resulting in increased bone resorption.

- There are also certain genetic factors that predispose a person to systemic bone loss resulting in periodontal destruction.

- Other factors such as cigarette smoking and sub optimal calcium intake may put individuals at higher risk for development of both osteopenia and periodontal disease.

The risk factors for osteoporosis include many risk factors associated with advanced periodontal disease. Since both osteoporosis and periodontal diseases are bone resorptive diseases, it has been hypothesized that osteoporosis could be a risk factor for the progression of periodontal disease.\textsuperscript{2}

Kribbs\textsuperscript{12} was the first to address the relationship between systemic bone mineral density and mandibular density when measured by quantitative analysis on intraoral radiographs. The osteoporotic group had less mandibular bone mass and density and a thinner cortex at the gonion than the normal group\textsuperscript{12}. Most studies reported to date concerning this relationship are cross-sectional and relate systemic bone mineral density with mandibular mineral density. In general, a correlation is reported between systemic and oral bone mineral densities\textsuperscript{2}.

Low bone mineral density has been associated with higher tooth loss\textsuperscript{2}. Other reports fail to find this correlation. Tooth loss could serve as a surrogate evaluation for periodontal disease, assuming that 100% of attachment is lost when the tooth is lost. The underlying reason for loss of teeth is often unknown and could include reasons other than terminal periodontal disease. The extent of disease around the remaining teeth is also not taken into account in these analyses. Therefore, an accurate measurement of the extent of periodontal destruction cannot be made by using tooth loss as a variable in the analysis of the relationship between osteoporosis and periodontitis. Most studies showed a correlation between reduced bone mineral density and increased severity of periodontal disease\textsuperscript{2}.

Von Wowern\textsuperscript{13} assessed osteoporosis using bone mineral content of the mandible and forearm, determined by dual-photon scanning, and found greater amounts of loss of attachment in osteoporotic women in a small population with a mean age of 68 years.

In a study population of 70 postmenopausal Caucasian women aged 51–78 years, skeletal systemic bone mineral density was assessed by dual-energy X-ray absorptiometry. Clinical attachment loss and interproximal alveolar bone loss represented periodontal disease severity. Mean alveolar bone loss significantly correlated with systemic bone mineral density. A trend for a correlation between clinical attachment levels and bone mineral density was found.\textsuperscript{2}

Larger prospective longitudinal studies are needed to further evaluate osteoporosis as a risk factor for periodontal disease progression as cross sectional studies. The oral ancillary study of the Women’s Health Initiative was designed to determine if there is an association between systemic osteoporosis and oral bone loss. In postmenopausal women hip-bone mineral density was confirmed with dual-energy X-ray absorptiometry. Alveolar bone height changes
over a period of 3 years were assessed with subtraction radiography. Subjects with osteoporosis presented with greater progression of alveolar bone loss than subjects with no osteoporosis over the 3-year period. Subjects with periodontal disease at baseline exhibited greater amounts of alveolar bone loss than subjects with no periodontal disease. This indicates a greater propensity to lose alveolar bone in subjects with osteoporosis, especially in subjects with pre-existing periodontitis.²

Pereira et al¹⁴ conducted a study to investigate the possible association between periodontal changes and osteoporosis in postmenopausal women. The participants were divided into three groups according to the bone mineral density assessed in the lumbar region: normal bone (G1, n = 15), osteopenia (G2, n = 12) and osteoporosis (G3, n = 6). Periodontal evaluation included clinical attachment level, probing depth, gingival bleeding index and visible plaque index, evaluated by two examiners blinded to systemic bone condition. The statistical process included the t-test for paired samples, with a significance level of 5% to check for changes in periodontal parameters considered at initial and final systemic bone density. The results showed that, after follow-up, there was a significant increase in gingival bleeding index in the group of women who had normal initial bone condition and progressed to osteopenia (after 3 years, 59.89%, p = 0.010) and osteoporosis (after 3 years, 74.37%, p = 0.035). In addition, the group diagnosed with osteopenia at baseline who progressed to osteoporosis after 3 years also showed a significant increase in gingival bleeding index (p < 0.001). The findings suggest that periodontal changes can be associated with osteoporosis in postmenopausal women.⁴

The effects of osteoporosis on both systemic health and oral health need to be well understood. As a healthcare provider, the dentist could serve as a pre-screener of patients with the potential for osteopenia or osteoporosis. Proper counseling of the need for prevention and treatment together with referral for further evaluation of their bone status could benefit our patients. An additional tool for pre-screening may lie in the information obtained on our dental radiographs. Evaluation of the coarseness of trabeculation of alveolar bone, as seen on intraoral radiographs, could be a helpful clinical indicator of skeletal bone mineral density and better than densitometric measurements of the alveolar bone. Dense trabeculation is a strong indicator of high bone mineral density, whereas sparse trabeculation may be used to predict low bone mineral density².

References:


The concept of Lesion Sterilization and Tissue Repair (LSTR) therapy that employs the use of a mixture of antibacterial drugs, has been used for disinfection of oral infectious lesions, including dentinal, pulpal and periapical lesions.

Primary Teeth which may be indicated for extraction can be saved by "LSTR 3-Mix MP Save Pulp Therapy" thus saving space and serving as natural space maintainers.
Save pulp, Save space

Nain S.1, Jha P.2

Abstract:
The teeth with infected root canals, particularly those in which infection has reached the periradicular tissues are a common problem in primary dentition. Early loss of primary teeth results in ectopic eruption, disturbance of eruption sequence, drifting of erupted teeth, space loss for the successor permanent teeth, development of aberrant habits, alterations in speech, and impairment of function. Thus, it is important that primary dentition should be maintained in the dental arch, provided it can be restored to function and remain free from the disease. An intact tooth successfully disinfected and restored clinically is a superior space maintainer than an appliance. The concept of lesion sterilization and tissue repair (LSTR) therapy that employs a mixture of antibacterial drugs for disinfection has been used for teeth which were indicated for extraction, so that they could be used as natural space maintainers.

Keywords: LSTR, pulp therapy, natural space maintainer

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