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Journal of Contemporary Dentistry

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The Scientific Journal of the Mahatma Gandhi Mission Dental College was launched in June 2011.

This journal is dedicated to increasing scientific exchange across college departments and to encourage postgraduates, staff and students to be involved in scientific literary work.

This journal also endeavors to promote a multidisciplinary outlook in dentistry. This journal publishes evidence-based original scientific articles presenting relevant and useful information to all dentists. Additionally, it publishes case reports of innovative techniques, new instructional methodologies and instructive clinical reports with an interdisciplinary flair.

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Sabita M Ram, Dean, Professor and Head
MGM Dental College and Hospital
Sector 18, Kamothe, Navi Mumbai-410209
Maharashtra, India
e-mail: jcdent2011@gmail.com

Production Office
Jaypee Brothers Medical Publishers (P) Ltd.
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Editorial

The political events of the last few months in this country have seen significant changes. The media-branded "MODI-wave" has showcased our new Prime Minister as a man, not only FOR change, but someone who can affect it successfully. His leadership is inspiring and vision commendable. But what is immensely noteworthy is his constant insistence on doing everything 'together'. His repeated rhetoric emphasizes the importance of citizen participation and 'teamwork'. Even his handpicking of key individuals of stature into his cabinet or his empowering of the bureaucracy, all go to show his belief of effecting change together as a 'Team'.

Teamwork, my friends is the way to go, what with each one having his own talent to contribute and this, collectively bringing about a superlative end product. Even in our field of Dentistry, it is only a team or a multidisciplinary approach that impresses the patient and offers superior solutions. Today in a day and age of evidence-based dentistry, it is only the contribution of individual minds, masters in their own respective areas of specialization that can offer treatment options that may be a 'blind spot' for someone else. If a clinician feels he can be a one-man-show and perform all aspects of treatment modalities himself, he is sounding the death knell.

Specialization is the buzz word today in our country and will only become more defined with time. Patients are becoming more aware of treatment options, thanks to the information overload available through the Internet. If we can offer our patients team-centric treatment plans that have been whetted by different specialists, patients become convinced and superior standards of quality care are delivered.

In many ways, we at the JCD Editorial Board too practice 'specialization'. Our team, each a specialist in his own right brings a different talent to the table and a Journal of excellence in every issue is born. You will be glad to know that next year we are hoping and striving to have the JCD Pub Med indexed and efforts are on in this direction.

As we bid adieu to the year going by and as we welcome 2015, let us pledge to remain committed to this one principle of 'Teamwork'. That it is not the 'I' but the'WE' that counts and as the acronym of TEAM spells T-ogether E-veryone A-chieves M-ore.

Let us continue to remain inspired by our new political class and pledge also to remain integrated into the system and our PM's dreams of making our country world class through his various initiatives. Yes my friends, TOGETHER we can and WE WILL!

Dr Richard Pereira
Editor-in-Chief

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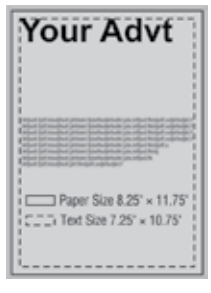

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RESEARCH ARTICLE

Comparison of Calcium Sulfate and Bovine Collagen Barriers for Alveolar Ridge Augmentation

[1]Matthew L Heaton, [2]David G Kerns, [3]William W Hallmon, [4]Harvey P Kessler, [5]Robert Spears
[6]Eric S Solomon, [7]Ibtisam Al-Hashimi

ABSTRACT

Calcium sulfate is a biologically compatible osteoconductive graft material that binds underlying bone graft and provide space maintenance. The purpose of this study was to evaluate calcium sulfate as a barrier compared to a collagen membrane for augmentation of a standardized surgically created ridge defect. For this purpose, bilateral extraction of mandibular premolars was performed on six foxhounds (*Canis familiaris*). Eight weeks later, a standardized osseous ridge defects (24 total) were created using a 6 mm trephine. The study was approved by the Institutional Animal Care and Use Committee (IACUC) at Baylor College of Dentistry. The osseous defects were allocated into three groups (8 defects each): group 1 received autogenous bone graft covered with collagen membrane (CM); group 2 received autogenous bone graft covered with calcium sulfate barrier (CS), and group 3 was used as control and did not receive bone augmentation and was used as control. The animals were sacrificed after 12 weeks following bone augmentation and sites were evaluated histologically for total ridge width, percentage of bone gain and cortical bone thickness.

Results: All sites exhibited bony fill within the defect. Analysis of variance did not reveal statistically significant difference in the mean total bone gain among CM, CS, and control groups (12.2,11.6, and 11.9) mm^2, respectively, p = 0.875.

Conclusion: Calcium sulfate does not appear to improve bone regeneration in an osseous defect.

Keywords: Guided bone regeneration, Ridge augmentation, Calcium sulfate, Collagen membrane.

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[1]Private Practitioner, [2]Professor and Director, [3]Regents Professor (Retired), [4-7]Professor

[1]Private Practice, Department of Graduate Periodontics Knoxville, Tennessee, USA

[2,3,7]Department of Periodontics, Texas A&M University, Baylor College of Dentistry, Dallas, Texas, USA

[4]Department of Oral Pathology, Texas A&M University, Baylor College of Dentistry, Dallas, Texas, USA

[5]Department of Biomedical Sciences, Texas A&M University Baylor College of Dentistry, Dallas, Texas, USA

[6]Department of Administration, Texas A&M University, Baylor College of Dentistry, Dallas, Texas, USA

Corresponding Author: David G Kerns, Professor and Director Department of Periodontics, Texas A&M University, Baylor College of Dentistry, Dallas, Texas, USA, Phone: 2148288140, e-mail: dkerns@bcd.tamhsc.edu

INTRODUCTION

Tooth extraction can result in a loss of up to 50% of socket alveolar bone in both a horizontal and vertical dimension.[1] Fugazzotto[2] reported that progressive atrophy of the residual alveolar ridge occurs up to 12 months following extraction.

Osseous grafting of a deficient alveolar ridge involves placement of a bone graft within the alveolar defect and a barrier to cover and protect the grafted bone.[3,4] Buser, was one of the first to report successful ridge augmentation with guided bone regeneration (GBR) in humans using an expanded polytetrafluoroethylene (ePTFE) membrane and tenting pins.[5] Becker et al reported bone regeneration of a alveolar ridge deficiencies using ePTFE and resorbable pins.[6] GBR as a ridge augmentation procedure can be accomplished using particulate bone, however, corticocancellous block grafts are useful for augmentation of severely resorbed alveolar ridge defects.[7,8] Other alternatives to augmentation include distraction osteogenesis and use of growth factors, such as platelet-rich plasma or recombinant human bone morphogenic protein-2.[9-12]

The use of a resorbable membrane is common in ridge augmentation procedures, primarily due to the advantages of one surgical procedure *vs* multiple surgeries involved with placement of nonresorbable membranes.[13-15] One of the major problems associated with the use of the ePTFE membrane is wound healing following exposure of the membrane, which often leads to localized tissue necrosis or infection requiring removal of the membrane.[16,17] It has been reported that early exposure of a membrane may result in a less successful outcome in GBR procedures.[18] Resorbable membranes tolerate poor vascularity and exposure better than nonresorbable membranes, with secondary epithelialization occurring over resorbable membrane exposures in most cases.[19,20] Collagen-based membranes are usually degraded and incorporated into the surrounding periodontium within

3 to 6 months following placement, which allows adequate time for osseous grafting materials to mature.[19-21] Modification of collagen fibers known as cross-linking can prolong the rate of degradation.[21] Collagen-based membranes have been found to be comparable to e-PTFE membranes in the management of extraction socket and furcation defects.[22,23] Use of collagen membranes in ridge augmentation procedures is primarily limited to case reports, however current reports show promising findings in terms of quantity and quality of bone regenerate enabling dental implant placement.[19,20,24]

An alternative to ePTFE or collagen-based membranes for use in GBR procedures is calcium sulfate (CS).[25,26] Medical grade calcium sulfate is a chemical compound that has been used for hard-tissue augmentation in the medical field for decades.[27,28] Calcium sulfate is a biologically compatible graft material that is osteo-conductive, acting as a natural scaffold to preserve bone volume and allow proliferation of osteoprogenitor cells. An *in vitro* study by Payne et al compared fibroblast migration over different barrier materials found a significantly greater migration rate over CS compared to PTFE and polylactic acid.[29] Sottosanti advocated the use of CS in conjunction with a bone grafting material as a composite graft, with the CS acting as a stabilizer and a binder of the osseous particles.[25] Histological analysis of biopsies taken from extraction sites grafted with CS showed almost complete resorption of the material within 3 months of placement, and bone fill was greater compared with non-grafted control sites.[30]

Additional benefits beyond osteoconductivity and space maintenance have been found related to potential angiogenesis as a result of CS implantation. In a study of microvessel density within grafted osseous defects in rabbit tibiae, Strocchi et al reported that defects filled with CS and covered with ePTFE membrane had higher vascular density than those filled with CS or autologous bone only.[31] These findings add additional support to the use of CS in dental regenerative procedures.

The use of CS in regeneration procedures is a practical adjunct to osseous grafting, however, the application of the material in GBR procedures is not widely accepted. Clinical studies that have used CS in ridge preservation procedures, endodontic surgery, dental implants and sinus augmentation add evidence supporting the use of CS as a graft material in GBR procedures.[25,32-37]

The purpose of this study was to compare bone regeneration using a bovine collagen membrane (CM) and CS as a barrier for ridge augmentation.

MATERIALS AND METHODS

The experimental model used in this study involved the creation of standardized alveolar ridge defects followed by GBR using osseous grafting and barrier devices in a canine model. Study protocol was approved by the Institutional Animal Care and Use Committee at Baylor College of Dentistry—a member of the Texas A&M University Health Science Center.

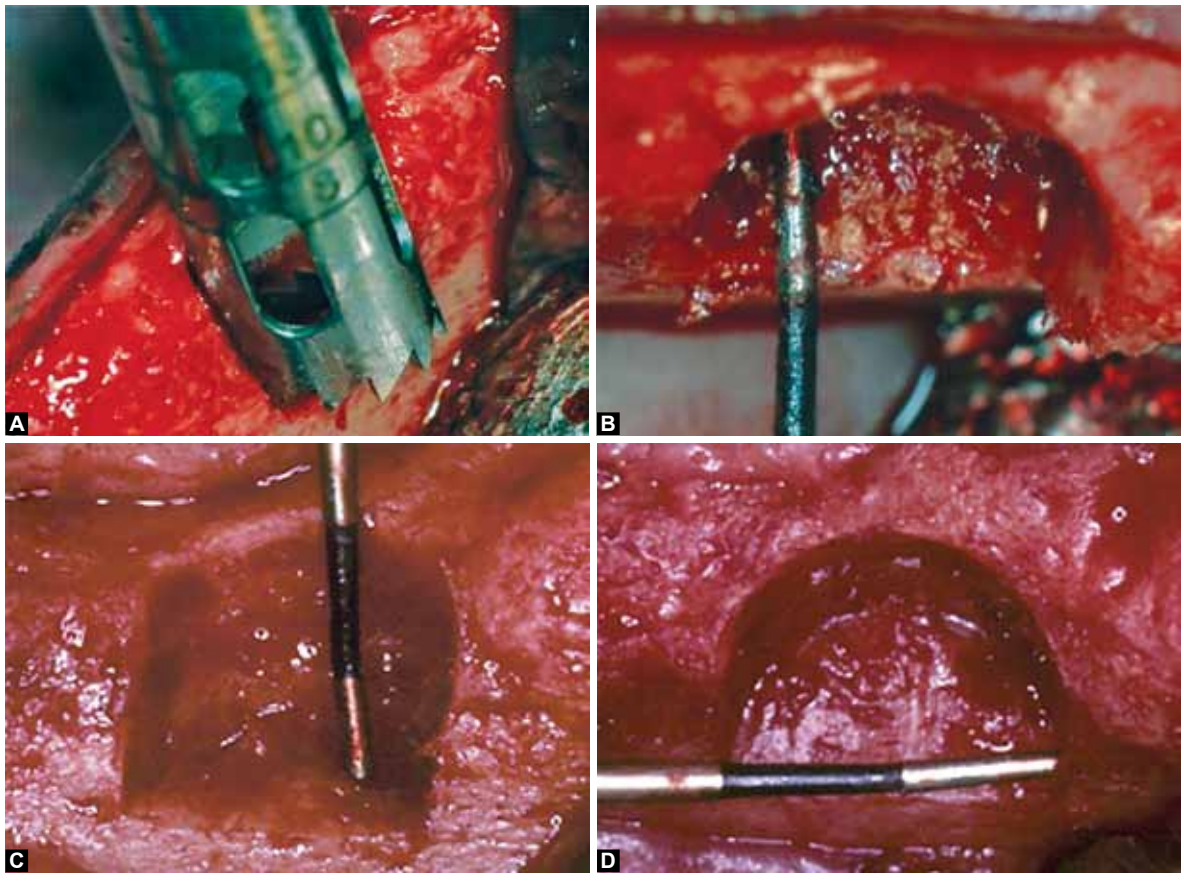
STUDY ANIMALS

Six female American foxhounds (*Canis familiaris*) approximately 2 years old and weighing 25 to 30 kg were used in this study. All animals were subjected to a physical and dental examination and were quarantined for 10 days upon arrival. The protocols for anesthesia, postoperative care, and necropsy of the animal subject follow a model used in a previous study undertaken at this institution.[38] The study was approved by the Institutional Animal Care and Use Committee (IACUC) at Baylor College of Dentistry.

SURGICAL PROCEDURES

In order to create a ridge defect, four premolars[1-4] were extracted on each side of the mandible, under general anesthesia. Extractions were performed using a flap approach to allow sectioning of the teeth. The flaps were reapproximated and sutured with 4.0 polyglactin 910 (Vicryl™, Ethicon, Johnson and Johnson, Cincinnati, OH, USA) suture material. Eight weeks following extractions, the second phase of the study was initiated to create the alveolar bone defects in the mandible. The first three defects in each animal were allocated to receive each of the three treatment groups (CM, CS, Ctrl) with the fourth defect randomly allocated to one of the three groups, ensuring a uniform distribution of groups among all animals. Following general anesthesia, a midcrestal incision was made across the edentulous area from mesial to distal, with intrasulcular extensions of the incision at teeth immediately adjacent to the site. Mucoperiosteal flaps were reflected on the buccal and lingual aspect of the site using an envelope flap. After exposing the alveolar ridge, a semicircular cut was made in the crest of the ridge using a 6.0 mm diameter trephine bur on a dental handpiece at a speed of approximately 600 rpm irrigated with sterile saline. All defects were created to a standardized morphology, with proportions of 3.0 mm in the buccolingual dimension, 6.0 mm in the mesiodistal dimension, and 6.0 mm in the apico-occlusal dimension (Figs 1A to D). The center of the most distal site was located 6 mm mesial to the 1st molar and the center of the next site was located 9 mm mesial to the most distal site.

In the experimental sites, autogenous bone graft was placed into the defect prior to the placement of the barrier. The graft consisted of bone harvested from the mandible using an osseous collection device (SafeScraper™, BioMet 3i,



Figs 1A to D: Alveolar ridge defects were created in the mandible using a 6.0 mm trephine (A), with a depth of 3 mm (B), a height of 6 mm (C) and a width of 6 mm (D)

Palm Beach Gardens, FL, USA). The bone was collected from the exposed mandible at least 15 mm away from the experimental and control sites. The trephined bone obtained after defect creation also provided donor autogenous graft material. Prior to placement in the defect, the bone graft was mixed together with blood collected from the surgical site. The graft was then covered with either, calcium sulfate, CS (Calcigen™ Oral, BioMet 3i, Palm Beach Gardens, FL, USA) putty or a bovine collagen membrane, CM (Ossix™, BioMet 3i, Palm Beach Gardens, FL, USA) depending on site allocation (Figs 2A and B). The CM was hydrated in sterile saline and placed over the grafted site with at least 3 mm overlap onto adjacent bone. The CS putty was prepared by mixing a setting solution consisting primarily of distilled water with CS dihydrate powder. The CS mixture was allowed to thicken to a putty-like consistency, then shaped and placed over the grafted site. Control sites were operated using the same surgical protocol that was used for experimental sites, including flap reflection and defect creation; however, no grafting or augmentation of the sites were performed.

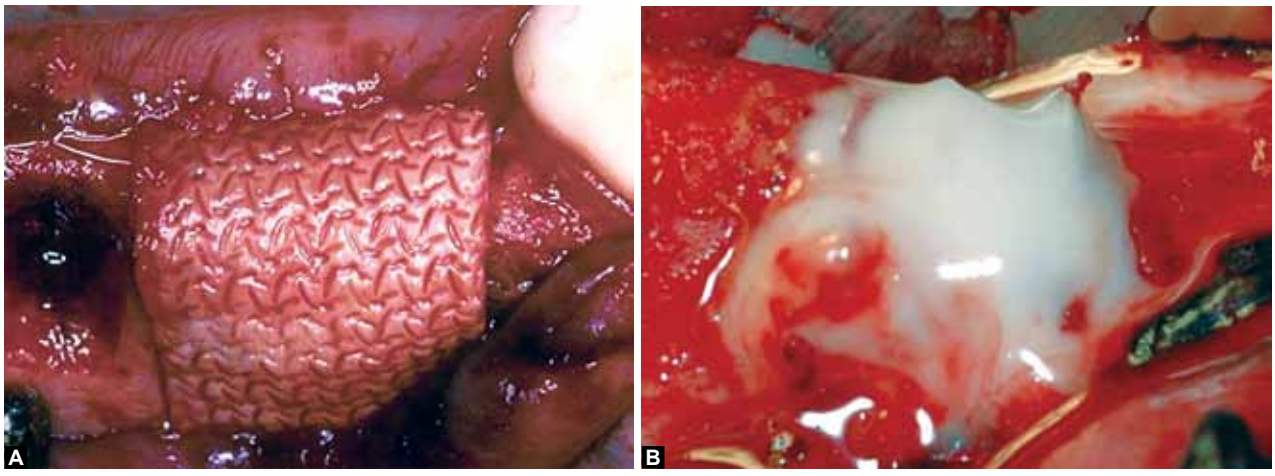
Cortical perforations were created in the coronal aspect of the alveolar ridge using a #2 round bur. Perforations were placed 1 mm lingual to the center of the surgically-created defect followed by deposition of India ink dye. This tattoo served as a reference point for identification when sectioning the specimens for histological analysis. The mucoperiosteal flaps were reapproximated to obtain primary wound closure and sutured with 4.0 polyglactin 910 suture material, with periosteal releasing incisions made as needed to assure minimal flap tension.

Twelve weeks following defect creation, all animals were euthanized under general anesthesia and the mandibles were resected *en bloc* with an oscillating autopsy saw, immersed in 70% ethanol and submitted for histological processing and analysis. Bone regeneration was evaluated by measuring defect fill in terms of area, percent bone gain, width and cortical bone thickness.

HISTOLOGICAL ANALYSIS

Individual sites were sectioned and bisected with a rotary diamond blade with a thickness of 0.5 mm in a buccolingual orientation using the crestal India ink tattoos and 1st molar teeth as reference points. Each specimens was prepared for histological analysis, 10 sections of each site were obtained in a longitudinal axis from facial to lingual. The sections were stained with alizarin red, which stains osteoid and mineralized bone tissues red.

Image acquisition of the entire section, including the complete buccal defect area, was accomplished using a digital camera attached to a light microscope



Figs 2A and B: Defects were grafted with autogenous bone and covered with either CM (A) or CS (B)

(Olympus DP-12, Olympus America, Center Valley, PA, USA). A calibrated scale was created using the image capture software that could be superimposed over the digital image. The scale had a dimension of 3 mm by 6 mm, corresponding to the dimensions of the surgically created defect (Figs 3A and B). Positioning of the scale was accomplished using the alveolar crest and buccal cortex as reference points, with an orientation of 3 mm buccolingual and 6 mm coronoapical. This allowed for more precise location of the defect during histological analysis.

The defect regions were analyzed histomorphometrically using an image analysis software program (MetaMorph, Molecular Devices Corp, Downingtown, PA, USA), (Figs 4A to D). All histomorphometric analysis was done without knowledge of the treatment assignment of the sections. Using the applied 3 × 6 mm scale as a reference, a calibration was performed (208 pixels = 1 mm). The primary variable measured within the defect was the total regenerated area. This was accomplished by tracing the perimeter of the defect with the borders consisting of the buccal cortex and the applied scale (43264 pixels = 1 mm^2). Additionally, the bone fill for the entire defect was measured by outlining each individual segment of bone within the defect, with the summation of each segment equaling the total area of bone regenerate. The sum total area of bone regenerate for each defect was divided by a fixed measurement, specifically the area of a 3 × 6 mm rectangle, yielding a percentage of bone fill in each defect. Use of the 3 × 6 mm rectangle as a standardized area was designated to equilibrate all sites for group comparison, as no one defect was morphologically identical to another.

Another parameter included measurement of the width of bone regenerate within the defect, which was obtained by measuring the linear distance from the buccal cortex of the defect inward to the border of the applied scale. This distance was calculated at the crest of the defect, coronal 1/3rd (2 mm apical of the crest), apical 1/3rd (4 mm apical of the crest), and at the base of the defect according to the applied reference scale. Analysis of the thickness of the regenerated buccal cortex within the defect was also accomplished. This measurement was obtained by identifying the area of greatest and least thickness within the cortex, then calculating the linear distance of thickness at each site to determine the range of cortical bone thickness.

STATISTICAL ANALYSIS

The data was entered into a statistical software program (SPSS, Chicago, IL, USA). Descriptive statistics were calculated for each site, including total area of regenerate, the percentage of bone regenerate as compared to the standard 3 × 6 mm reference area, the width of regenerate at the crest, coronal third, apical third, and base of the defects, and the maximum and minimum width of the regenerated buccal cortex. All four measurements were compared with an analysis of variance (ANOVA) between study groups with the defect site as the individual unit of observation. ANOVA was also performed for each of the four variables to determine if the significance of possible confounding variables including whether defect sites were influenced by animal. A student's t-test was performed to determine whether anterior-posterior defect location had any influence on regeneration within the defects.

RESULTS

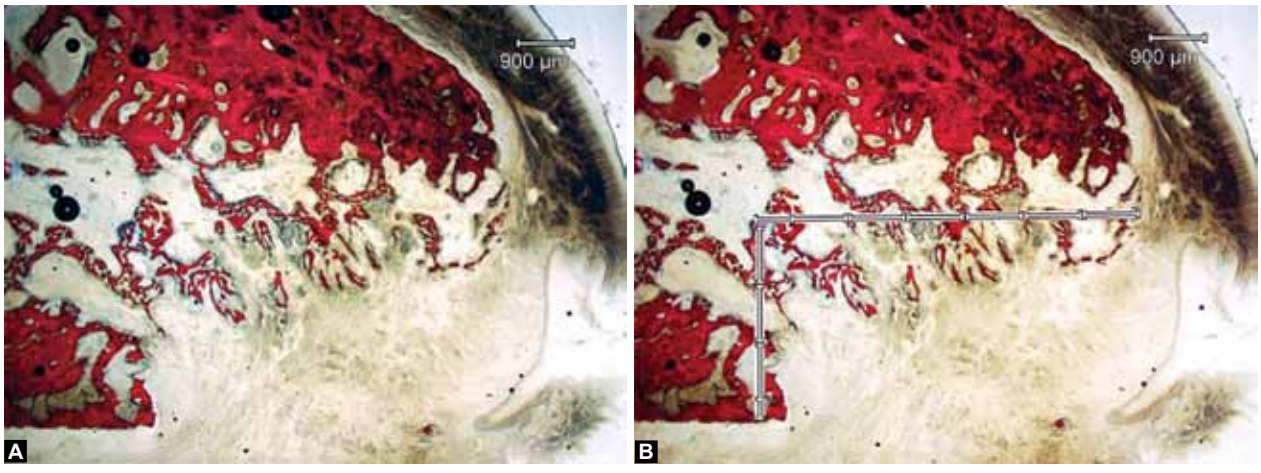
All animals successfully completed the initial phases of treatment consisting of bilateral mandibular premolar extractions, followed by ridge augmentation procedures after 8 weeks of healing. One animal died 7 days following alveolar ridge augmentation procedures, suffering from acute renal failure secondary to undiagnosed pancreatic cancer (necropsy report). Sites allocated within this animal included two sites treated with a CM, one treated with CS, and one site designated as a control.

Individual sites from this animal were submitted for histological processing and analysis of the specimens was performed; however, data from these sites were only evaluated and not included in the statistical analysis (Figs 3A and B). The other five animals completed the study without complications.

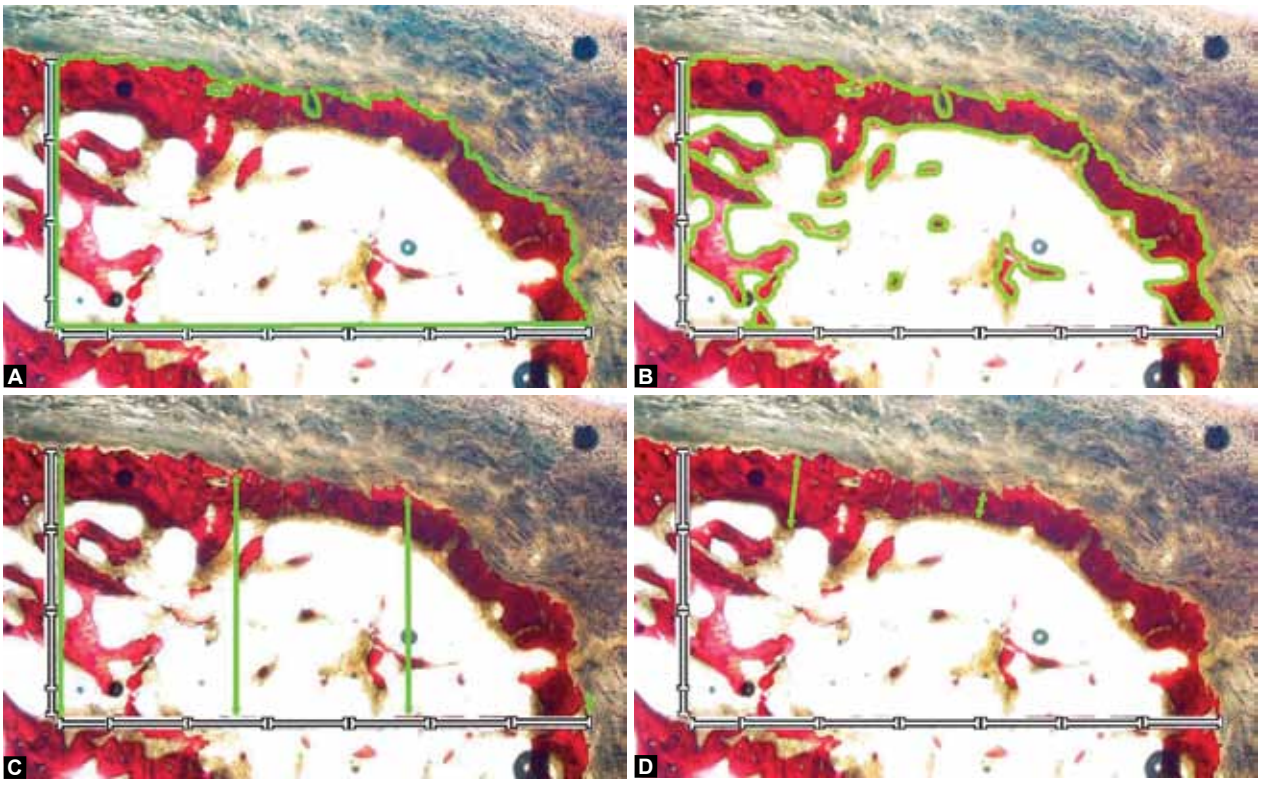
Examination of the surgical sites at 1 week postsurgically revealed no dehiscence of soft tissue or membrane exposure, with maintenance of primary wound healing over all defect sites in all animals. Following necropsy and tissue fixation, histological analysis of individual sites revealed regeneration of soft and hard tissues within all surgically created defects after 12 weeks of healing (Figs 5A to C). All sections were appropriately stained and mounted for histological analysis and comparison.

The descriptive statistics revealed a similar mean and median for all outcomes, indicating the presence of a normal distribution. Thus, the sample met the requirements for parametric analysis.

A comparison between groups revealed a greater mean area of regenerated bone in sites treated using CM and bone graft (12.2 mm^2) compared to sites treated using CS and bone graft (11.6 mm^2) or control sites (11.9 mm^2). However, an analysis of variance found no statistical significance (p = 0.875) in these differences (Table 1).



Figs 3A and B: Histology of the site 1 week after defect creation without (A) and with (B) reference scale (alizarin red stain; original magnification × 0.625)



Figs 4A to D: Histomorphometric analysis of specimens for total area (A), percent bone (B), width at crest, coronal 1/3rd, apical 1/3rd, and base of the defect (C) and range of cortical bone thickness (D). Green line indicates where measurements were taken

The percentage of bone within the defects as related to a standardized area was found to be greatest in sites treated with CS and bone graft (38.2%), followed closely by control sites (37.9%) and sites treated with CM and bone graft (36.3%), although no statistically significant difference was detected between groups using ANOVA (p = 0.942).

Measurement of cortical bone thickness revealed a range of 0.49 to 1.43 mm for control sites and 0.56 to 1.38 mm for CS sites. Defects treated with CM and bone graft demonstrated the thinnest buccal cortex, with a range of 0.41 to 1.06 mm. Although these measurements demonstrated the most variability of all evaluated parameters, no statistically significant differences were found between groups using ANOVA for maximum (p = 0.347) and minimum cortical bone thickness (p = 0.688).

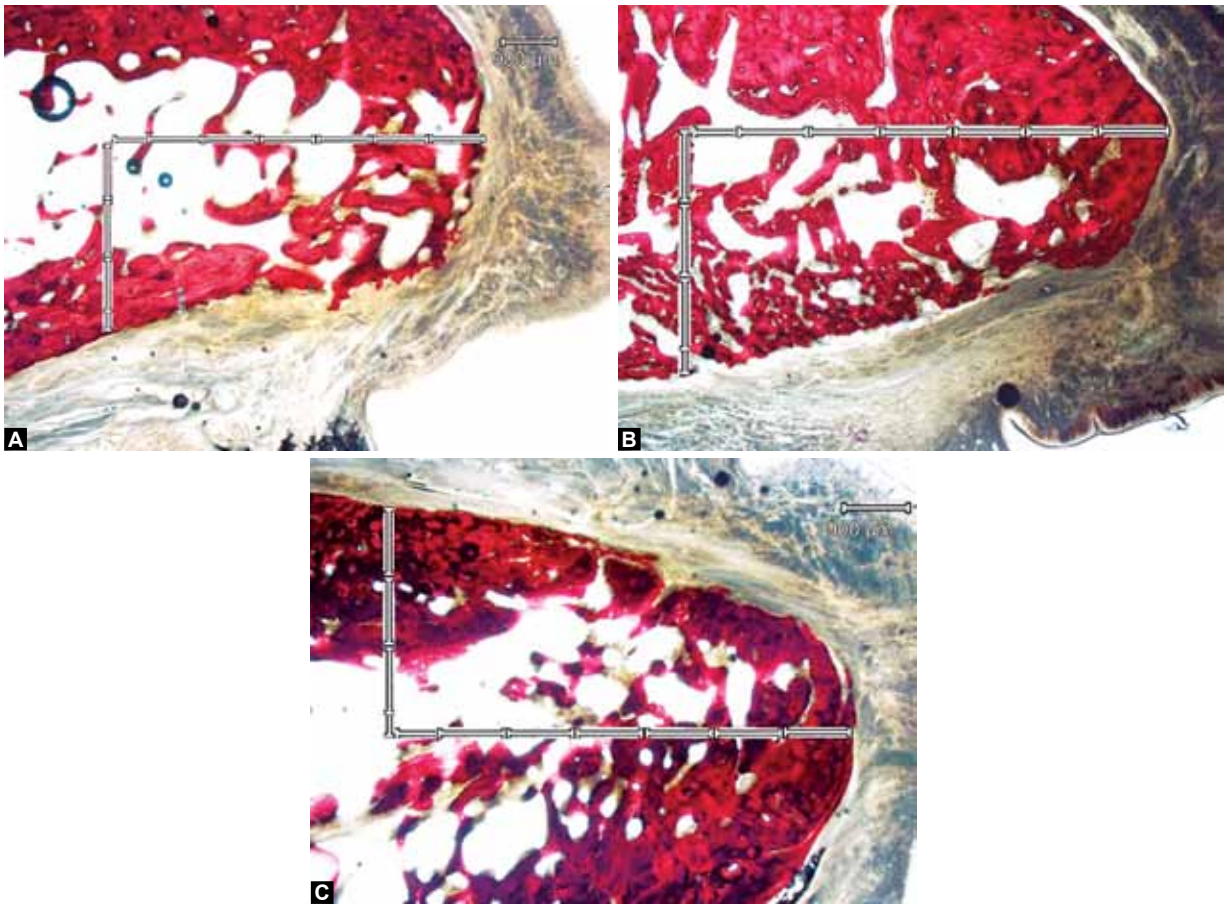
An evaluation of the width of regenerated bone at four different levels revealed little differences between groups at all points of measurement (Table 2). All sites regardless of treatment demonstrated little horizontal bone fill at the crest, with a mean distance of 0.33 mm at the crest for all three groups. Width of bone growth at the crestal level was not significantly different between groups according to ANOVA (p = 1.00). Horizontal fill at the coronal 1/3rd of the site was greatest in defects treated with CM and bone graft (1.62 mm) and control defects (1.61 mm), and slightly less in those treated with CS and bone graft (1.48 mm); however, no statistically significant differences were found between groups using ANOVA (p = 0.879). In the apical 1/3rd of the site, the greatest horizontal fill was again seen in the CM group (2.30 mm) followed by control sites (2.22 mm) and CS sites (2.08 mm), although no statistically significant differences were seen using ANOVA (p = 0.626). Finally, all treatment groups

Table 1: Regenerated bone area, percent bone fill and cortical bone thickness

Group	*Area (mm^2)*	*Percent bone (%)*	*Cortical bone thickness (mm)*
Collagen membrane	12.1	36.3	0.41-1.06
Calcium sulfate	11.6	38.2	0.56-1.38
Control	11.9	37.9	0.49-1.43

Table 2: Width of regenerated bone within the defect

Group	*Crest (mm)*	*Coronal 1/3rd (mm)*	*Apical 1/3rd (mm)*	*Base (mm)*
Collagen membrane	0.33	1.62	2.30	2.85
Calcium sulfate	0.33	1.48	2.08	2.85
Control	0.33	1.61	2.22	2.82



Figs 5A to C: Histomorphometry of three sites 12 weeks after defect creation. These sites were treated using CM (A) or CS (B) as well as a nongrafted control specimen (C)

demonstrated similar horizontal fill at the base of the defects, with a fill of 2.85 mm for the CM and CS groups and 2.82 mm for control sites. No statistically significant differences were found between any of the groups using ANOVA ($p = 0.867$).

An analysis of variance evaluating differences between animals demonstrated no statistically significant differences for most parameters, including total area, horizontal width at all levels (crest, cortical 1/3rd, apical 1/3rd, base), and percent bone. Cortical bone thickness in terms of mean maximum thickness was found to be significantly greater for one animal (1.97 mm, $p = 0.001$); however, mean minimum thickness was not significantly different ($p = 0.089$).

Differences between sites in terms of location were analyzed using a student's t-test. Results demonstrated no statistically significant differences between all parameters except percent bone, which was found to be 42.6% ± 7.6 for mesial sites and 32.4% ± 9.6 for distal sites ($p = 0.017$).

DISCUSSION

This study evaluated bone regeneration in surgically created alveolar ridge defects in the canine mandible using autogenous bone grafts and barriers consistent with the principles of GBR. The canine model was chosen because of the potential for intersubject comparison, as well as the opportunity to control the defect size. Multiple measures of bone regeneration were evaluated from histologic sections, including the total area of bone regenerated within the surgically created defect. Measurements were made on four sites, specifically, the crest, coronal third, apical third and at the base of the defect. Our results showed similar amount of width regeneration for all groups (Table 2).

Regeneration within the defects was also measured in terms of percent bone gain. This measurement was taken by calculating the total area of bone particles within the defect and dividing that number by a standardized 3 × 6 mm area; therefore, the percentage value does not reflect the actual percent bone regenerated within the defect itself. Comparison of percent bone to a standardized area was performed to eliminate variability seen within groups based on morphology of the regenerated defects. Percent bone regeneration was found to approximate 38% in sites treated with CS, which was only slightly greater than control sites (37.9%) and sites treated using a collagen membrane (36.3%).

Cortical bone thickness is an important clinical finding in regenerated bone, as the cortical bone provides primary stability for dental implants immediately after placement. Few studies quantified the thickness of cortical bone, but Lekholm and Zarb's classification of bone types emphasizes the thickness of cortical bone in relation to implant success in type IV bone, which is characterized by thin cortical bone and minimal trabecular bone.[39] Albrektsson et al found that survival rates of machined-surfaced titanium implants placed in type IV bone were significantly less than implants placed in types I, II or III bone. Therefore, it is particularly important for the clinician placing a dental implant in a previously grafted site to appreciate the thickness of the regenerated cortex as it may affect the course of treatment. For example, the clinician may choose to place the implant using a two-stage submerged approach instead of a one-stage transgingival approach if primary stability of the implant cannot be obtained.

In this study, the cortical bone thickness was greatest in nongrafted sites (Ctrl) with a range of 0.49 to 1.43 mm. This was comparable to sites treated with CS, which exhibited a range of 0.56 to 1.38 mm. Sites treated using a collagen membrane demonstrated the thinnest cortical bone of all treatment groups, with a range of 0.41 to 1.06 mm respectively. While the differences between the groups were small and not significantly different, there may be clinical implications associated with these measurements.

A reasonable explanation as to why cortical thickness was less in sites treated with the collagen membrane may lie in the occlusive nature of the barrier. The collagen membrane used in this study has shown to provide barrier function for up to 6 months in humans, and is visible in many of the histologic specimens taken from this study as well as others.[19,20,24] The increased barrier function of this membrane was likely due to cross-linkage of the collagen fibers.[40] Other studies reported poor regeneration using highly cross-linked collagen membranes, resulting in increased rates of flap dehiscence compared to low cross-linked membranes.[41] Additionally, the occlusive nature of the membrane may reduce blood supply to the underlying graft as it prevents connective tissue from coming in contact with the grafted bone, which may limit the regeneration of the buccal cortex. This effect was not seen in control sites or sites treated with CS. Perhaps an increased healing period allowing for further degeneration of the membrane would have produced different results, such as an increased thickening of the buccal cortex in sites treated with a collagen membrane.

A possible explanation of why cortical thickness was greater in the control group could be due to an increased blood supply to control sites, as no barrier devices were placed. Increased cortical thickness in CS sites might be explained by a more rapid degradation of the barrier device, reported to be approximately 8 weeks, which would allow for an increased blood supply to the regenerating

cortex as the CS resorbs.[30] This study supports the findings of Sottosanti based on the fact that CS remnants were not detected in any of the histologic specimens.

Additional comparisons between individual sites were generally found to be not significantly different, with the exception of site location. In terms of percent bone, mesial sites were found to have an increased amount of regeneration over distal sites, on the order of 42.6 to 32.4%. This difference was found to be statistically significant using a student's t-test. A possible explanation for this difference might be related to Lekholm and Zarb's classification of bone types.[39] In their explanation of bone structure based on anatomical location, they found a decrease in trabecular bone density in a mesial to distal direction in the maxilla and mandible. While the distance between mesial and distal sites in this experiment was only 9 mm, this could be sufficient to explain the difference in the bone percentage. Other considerations include the close proximity of the mesial defect to the mental foramina, of which this canine species has two bilaterally, which would provide a greater periosteal blood supply to a regenerating graft.

Other findings of this study include the lack of intraoral complications following surgical procedures. No soft tissue dehiscences were detected following augmentation in either the collagen membrane or CS groups, which confirm previous findings stating the biocompatibility of these materials.[40,42] Additionally, all groups exhibited some regeneration, although regeneration within control sites was not found to be significantly different from the experimental sites. This was an unexpected finding, as most controlled studies of ridge augmentation have demonstrated a reduced regeneration within control sites compared with grafted and/or membrane treated sites.[43,44]

An explanation for the profound regeneration within all sites may be related to the size of the surgically created defect. Design of the semicircular defect was chosen to simulate an atrophic ridge similar to what often is encountered when the buccal cortex is lost following tooth extraction. This study involved creation of a buccal ridge defect measuring 3 × 6 × 6 mm (buccolingual, coronoapical, mesiodistal). Other studies with surgically created defects have utilized larger defects.[43-47] In a study of ridge augmentation in the canine, Seibert and Nyman created buccal ridge defects measuring 3.5 × 7 × 13 mm to compare GBR using membranes. The authors reported new bone formation in sites covered with a membrane after 90 days, with no new bone formation in sham-operated control sites. Von Arx et al created buccal ridge defects in the canine mandible with dimensions of 8 × 10 × 14 mm for the purpose of comparing GBR using various bone grafting materials with or without e-PTFE membranes. All sites exhibited regeneration within the defects after 6 months; however, no empty control defects were utilized. Within this study, no statistically significant differences were seen for bone regeneration achieved within experimental or control defects in terms of area, percent bone, width and cortical thickness, leading to the assumption that the dimensions of the defect used in this study were not large enough to allow for comparison of grafted *vs* nongrafted ridge defects (critical-sized defects). It is possible that creation of a larger size defect comparable to that utilized in the study by Seibert and Nyman may result in more pronounced differences between experimental and control groups.[43] Perhaps the critical size for an alveolar ridge defect in the canine may be somewhere in between the size of the defect used in this study and those used in other studies.

The results from this study demonstrate that calcium sulfate is a biocompatible material that may be useful as an adjunctive grafting component in GBR procedures. It is unclear whether the regeneration achieved using CS is directly related to its barrier function or whether the CS merely stabilized the graft material during initial wound healing. Calcium sulfate has been used succes sfully as a binding agent for bone grafting material in ridge preservation and periodontal regenerative procedures, therefore, future research may address the capabilities of calcium sulfate as a bone graft binder and as a barrier in combination for ridge augmentation procedures.

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RESEARCH ARTICLE

A Comparative Evaluation of the Retention of Denture Bases fabricated using Selective Pressure, Massad's and Functional Impression Techniques: A Clinical Study

[1]Ragini Sudhakar Sanaye, [2]Naisargi Shah, [3]Sabita M Ram

ABSTRACT

Background: Impression techniques have evolved considerably during the last decade. However, it needs to be assessed whether the retention achieved with these techniques is adequate enough to establish them as an alternative to the conventional techniques.

Purpose: This study was planned to evaluate the retention of denture bases fabricated using the selective pressure, functional and Massad's impression techniques.

Materials and methods: Twenty completely edentulous patients were selected and each of them was subjected to three definitive impression techniques: selective pressure, functional and Massad's techniques. The permanent bases were fabricated and checked for retention with a custom made retention checking apparatus. The load required to dislodge the denture base fabricated using each technique, from the maxillary foundation was recorded and this data was subjected to statistical analysis.

Results: The statistical analysis shows that the difference between the selective pressure and the functional impression technique is statistically significant (p = 0.046) However, this result needs verification by collecting more data or designing another study, since the observed p-value is closer to the significance level (i.e. 0.05). Though the difference between the means of Massad's and functional techniques is of 39 gm, it is statistically not significant (p = 0.09). The difference between means load to dislodge denture bases for selective pressure and Massad's techniques (5.5 gm) is not statistically significant (p = 0.95).

Conclusion: The three impression techniques yielded adequately retentive permanent denture bases. However, retention of the denture bases obtained from the selective pressure impression technique was best, followed by the Massad's and functional techniques.

Clinical implication: The results of this study indicated that the denture bases fabricated using selective pressure impression technique were more retentive than the Massad's and the Functional impression technique.

[1]Postgraduate Student, [2]Professor, [3]Professor and Head

[1-3]Department of Prosthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Ragini Sudhakar Sanaye, Postgraduate Student, Department of Prosthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: 02227426604, e-mail: ragz_8@yahoo.com

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INTRODUCTION

The evolution of dentistry and increased dental awareness has made the patient more demanding. The loss of teeth and supporting tissues by disease or accident is still a cause of concern, which demands replacement by artificial substitutes. Complete denture is a removable prosthesis that replaces the entire dentition and associated structures of the maxillae or mandible.[1] The fabrication of complete denture requires a number of steps, the first, being impression making. A complete denture impression is a negative registration of the entire denture bearing, stabilizing and border seal areas present in the edentulous mouth.[1] The objectives of an impression are to provide retention, stability, comfort and support to the denture. An impression also acts as a foundation for improved appearance of the patient and at the same time maintains the health of the oral tissues.[2] The impression techniques are numerous, but may be generally classified according to jaw position and the degree of pressure used when making the impression, that is, open or closed mouth, pressure, nonpressure or negative pressure, or selective pressure.

The selective pressure impression technique was proposed by Boucher in 1950. It combined the principles of both pressure and minimal pressure techniques. It confined the forces acting on denture to the stress bearing areas. These tissues were recorded under slight pressure while other tissues were relieved with minimal pressure.[3] Functional impression materials were those which, when applied to the tissue surface of a denture base or impression tray, recorded the topography and position of the basal seat and border tissues as they existed in a functional state.[4] Tissue-conditioning materials had been

found useful as functional impression materials.[4] The functional impression technique utilized the property of the tissue conditioners to allow time for the tissues to reposition themselves as they had an ability of getting compressed under pressure but rebound when pressure was released. Elastomeric impression materials are being used in recent times for impression making in complete denture fabrication. Joseph Massad in 2007 proposed a modified impression technique which included building or layering method of impression making, maintaining the integrity between layers of the impression materials of varying viscosities depending on the compressibility of the tissues.[5] It provided detailed and customized impression of the edentulous patient using both the static and functional concepts of impression making in one application.[5]

The introduction of new impression materials and techniques has made it necessary to evaluate whether these are efficient and accurate enough to substitute the conventional techniques and materials being used since decades. The retention achieved in a denture is an important criteria to check the accuracy and efficacy of an impression material or technique. Hence, this study was planned to evaluate the selective pressure, functional and Massad's impression techniques and correlate the retention achieved for the denture bases fabricated using these techniques.

MATERIALS AND METHODS

Twenty completely edentulous patients were selected based on the inclusion and exclusion criteria (Fig. 1). The selected patient's history, examination, both intraoral and extraoral were carried out to assess the patient's tissues. Special emphasis in the examination was given to the maxillary arch and variation in the compressibility of the overlying tissues were assessed with a T- burnisher and marked on a cast which was used as a reference for special tray fabrication for selective pressure, functional impression technique and to determine the areas where different viscosities of elastomeric impression materials will be placed during the Massad's impression technique. An appropriate maxillary edentulous stock metal tray with 5 mm clearance between the tray and maxillary ridge was selected and primary impression was made with impression compound (Y Dents). The impression was poured in dental plaster Type II (Kaldent) to obtain a primary cast for each patient. The primary cast was duplicated in putty (Aquasil) to achieve two primary casts for each patient which were numbered as No. 1 and 2. On the cast No. 1 auto polymerizing acrylic resin special tray (DPI) was fabricated for selective pressure impression technique, with a spacer design by referring to the chart on which the compressibility was marked and also the stress bearing and relief areas. The tray was fabricated using by dough technique. The tray for selective pressure impression technique was kept 2 mm short of the sulcus. On cast No. 2 auto polymerizing acrylic resin special tray (DPI) was fabricated for functional impression technique. The tray was made extending to the sulcus and without handle so that the patient could perform the functional movements easily. The definitive impression techniques were grouped as following:

Selective pressure impression technique.[6-9]
Massad's impression technique.[5,10-14]
Functional impression technique.[15-17]

Selective Pressure Impression Technique

The special tray fabricated on cast No. 1 was checked for adaptation and extension and modified whenever required. The border molding was done with low fusing impression compound (DPI Pinnacle) by sectional method. The definitive impression was made with zinc oxide eugenol impression paste (DPI) standardizing the manipulation of materials (Fig. 2).

Massad's Impression Technique

The second definitive impression technique was the Massad's technique. Specially designed trays which could be molded in hot water were selected for individual patients taking into consideration size of the arch. The tray size selection was done by measuring the distance between the tuberosities using a caliper and relating it to the chart given with the trays. The tray was modified wherever required. In this technique depending on the resiliency of the tissues, the elastomeric impression materials of various viscosities were used. High viscosity polyvinylsiloxane material (Aquasil) was used for making tissue stops, ensuring a uniform distance of approximately 2 to 3 mm from the vestibular sulcus. Single step border molding was then performed with high viscosity polyvinylsiloxane material (Aquasil). The light viscosity polyvinylsiloxane impression material (Aquasil) was loaded corresponding to the areas to be relieved over the tray and medium viscosity polyvinylsiloxane (Aquasil) was loaded in the other areas. The loaded tray was placed in the oral cavity and impression was made (Figs 3 and 4).

Functional Impression Technique

The special tray fabricated on cast No. 2 was checked for adaptation and extensions. Any necessary corrections were made. The spacer was removed. The powder and liquid of the tissue conditioner (D-soft) were mixed according to manufacturer's instructions and loaded onto the tray and impression was made. The patient

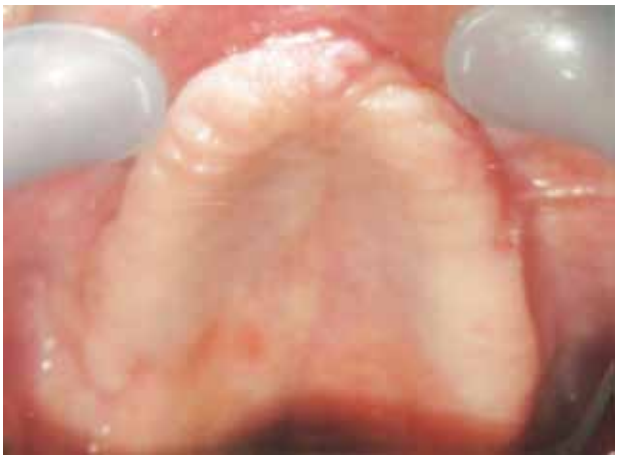

Fig. 1: Preoperative intraoral

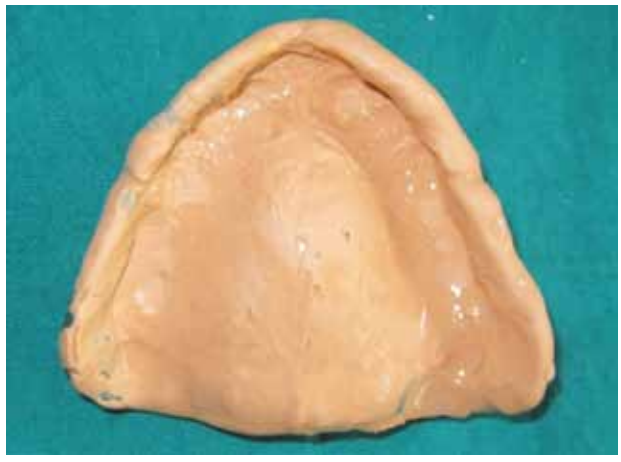

Fig. 2: Final impression with selective pressure impression technique

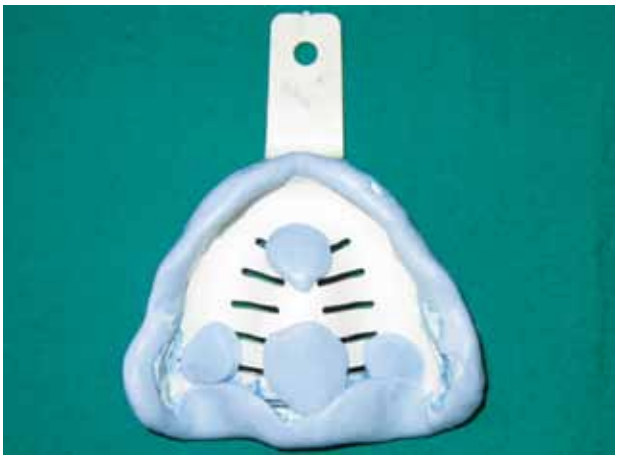

Fig. 3: Border molding for Massad's technique

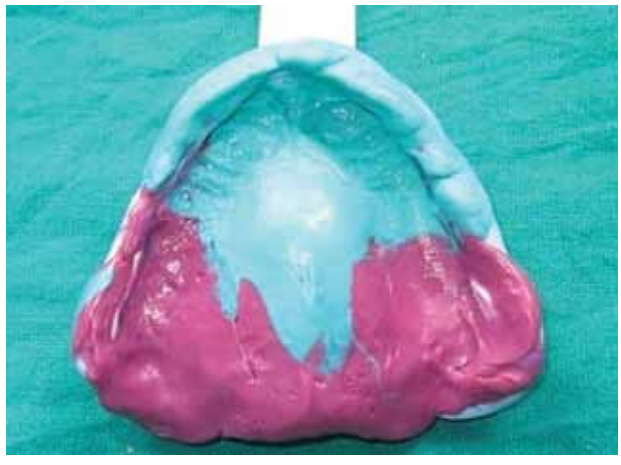

Fig. 4: Final impression using Massad's impression technique

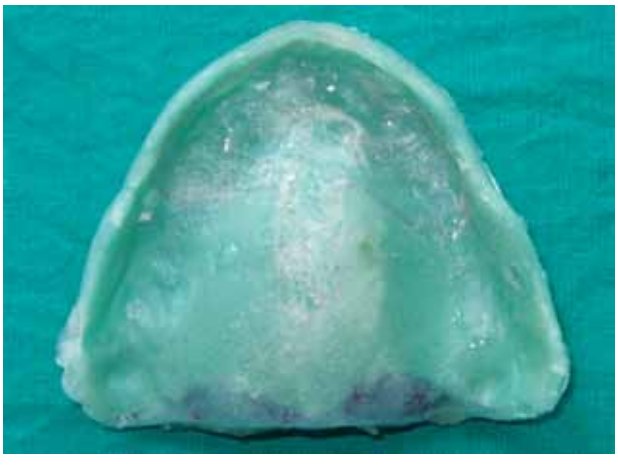

Fig. 5: Final impression with functional impression technique

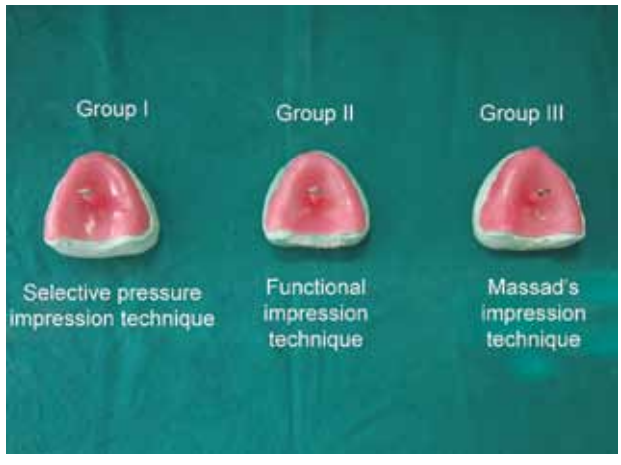

Fig. 6: Permanent bases with metal hooks

was instructed to make functional movements like swallowing, speech and pursing of lips. After three minutes the tray was removed and impression was checked for any voids. Impression material was added if required. The tray was placed in the oral cavity again for 30 minutes (Fig. 5).

The three definitive impressions were poured in Type III dental stone (Kaldent). The tissue conditioner impression was coated with dental stone using a paint brush taking care, not to disturb the tissue conditioner material. After this layer of stone was set, the second layer of stone poured followed by the base. Other impressions were poured using the conventional technique. The casts were retrieved and permanent bases were fabricated with heat polymerizing acrylic resin. The bases were then retrieved, finished and polished. The bases were

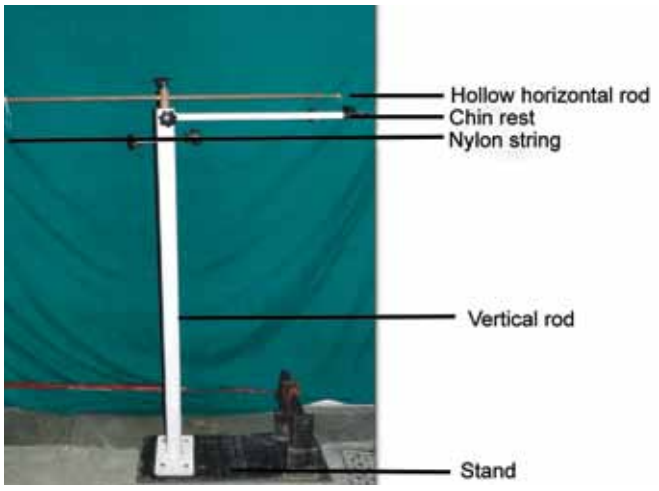

Fig. 7: Retention measuring apparatus

Fig. 8: Bases loaded with weights to check for retention

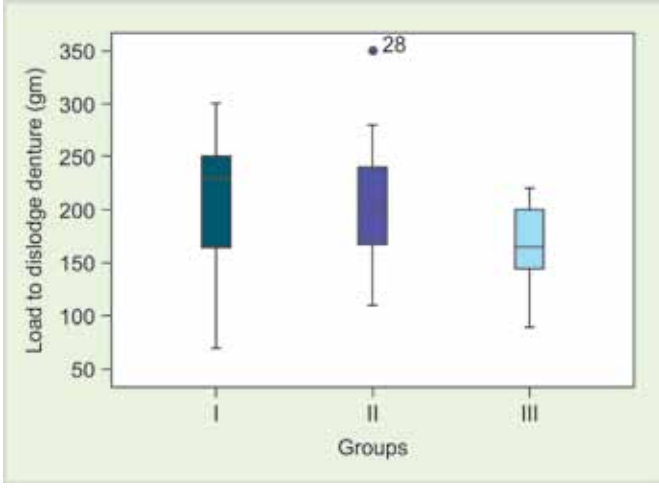

Fig. 9: Boxplots for load to dislodge denture bases

then placed in cold water till further use. A hook was attached at the center of the denture base with self polymerizing acrylic resin keeping it perpendicular to the occlusal plane of the edentulous ridge (Fig. 6). The components of the retention measuring apparatus were secured in position. The selected patient was made to stand in a cephalostat (Figs 7 and 8). The patient was made comfortable, the maxillary denture base fabricated using selective pressure technique was placed on the maxillary foundation. The nylon string on one end was attached to the hook of the denture base. The other end had the weighing pan on which weights were added very slowly taking care not to disturb the assembly. The weight used to dislodge the denture base was recorded. Three such readings were taken and the average of three readings was considered the definitive reading for that base. After an interval of 48 hours, the next base fabricated using Massad's impression technique and again after 48 hours the base fabricated using functional impression technique was checked for retention. In a similar manner all the 20 patients' denture bases were checked for retention and the weights which dislodged the bases were recorded (Table 1).

The readings were then subjected to statistical analysis:

- One-way ANOVA (Table 2) and
- Post hoc tests: Multiple comparisons by using Scheffe test for subjects (Tables 3 and 4).
- The level of significance was set at 0.05.

RESULTS

The statistical analysis shows that the difference between the selective pressure and the functional impression technique is statistically significant (p = 0.046) However, this result needs verification by collecting more data or designing another study, since the observed p-value

Table 1: Load required to dislodge the denture bases

Patient	*Group I (gm)*	*Group II (gm)*	*Group III (gm)*
P1	150	120	110
P2	140	190	160
P3	70	200	90
P4	250	110	150
P5	95	110	90
P6	250	200	170
P7	240	200	180
P8	300	350	150
P9	245	240	190
P10	180	190	150
P11	260	230	220
P12	220	240	200
P13	200	180	160
P14	160	150	120
P15	300	280	210
P16	250	240	220
P17	240	230	200
P18	260	265	210
P19	210	200	180
P20	170	155	140
Total	4190	4080	3300

Table 2: Result of one-way ANOVA test for load to dislodge denture base

Source of variance	*Sum of squares*	*DF*	*Mean square*	*F*	*p-value*
Between groups	23543.33	2	11771.67	3.86	0.03
Within groups	173975	57	3052.193	–	–
Total	197518.3	59			

Table 3: Results of Scheffe's multiple comparisons

Pairs of groups compared	*Mean difference*	*Std. Error*	*p-value*	*95% confidence interval*	
				Lower bound	*Upper bound*
Group I-II	5.5	17.47	0.95	–38.41	49.41
Group I-III	44.50	17.47	0.046	0.59	88.41
Group II-III	39	17.47	0.09	–4.91	82.91

Table 4: Homogeneous subsets in terms of mean load to dislodge denture base

Groups	*n*	*Subset for alpha = 0.05*	
		1	*2*
III	20	165	–
II	20	204	204
I	20	–	209.5
p-value	–	0.09	0.95

is closer to the significance level (i.e. 0.05). Though the difference between the means of Massad's and functional techniques is of 39 gm, it is statistically not significant (p = 0.09). The difference between means load to dislodge denture bases for selective pressure and Massad's techniques (5.5 gm) is not statistically significant (p = 0.95) (Fig. 9).

DISCUSSION

The result of the study emphasizes that all three impression techniques yield adequately retentive permanent denture bases. However, the retention of the denture bases obtained from the selective pressure impression technique was better than the Massad's and functional technique. This is in accordance with Sharry, Wang and Khlevnoy who recommended definitive impressions with a spaced custom tray and zinc oxide eugenol impression paste. The difference measured though is not of a significant value to imply an alternate hypothesis. Williams, Zarb, Gilbert and Blandin, Chee and Donovan[18] stated that greater accuracy is obtained in custom made trays than with impressions made in stock trays. The denture base fabricated by the Massad's impression technique did not show much difference as compared to the selective pressure impression technique though the bases were less retentive. This may have been due to lack of a special or custom tray in the Massad's technique. The specialized stock trays designed by Massad were used. They did not fit as well as the special tray for the respective individual. The varying viscosity of elastomeric impression materials did have an advantage because low viscosity was used for applying light pressure in relief areas, medium body for other areas of the palate and high viscosity for border molding. This was a single step impression technique. It used contemporary materials having more accuracy and dimensional stability. It may however be expensive as the trays are technique specific and elastomeric impression materials are more costly than the zinc oxide eugenol impression paste. The functional impression technique in which the tissue conditioner material was used for making the impression showed the least retentive denture bases as compared to the Massad's and selective pressure technique. The lower retention of the bases fabricated by the functional impression technique may have been due to the fact that the material had a property to flow and did not exert any pressure on the peripheral tissues which is achieved by low fusing compound and the high viscosity impression material.

CONCLUSION

Within the limitations of the study the following conclusion were drawn:

1. The permanent denture bases fabricated using selective pressure definitive impression technique were the most retentive among the three definitive impression techniques.
2. The permanent denture bases fabricated using Massad's definitive impression technique were more retentive than the functional impression technique, but less retentive than the selective pressure impression technique.
3. The permanent denture bases fabricated using functional impression technique were the least retentive among the three impression techniques.
4. All the three definitive impression techniques-selective pressure, Massad's and functional impression technique yielded denture bases with adequate retention.

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REVIEW ARTICLE

Mouth Breathing: A Menace to Developing Dentition

[1]Ankita Jain, [2]Dara John Bhaskar, [3]Devanand Gupta, [4]Priyanka Yadav, [5]Deepak Ranjan Dalai, [6]Vikas Jhingala
[7]Yogesh Garg, [8]Monika Kalra

ABSTRACT

Purpose: To know the adverse effects of mouth breathing on developing dentition.

Introduction: Mouth breathing as an oral habit is seldom discussed in detail and as a consequence has tended to be overlooked by dental professionals. There is a large controversy about the causal relations between dentofacial deformities and mouth breathing habits. A review of current data on the skeletofacial, dental and gingival changes that occur in mouth breathing individuals is given, with the intention of raising the awareness of dental professionals to the special needs of these patients.

Materials and methods: This review article is formulated based on the available literature online. A thorough search was made on the pubmed and other reliable sources and then this review is formed.

Conclusion: Some postural and morphological changes during long-term adaptation to oral respiration are evoked: opening of the bite with a lowered postural position of the mandible, reduction of upper arch width, downward and backward rotation of the mandible, increased lower facial height and changes in the inclination of the lower and upper incisors.

Keywords: Mouth breathing, Habit, Dentofacial, Respiration.

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INTRODUCTION

For some, the saying 'spring is in the air' is quite factual. When the winter snow melts and vegetation bloom, pollen and other materials can inflict chaos on those suffering from seasonal allergies, usually causing a habit called 'mouth breathing'. The mouth does not usually contribute in respiration. For usual dentofacial growth to happen there ought to be normal breathing. Increased struggle to the flow of air through the nasal passages may be considered to be the key reason of mouth breathing.[1-4]

Mouth breathing has been declared to have serious effects on the growth of the facial skeleton and occlusion of teeth on account of the displacement of normal lateral, buccal and lingual muscular forces.[5] A number of persons may appear to be mouth breathers because of their mandibular posture or incompetent lips. It is common for a 3 to 6-year-old to be slightly lip incompetent. Other children have been labeled mouth breathers because of a suspected nasal airway obstruction. When nose breathing is disrupted by adenoid and tonsil hypertrophy, rhinitis, nasal septum deviation, there is a prevalence of mouth breathing. According to Paul and Nanda, there is much evidence that mouth breathing produces deformities of the jaws, inadequate position or shape of the alveolar process and malocclusion and results in the development of 'adenoidal facies' or 'long face syndrome'.[3,5-8]

CLASSIFICATION

- Sim and Finn (1987)[1,2,8] classified mouth breathing as:
  - *Obstructive:* Children with an increased resistance to or a complete obstruction of the normal flow of air through the nasal passages. Seen in ectomorphous individuals with long narrow faces and nasopharyngeal passages.
  - *Habitual:* Child who continually breathes through the mouth by force of habit, although the obstruction has been removed.
  - *Anatomical:* Short upper lip does not permit closure without undue effort.
    a. Total blockage: Nasal passages are completely blocked.
    b. Partial blockage (Fig. 1).

ETIOLOGY

Causes of mouth breathing are the following:

- Nasal obstruction[1-4]
  - Enlarged turbinate:
    This may be due to:
    a. Allergies
    b. Chronic infections of mucous membrane
    c. Atrophic rhinitis

[1,4-8]Postgraduate Student, [2]Professor, [3]Senior Lecturer

[1,2,5-8]Department of Public Health Dentistry, Teerthanker Mahaveer Dental College and Research Centre, Moradabad Uttar Pradesh, India

[3]Department of Public Health Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

[4]Department of Public Health Dentistry, Rajasthan Dental College and Hospital, Jaipur, Rajasthan, India

Corresponding Author: Ankita Jain, Postgraduate Student Department of Public Health Dentistry, Teerthanker Mahaveer Dental College and Research Centre, Moradabad, Uttar Pradesh India, Phone: 09808723156, e-mail: ankitajain.0815@gmail.com

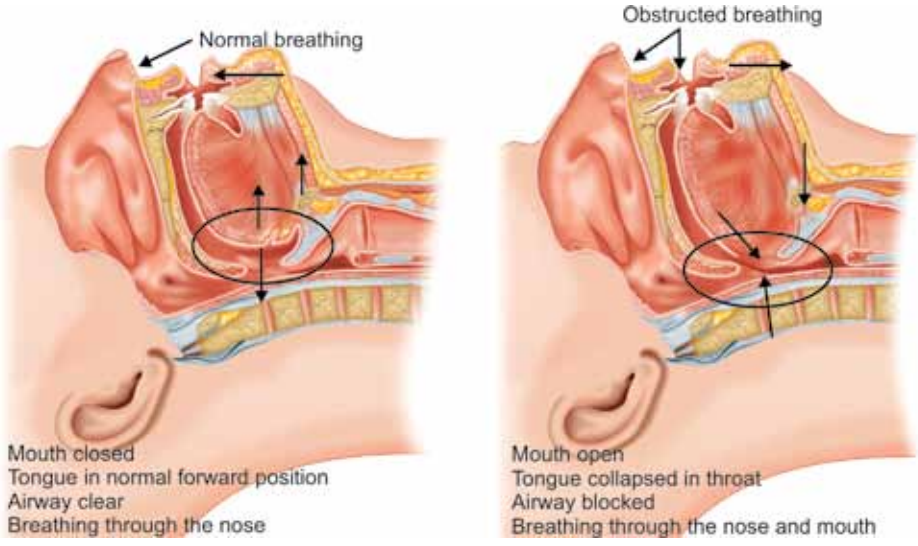

Fig. 1: Difference between normal and obstructed breathing

d. Hot and dry climatic conditions
e. Polluted air.

– Hypertrophy of pharyngeal lymphoid tissue (adenoids): Repeated infection results in the overgrowth of lymphoid masses blocks the posterior nares, rendering mouth breathing necessary.
– Intranasal defects:
  a. Deviated nasal septum
  b. Subluxation of septum
  c. Thickness of septum
  d. Bony spurs
  e Polyps
– Allergic rhinitis
  Continuous infections and toxins of the bacteria may sensitize the tissue to develop allergic reactions.

EFFECTS OF MOUTH BREATHING

Resistance is lacking to the diaphragm and intercoastal muscles so negative pressure is not created to promote airflow. Children who breathe predominantly through their mouth pose difficult problems for healthcare professionals.[2,9]

The head posture is the result of a complex and delicate balance between the muscles involved in the cervical-mandibular-cranial system designed to maintain the pharyngeal airway. Hence, the forward head posture, commonly related to mouth breathing, is described as an adaptation to expand and facilitate the air flow through the oropharynx.[10]

In addition to various types of abnormal facial growth and dental malocclusions, many other medical problems can be attributed to mouth breathing. First and foremost, nasal respiration (which is produced in the nasal sinuses) is essential for the production of nitric oxide. Studies have shown that upper airway obstruction/mouth breathing can cause sleep disorders and sleep apnea. Studies have shown that children with sleep disorders have problems paying attention in school, are often tired, and may exhibit behavior problems; many of these children often are misdiagnosed with attention deficit hyperactivity disorder (ADHD).[11]

CLINICAL FEATURES

- Effect on face,[1,2] (Fig. 2):
  1. Lips slack and stay open
  2. Short upper lip
  3. Molding action of upper lip on incisors is lost thereby resulting in proclination and spacing.
  4. Lower lip: heavy and everted.
  5. Tongue is suspended between upper and lower arches resulting in constriction of buccal segment (V shape arch).
  6. Increased mandibular plane angle.
  7. Retrognathic maxilla and mandible.

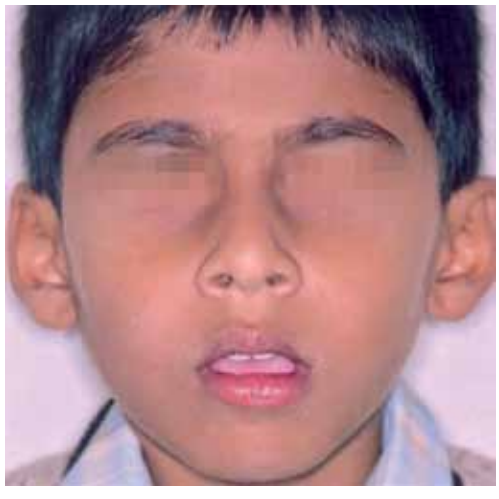

Fig. 2: Adenoid facies

- Effect on occlusion of teeth[1,12]
  1. Proclination of anteriors justified by interposition of the hypertonic lower lip between maxillary and mandibular incisors provoking labioversion of the maxillary incisors. Koski reported that the mandibular incisors presented retroclination in relation to the mandibular plane in patients with hypertrophic adenoid.[5]
  2. Distal relation of mandible to maxilla
  3. Lower anteriors supraerupt to touch the palatal tissues.
  4. Posterior crossbite
  5. Anterior open bite[13,14]

The maxilla and mandible were more retrognathic in the mouth breathing group. The maxillae were more retrognathic owing to upper airway obstruction resulting from the hypoplasia of the maxillary sinus and narrowing of the nasal cavities. Narrow palatal and cranial widths are also associated. This is due to the low set position of the tongue in order to allow an adequate inflow of air through the mouth. Thus, an imbalance of forces exerted by the tongue and facial musculature on the maxilla leads to a constricted maxillary arch. There may be flaring of incisors and a decrease in the vertical overlap of the anterior teeth[2,3,15-17] (Fig. 3).

- *Effect on gingiva[1]:* Gingival tissues: Constant wetting and drying of the gingiva causes irritation, saliva about the exposed gingiva tends to accumulate debris resulting in an increase in bacterial population.
  1. Hypertrophic mouth breathing gingivitis
  2. Nonhypertrophic mouth breathing gingivitis.
- *Speech defects:* Abnormalities of the oral and nasal structures can seriously compromise speech performances. Nasal tone in voice is seen.[2]

  Effect on lip: These patients frequently have a lip apart posture, although the lip apart posture should not be regarded as pathognomonic for nasal obstruction. On smiling, many of these reveal large amounts of gingiva producing the 'gummy smile'. Children who mouth breathes have a short thick incompetent upper lip and a voluminous curled over lower lip[2] (Fig. 4).

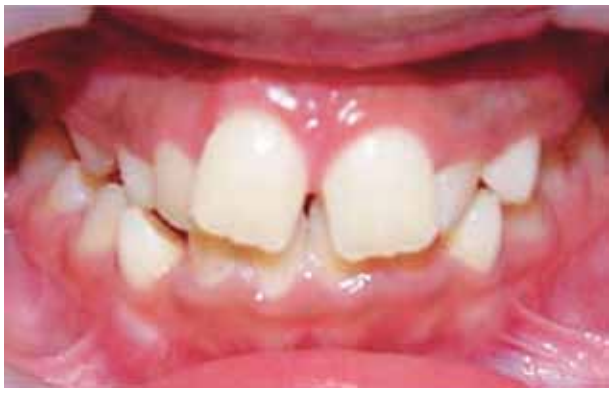

Fig. 3: Effects of mouth breathing on teeth

Fig. 4: Lip apart swallow

- *Effect on external nares:* Long-standing nasal airway obstruction can lead to a disuse atrophy of the lateral cartilage. The result is a slit-like external nares with a narrow nose.[2]
- *Other effects:* It may lead to otitis media. The palatoglossus muscle is active in the case of nose breathers, whereas the levator palatine activity is lower when nose breathing was compared with mouth breathing. There is also a dull sense of smell and loss of taste. The occurrence of halitosis was high among the children with mouth breathing. Mouth breathing irritates the mucosa, and these children often will have swollen tonsils and adenoids, one of the major causes of upper airway obstruction, sleep disorders and sleep apnea[13,15] (Fig. 5).

DIAGNOSIS OF MOUTH BREATHING

Diagnose the habit by looking for the following symptoms:

- Subjective symptoms
  1. *History:* A good history should be recorded from patients and parents also, as children may deny the habit.
  2. Clues about nasal stiffness, nasal discharge, sore throat, repeated attacks of cold.
  3. Posterior nasal defects.
- Objective symptoms
  1. Hoarseness of voice
  2. Malocclusion
  3. Restlessness at night, feeling thirsty
  4. Mouth breathing gingivitis
  5. Association with other habits.
- Methods of examination
  1. Observe the patient
     Mouth breathers: Lips will be apart
     Nasal breathes: Lips will be touching
- Ask the patient to take a deep breath through nose.

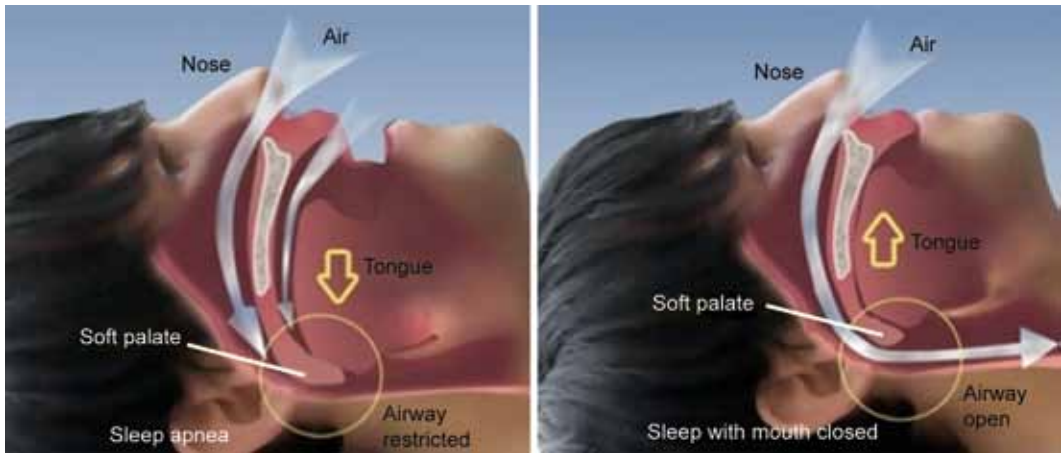

Fig. 5: Sleep apnea

Most mouth breathers respond to this request by inspiring through the mouth. The nose does not change the size or shape of external nares occasionally contracts the nasal orifices while inspiring.

Clinical Tests[1,2]

- *Mirror test:* It is also called as Fog test. A double sided mirror is held between the nose and mouth. Fogging on the nasal side of the mirror indicates nasal breathing while fogging on oral side—mouth breathing.
- *Massler's water holding test:*[1,18] Patient is asked to hold the mouth full of water. Mouth breathers cannot retain the water for a long time.
- *Massler and Zwemer butterfly test/Cotton test:*[1,18] Butterfly shaped cotton strands are placed over the upper lip below nostrils. On exhalation if the fibers of the cotton flutter downwards patient is nasal breather and if fibers flutter upward he is a mouth breather.
- *Inductive plethysmography (Rhinometry):*[1,18] The total airflow through the nose and mouth can be quantified using inductive plethysmography, the only reliable way. This allows the percentage of nasal and oral respiration to be calculated. A minority of the long face children had less than 40% nasal breathing. Nasal air flow characteristics are studied by using devices consisting of flow meters and pressure gauges.

One cross-sectional study used the plethysmograph on normal children and reported:

Prior to age 8—there were as many oral or predominantly oral breathers as nasal or predominantly nasal breathers.

After age 8—the majority of the children were nasal or predominantly nasal breathers (Warren et al, 1990).

Cephalometrics[1,2]*:* Can be used to calculate amount of nasopharyngeal space, size of adenoids and to know the skeletal patterns of the patient by taking various cephalometric angles.

TREATMENT CONSIDERATION

1. *Age of child:* Mouth breathing in many instances is self correcting after puberty. This can be attributed to the increase in nasal passages as the child grows, thereby relieving the obstruction caused due to enlarged adenoids.
2. *ENT examination:* An otorhinolaryngologist examination may be advised to determine whether conditions requiring treatment are present in the tonsils, adenoids or nasal septum. If habit continues after removal of cause then it is habitual.
3. *Prevention and interception:* Mouth breathing can be intercepted by use of an oral screen.[1,2]

TREATMENT OF MOUTH BREATHING

Treatment according to symptoms: Gingiva of the mouth breathers should be restored to normal health by coating the gingiva with petroleum jelly.

It may be divided under three main factors:

1. *Remove the cause:* Etiological agents should be treated first. Removal of nasal or pharyngeal obstruction by surgery or local medication should be sought. If a respiratory allergy is present, it should be brought under control.

   Rapid maxillary expansion has been reported to reduce the rapid maxillary expansion.
2. *Intercept the habit:* If the habit continues even after the removal of the obstruction then it should be corrected. Methods of correction:
   a. *Exercises:*[1,2,19]
      - During day time—hold pencil between the lips.
      - During night time—tape the lips together with surgical tape in habitual mouth breathing.

- Hold a sheet of paper between the lips.
- Piece of card 1 × 1½" held between the lips.
- *Patients with short hypotonic upper lip:* Stretch the upper lip to maintain lip seal or stretch in downward direction toward the chin.
- *Button pull exercise:* A button of 1½" diameter is taken and a thread is passed through the button hold. The patient is asked to place the button behind the lip and pull the thread, while restricting it from being pulled out by using lip pressure.
- *Tug of war exercise:* This involves two buttons, with one placed behind the lips while the other button is held by another person to pull the thread. Blow under the upper lip and hold under tension to a slow count of 4 repeat 25 times a day. Draw upper lip over the upper incisors and hold under tension for a count of 10.

b. *Maxillothorax myotherapy:*[1,2] This was advocated by Macaray 1960. These expanding exercises are used in conjunction with the Macaray activator. Macaray constructed an activator out of aluminum with which development of the dental arches and dental base relationship could be corrected at the same time as encouraging mouth breathing. The mouth breather holds the activator in the mouth and at the same time with the left and right arms alternately carries out 10 exercises 3 times a day.

c. Oral screen[1-3,20-22]
   - First introduced by Newell in 1912.
   - It is a myofunctional appliance that is easy to fabricate and easy to wear.

DEFINITION

- *Graber:*[22] An appliance that utilizes the musculature to control abnormal muscle habits and aids in correction of the developing malocclusion.
- *C Phillip Adams:*[12] A removable appliance, used to deflect or eliminate muscle forces on certain teeth. Commonly placed in the vestibule between the lips, cheeks and the teeth.

PRINCIPLE

It is a functional appliance by virtue of the fact that it produces its effects redirecting the pressures of the muscular and soft-tissue curtain of the cheeks and lips. It works on the principle of both force application and force elimination. For example anterior teeth proclination can be corrected utilizing the principle of force application. The screen comes in contact with the proclined teeth so that the forces from the lips are transmitted directly to the proclined teeth through the screen. Posterior cross bite can be corrected utilizing the principle of force elimination by providing a spacer between the teeth and the screen.[20,21]

INDICATIONS

1. Habit-correcting appliance
2. It helps retrain and strengthen lip action
3. Lip exercises are possible with oral screen, which improves the tonicity of the lips.
4. To correct simple labioversion of the maxillary anterior teeth.

CONTRAINDICATION

It should not be used if the child has nasorespiratory distress or a nasal obstruction.[22]

CONSTRUCTION[12,20,21]

Upper and lower impressions are made must reproduce the full depth of the labial sulcus and casts are prepared. The casts are occluded and sealed. Posteriorly, the appliance will extend up to the distal margin of the last erupted teeth. The upper and lower borders will extend to the full depth of the sulcus.

Rapid maxillary expansion (RME):[1,23,24] Patients with narrow, constricted maxillary arches benefit from RME procedures aimed at widening of the arch. It increases nasal air flow and decrease nasal air resistance. Increase in intranasal space occurs due to outer walls of nasal cavity moving apart.

3. Correction of malocclusion[1,2,25-30]
   a. Children with class I skeletal and dental occlusion and anterior spacing—oral shield appliance
   b. Class II division 1 without crowding, age 5 to 9 years, monobloc activator both to correct malocclusion and deterrence of habit.
   c. Class III malocclusion: interceptive methods are recommended as chin cap.

DISCUSSION

Mouth breathing habit was the second most prevalent habit in the study conducted by Deepak P Bhayya and Tarulatha R Shyagali[31] with the incidence rate of 17%. This incidence was higher when compared to the findings of the previous studies. Amr Abou-EI-Ezz et al, in their study on prevalence of mouth breathing habit and its probability as etiological factor of malocclusion have concluded that malocclusion is highly associated with habits existence and this relationship is statistically highly significant ($p < 0.001$). Motta LJ[17] finds out that

there were a significantly greater number of boys with the mouth breathing pattern than girls.

Malhotra S et al[18] finds out that children who breathe predominantly through their mouth pose difficult problems for healthcare professionals. The dental professional apprehend that faces of the mouth breathers might develop aberrantly, possibly because of disruption of normal functional relationships caused by chronic airway obstruction and altered path of airway. Oral respiration, low tongue posture and elongation of lower anterior facial height are apparent at 3 years of age but more commonly detected after age five. The deleterious impact of decreased nasorespiratory function is virtually complete by puberty. In their study, an increase in gonial angle in mouth breathers was found and which was statistically significant. Bresolin et al[15] and results of Ung et al[19] confirms the finding of their study. According to Corruccini et al,[14] crossbite is prevalent in mouth breathers which are in agreement with Bresolin et al.[15] This conclusion should be treated with some caution, as the difference was statistically significant only in the rural sample where mouth breathing was infrequent.

There is some evidence that OS (oral screen) effects on incisor position may be due to only mechanical pressure on the upper incisors (Knosel M et al[20] and Owman-Moll and Ingervall).[21] However in many cases, assumed to be induced by hypotonic mimic muscles and stopped by subsequent open mouth situations, implicating low-negative intraoral pressure at the level of environmental atmospheric pressure, it may be postulated that orthodontic strategies should also address the normalization of these factors.

CONCLUSION

Many habits may be considered normal for a certain stage of the child's development. If parents are aware of normal and can differentiate between normal and abnormal for that age group, and have clear mind set regarding the cause and effect of particular habit, the situation can be dealt in better way. If the habit is causing a malocclusion or other pathologic process, it is the privilege and responsibility of the dentist to work with the child and parent's toward a resolution of the problem. So that dental care can be provided to the child timely. Habit can be intercepted before child needs to undergo corrective treatment.

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CASE SERIES

Middle Mesial Canal: A Common Finding—A Report of Three Cases

[1]Swati Bhosale, [2]Akilan Balasubramanian, [3]Rameshkumar Maroli, [4]S Jayasree

ABSTRACT

Aims and objectives: To present clinical case report of three mandibular first molar with middle mesial canal of independent and confluent type.

Case Report: Three patients with chief complaint in mandibular first molars were referred for endodontic treatment. All the three mandibular first molar showed presence of middle mesial canal and, in one case, extra root was observed. With aid of proper diagnostic and radiographic techniques, the endodontic treatment was performed.

Conclusion: Good knowledge of the potential aberrant canal morphology in mandibular molar will help clinician to successfully recognize and treat these difficult cases. Morphological variations in root canal system anatomy should always be considered at the beginning of treatment. Once endodontic treatment has been initiated, proper access cavity preparation is a basic prerequisite for the investigation and successful detection of all root canal orifices. Every effort should be made to find and treat all canals for successful clinical results. Better illumination and magnification under microscope help in locating hidden canals.

Keywords: Middle mesial canal, Mandibular first molar, Dental operating microscope.

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INTRODUCTION

Endodontic success depends on adequate canal debridement and complete filling of the canal. Studies have shown that main reason for the failure of endodontic treatment in case of molars is the missed canals.[1] Canals are missed either due to lack of knowledge or failure to identify and skill to negotiate it. To have proper cleaning and shaping of canals, every clinician should have thorough knowledge of root, and root canal anatomy is necessary. Mandibular first molar is found to have many anatomical variations, like multiple canals in both mesial and distal root, extra root as in radix entomolaris, radix paramolaris, C-shaped canal anatomy, etc.

Third canal in the mesial root of mandibular first molar is middle mesial (MM) canal similarly in distal root it is middle distal canal. Incidence of middle mesial canal is 1 to 15%.[2] Since Vertucci and Williams[3] first reported the presence of a MM canal in a mandibular molar, there have been multiple case reports of aberrant canal morphology in the mesial root.[4,5] In a clinical evaluation of 100 mandibular molars, Pomeranz et al[6] found that 12 molars had MM canals in their mesial roots and classified them into three morphologic categories as follows: fin, confluent and independent. According to their classification, an independent canal implies the canal originated as a separate orifice and terminated as a separate foramen, and only two cases were identified as independent. Goel et al[2] reported mandibular first molars had MM canals in 15.0% of specimens. Among these MM canals, only 6.7% of MM canals were independent.

This paper reviews the endodontic management of three cases, of a mandibular first molar with three mesial canals in the mesial root.

CASE REPORTS

Case 1

A 18-year-old female patient was referred to the department of endodontics with the chief complaint of intermittent pain in the lower right back teeth since last 4 to 5 months. Medical history was noncontributory. Clinical examination revealed a deep secondary caries in right mandibular first molar. The clinical and radiographic findings led to a diagnosis of chronic irreversible pulpitis of the right mandibular first molar, necessitating endodontic therapy. Radiographic evaluation of the involved tooth indicated a deep, carious lesion under temporary restoration approximating the pulp with apparently normal periapex (Fig. 1A). Under local anesthesia using 2% lignocaine with 1:80,000 adrenaline (Lignox, Indoco Remedies Ltd, India). An endodontic access cavity was established with rubber dam isolation. Investigation of

[1,2]Junior Resident, [3]Professor and Head
[4]Associate Professor

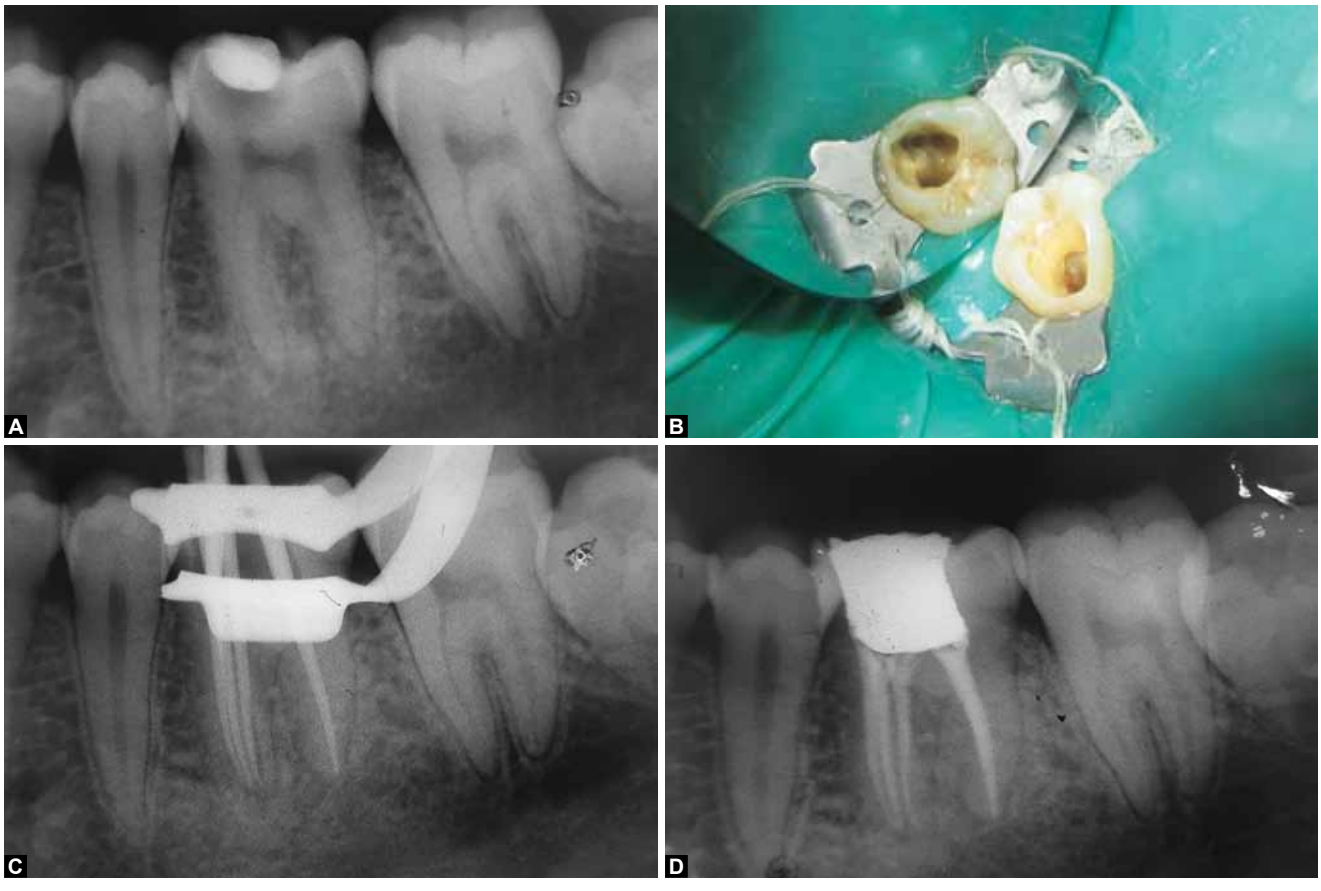
[1-4]Department of Conservative Dentistry and Endodontics Government Dental College, Calicut, Kerala, India

Corresponding Author: Swati Bhosale, Junior Resident Department of Conservative Dentistry and Endodontics Government Dental College, Calicut, Kerala, India, Phone: 024-45252085, e-mail: astitwaswati@gmail.com

the root canal system was initially performed with the aid of an endodontic explorer, and the canals were explored with a no. 10 Kfile (Mani Inc, Tochigi, Japan), two canals mesially and single canal distally were located initially. Access cavity is observed under microscope (Seiler Precision Microscope) and presence of third mesial canal was detected in between the two mesial canals (mesiobuccal, middle mesial and mesiolingual) (Fig. 1B). The additional canal was explored with a no. 10 K-file (Mani Inc, Tochigi, Japan). Individual canal instrumentation was performed using a crown down preparation with ProTaper nickel-titanium (NiTi) rotary instruments (Maillefer, Dentsply, Ballaigues, Switzerland). Copious chemical irrigation was performed with 5.25% sodium hypochlorite solution and EDTA (Glyde, Maillefer, Dentsply, Ballaigues, Switzerland). The root canals were dried with paper points (Maillefer, Dentsply, Ballaigues, Switzerland). $Ca(OH)_2$ is placed as an intracanal medicament. Master cone radiograph was taken (Fig. 1C) Obturation was performed after 2 weeks with resin sealer (AH plus, Dentsply, DeTrey Konstanz, Germany) and cold lateral condensation of gutta-percha (Maillefer, Dentsply, Tulsa, OK) and access is sealed with permanent restoration. Postobturation radiograph revealed three distinct orifices with three separate apical terminations of mesial canals (Fig. 1D). So, it was a case of independent middle mesial canal (Pomeranz's classification).

Case 2

A 16-year-old male patient reported with spontaneous pain in lower left back tooth indicative of chronic irreversible pulpitis with left mandibular first molar. Radiographic examination showed deep carious lesion approaching pulp with apparently normal periapical tissus and extra distal root (Figs 2A and B). After anesthesia and rubber dam placement, access cavity was prepared. Totally five distinct orifices-3 located mesially (mesiobuccal, middle mesial and mesiolingual) and two distally (distobuccal and distolingual) was detected (Fig. 2C). The canals were explored with no. 10 K-file (Mani, Inc, Tochigi, Japan). The working length radiograph confirmed the presence of 5 distinct orifices and four apical terminations (Fig. 2D). Chemomechanical preparation was performed using the ProTaper NiTi rotary files and the root canals were obturated with cold, laterally condensed gutta-percha (Maillefer, Dentsply, Ballaigues, Switzerland) and resin sealer (AH plus sealer-Maillefer, Dentsply, Ballaigues, Switzerland) after confinning

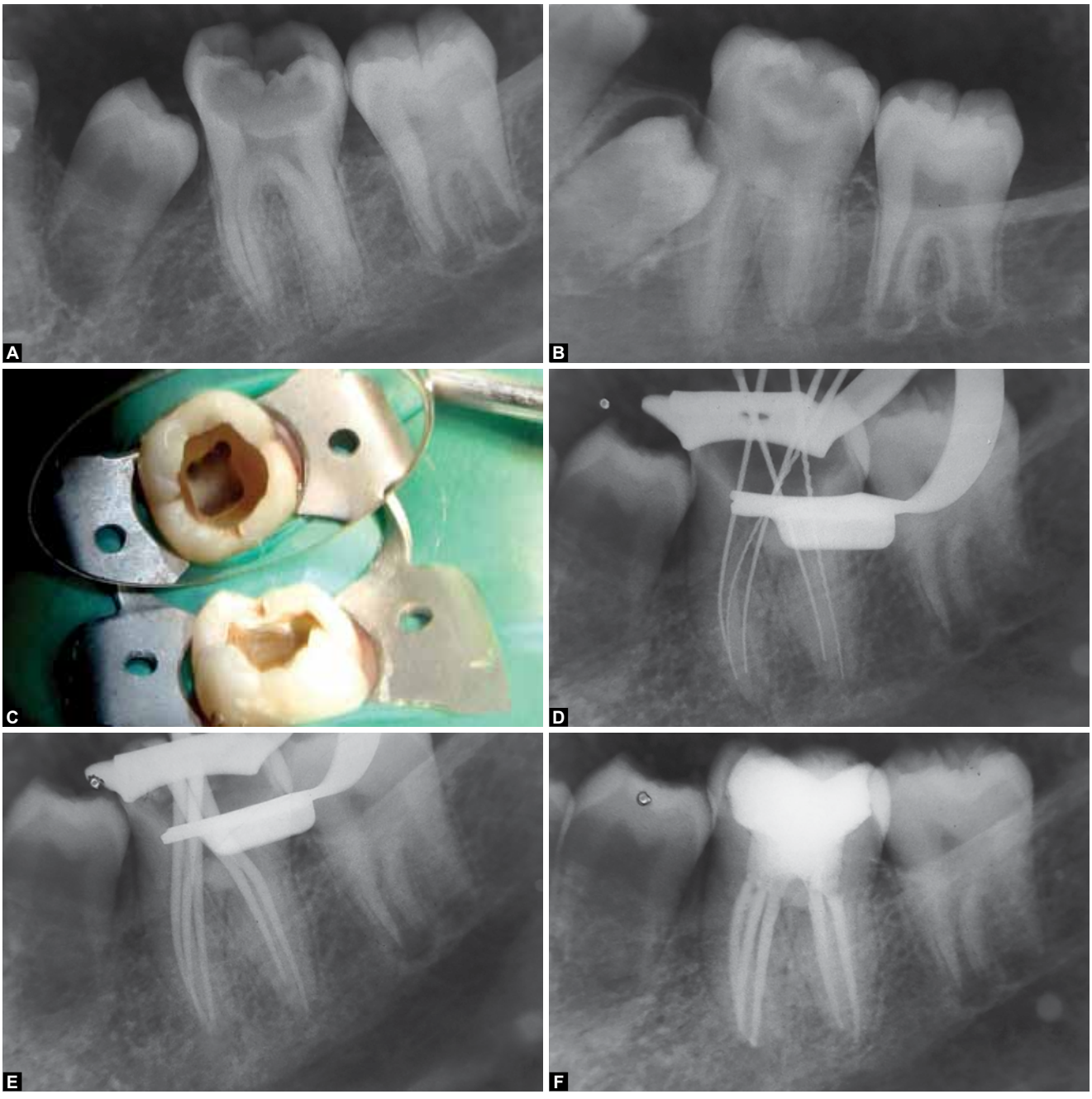


Figs 1A to D: (A) Preoperative intraoral periapical (IOPA) of 46 showing carious lesion approaching to pulp, (B) clinical photograph showing three canals in mesial root of right mandibular first molar, (C) master cone X-ray revealing independent type of middle mesial canal and (D) postobturation IOPA

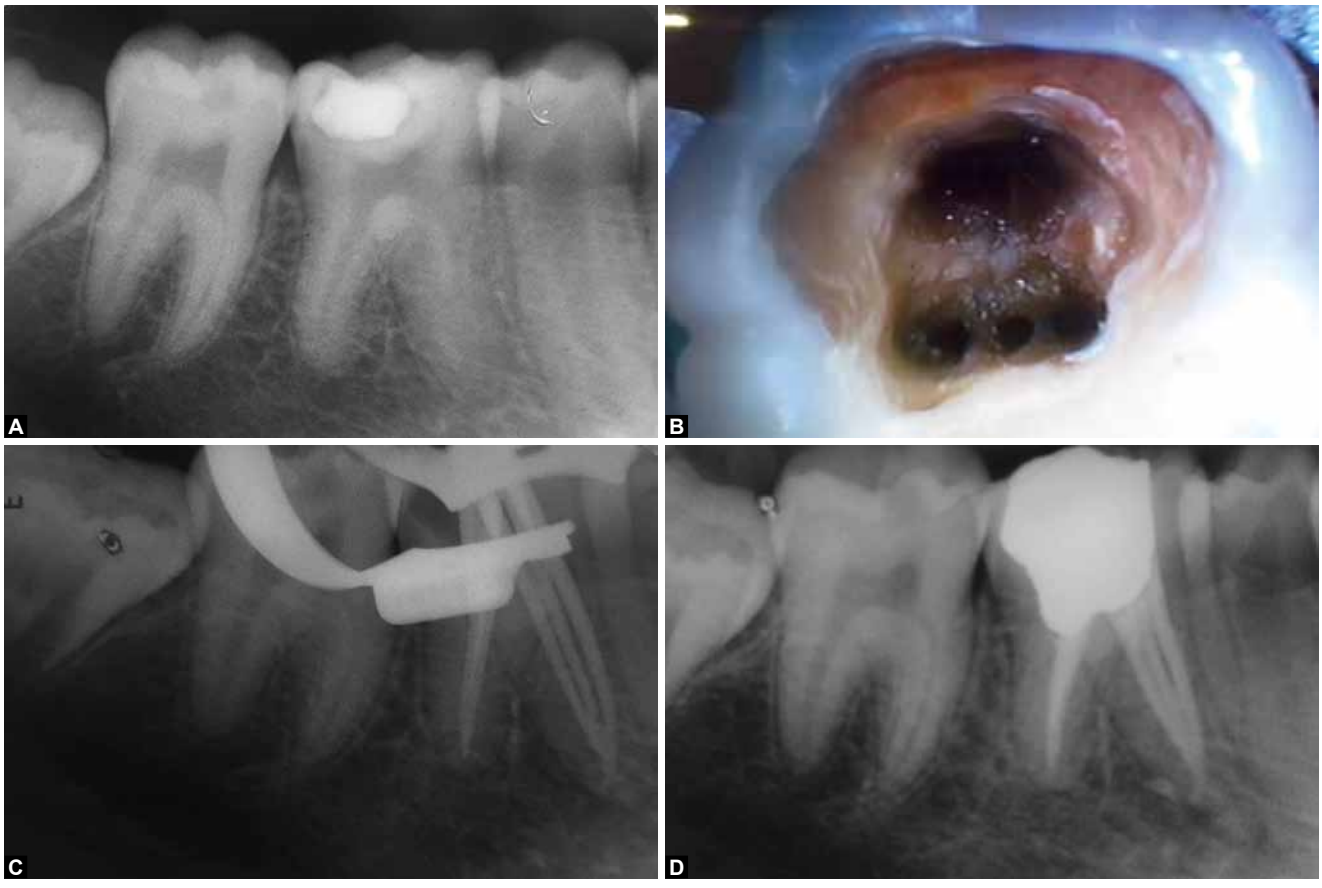
with master cone radiograph (Fig. 2E). Postobturation radiograph revealed the presence of confluent middle mesial canal originated as a separate orifice but joined in the apical third of the mesiobuccal canal and an extra distal root suggesting radix endomolaris (Fig. 2F).

Case 3

A 14-year-old male patient reported with spontaneous pain in lower right back tooth. Endodontic treatment was planned due to irreversible pulpitis (Fig. 3A). After anesthesia and rubber dam placement, access cavity was prepared and pulp tissue was removed. Totally four distinct orifices-3 located mesially (mesiobuccal, middle mesial, and mesiolingual) and one distally were detected on inspection using operating microscope (Fig. 3B). The working length radiograph confirmed the presence of four canals and mesial canals joined in the apical third to exit as one. Chemomechanical preparation was performed using rotary ProTaper files and obturated with cold, laterally condensed gutta-percha (Maillefer, Dentsply, Ballaigues, Switzerland) and resin sealer (AH plus, Maillefer, Dentsply, Ballaigues, Switzerland) (Fig. 3C). Postobturation radiograph revealed confluent middle mesial canal (Fig. 3D).



2A to F: (A and B) Preoperative IOPA showing carious lesion approaching to pulp and presence of additional distal root, (C) clinical photograph shows existence of five root canal orifices, (D) working length IOPA revealed five canals with three canals in mesial root, (E) master cone IOPA and (F) postobturation IOPA with confluent type of middle mesial canal



Figs 3A to D: (A) Preoperative IOPA, (B) access cavity as seen under microscope shows three orifices in mesial root of mandibular right first molar, (C) master cone IOPA and (D) confluent type of middle mesial canal as seen in postobturation IOPA

DISCUSSION

Several studies report anatomical variation in the mandibular first molar including the presence of middle mesial canal in mesial root. Fabra[7] in his study on 760 mandibular molars reported that (2.6%) had three canals in the mesial root. Among those in (65%) cases, the third canal joined the mesiobuccal canal in the apical third of the root and, in (30%), they converged with the mesiolingual canal, also in the apical third; the third canal ended as an independent canal in only one case. Walker[8] cites three canals in the mesial root of the mandibular first molars as an infrequent occurrence. While a third canal in the mesial root of mandibular first molars may not be a very frequent discovery, a review of the literature indicates that its prevalence is 0 to 15%.[9,10]

Preoperative radiographic analysis is critical for endodontics. Multiple angled periapical views help to reveal the presence of roots and canal systems. However, these may be of little value in the identification of a mid mesial canal system in a mandibular molar. The use of ultrasonic tips with their abrasive coatings helps to remove dentin conservatively. The working end of these tips are 10 times smaller than the smallest round bur and consequently they can be introduced into the wall/floor angles of the pulp chamber to look for hidden systems.[11]

The use of such tips eliminates the bulky heads of conventional handpieces which often obstruct vision and allows this 'chasing' to be carried out under direct vision. Any instrumentation on the floor of the pulp chamber should only be carried out under direct vision because of the risk of perforation.

The classical 'white line' between the mesiobuccal and mesiolingual orifices should invite further exploration in this area. This area can be chased and subsequently explored with small hand files for a 'catch'. Illumination and magnification will play a huge role in the identification of this anatomical feature if present. It can be found anywhere in the pulp chamber wall/floor fold between the mesiobuccal canal and the mesiolingual canal orifices. The use of dental operating microscope provides enhanced lighting and visibility and identifies subtle color changes, better understanding of floor map, fine instrumentation, coaxial illumination and magni-fication.[12,13]

Pomeranz et al[6] classified middle mesial canal into three morphologic categories as fin, confluent and independent. According to their classification, an independent canal implies the canal originated as a separate orifice and terminated as a separate foramen and is usually rare. In present case series, case 1 has independent type of middle mesial canal, whereas in other two cases it is confluent.

The preparation of this accessory canal system should be done cautiously and conservatively. The geometry of the mesial root shows it to be hourglass shaped and so a preparation in the mid section of the root is automatically closer to the danger zone increasing the possibility of a perforation. Difficulties in cleaning and shaping the mesial root canal system during conventional root canal treatment can result in failure. The highly variable anatomy of mandibular molars indicates the need for careful examination of the root anatomy to find every pathway and its possible portal of exit in this complicated system.

Failure to recognise the anatomy of a root canal system and developmental anomalies might lead to inadequate debridement of the root canal system and thus contribute to unfavorable endodontic treatment outcome and the subsequent need for retreatment or surgical intervention.[11]

CONCLUSION

The presence of the mid-mesial canal in the mesial root of the mandibular first molar is reported to have an incidence of one to 15%. This canal may be located anywhere between the mesiobuccal and mesiolingual orifices. The canal itself may be independent with a separate foramen or may join apically with either the mesiobuccal or mesiolingual canals. Canal preparation is a key factor in endodontic success. The clinician should be aware of the possibility of a mid-mesial canal and should explore for its presence rather than leave it to chance.

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CASE REPORT

Management of Extended Orbital Exenteration using Spectacle retained Orbitofacial Prosthesis

[1]KV Arun Kumar, [2]NK Sahoo, [3]Dinesh Kumar, [4]Virender Singh Legha

ABSTRACT

Restoration of facial defects is a challenge for both reconstructive surgeon and prosthodontist. There should be collective efforts from the restorative team involved in rehabilitation of the lost tissue to best of the form and esthetics. Orbitofacial defects warrant early and effective treatment protocol to allow incapacitated patients some level of social acceptance. A removable maxillofacial prosthesis which is closely adapted, well retained and with good color match is easily accepted by the patient. Retention of the orbitofacial prosthesis is achieved using various means, like implants, tissue undercuts, adhesives, magnets. A material chosen should be easy to manipulate and compatible to different retentive aids employed. This paper presents rehabilitation of extended orbital exenteration defect with spectacle retained orbitofacial prosthesis.

Keywords: Exenteration, Prosthesis, Orbitofacial, Rehabilitation.

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INTRODUCTION

Disfiguring wounds resultant to removal of orbital tumors often lead to psychological trauma to the patient. Large facial defects have limited means of anatomical retention but high expectation of esthetics.[1] Providing protection to the vital deeper structures and maintaining the form and esthetics is a greatest challenge in prosthetic rehabilitation of midfacial defects. When restoring lost orbital and surrounding facial structure, orientation of ocular component, shade matching plays a crucial role in the best outcome of the prosthesis. Retention of the facial prosthesis plays a vital role in the success of treatment. A well-retained and indiscernible prosthesis allows the patient to be accepted in society without being a victim of unwanted empathy.

[1,4]Reader and Instructor, [2]Professor and Head
[3]Assistant Professor

[1-4]Department of Dental Surgery, Armed Forces Medical College Pune, Maharashtra, India

Corresponding Author: KV Arun Kumar, Reader and Instructor, Department of Dental Surgery, Armed Forces Medical College, Pune, Maharashtra, India, Phone: 02026332931, e-mail: prarun2009@gmail.com

CASE REPORT

A 43-year-old male patient was referred to outpatient department for the prosthetic rehabilitation of orbitofacial defect on right side. His medical documents revealed that the patient had undergone orbital exenteration along with wide local excision including removal of eye lids for the management of sebaceous cell carcinoma of right eye. Craniotomy of right parental region was also been done. Adjuvant chemoradiation therapy was not given. Three months postsurgery, patient was referred to the division of prosthodontics for rehabilitation. Clinical examination revealed completely healed extended orbital exenteration of right orbit (Fig. 1).

Various treatment modalities were discussed with patient as well as the ophthalmologist. After weighing the pros and cons of different materials and techniques a treatment plan was formulated to fabricate orbitofacial prosthesis using heat-cured polymethyl methacrylate (PMMA) resin retained by the spectacles.

Impression of the defect along with the contralateral eye and surrounding structures was made using irreversible hydrocolloid material along with the type 1 impression compound acting as the tray (Fig. 2). Impression was poured using type 3 gypsum, and cast was retrieved. Wax pattern of the future prosthesis was

Fig. 1: Preoperative photograph of the patient

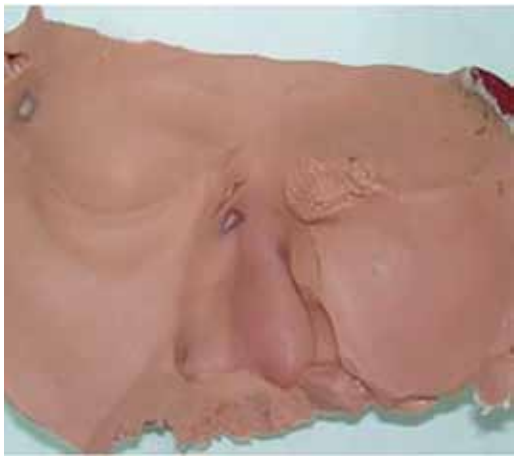

Fig. 2: Impression retrieved

prepared sculpting the anatomy of orbitofacial area using contralateral nondefect side as a guide. Pre-fabricated acrylic eye shell was selected after matching the color, size and shape of the unaffected eye. Selected eyeshell was incorporated into the wax pattern. Trial of the wax pattern and necessary corrections were done (Fig. 3). Thin polymerized acrylic sticks were attached to the corner of the eye shell to prevent its movement during dewaxing and PMMA resin packing. The wax pattern was flasked and dewaxed to prepare the mold. Intrinsic stains were added to heat cure PMMA resin mix to closely match the patient's skin.

The prosthesis was acrylized and finished. Extrinsic stains were used to match patient's skin. Eyelashes were created using patient's own hair and incorporated onto the prosthesis using cyanoacrylate resin. A properly fitting spectacle was selected. The prosthesis was attached to the rim of the spectacle using autopolymerizing resin (Fig. 4). The completed prosthesis was inserted (Fig. 5). The patient was instructed about the home care and maintenance of the prosthesis. Recall visits were scheduled every week for a month and subsequently once a quarter. NCCN protocol was followed during recall management.

DISCUSSION

Orbital exenteration is a surgical technique in which the orbital content (eye, adnexa and part of the bony orbit) is removed, to manage large orbital tumors. Bartisch G[2] a German Physician first described this procedure in 1583. This technique is generally reserved to life-threatening malignancies which are unresponsive to more conservative treatment modalities.[3] In extended exenteration, excision of adjacent tissues is performed in achieving complete excision of the tumor with healthy tissue margins.[4] For many facial defects, surgical reconstruction is the most natural way to restore appearance and normal function. However, surgical reconstruction is not always possible. Orbital prosthesis presents an attractive and possible alternative when esthetic and functional requirements are beyond the capacity of local reconstructive efforts.[5] Prosthetic rehabilitation of orbital exenteration involving eye lids and facial structures are done by selecting suitable reconstructive material and retentive aid. Frequent clinical examination of the exenterated wound would be necessary to evaluate the recurrence of the malignancy. Hence in the present case, easily removable maxillofacial prosthesis which can be firmly attached to spectacle frame was devised. Orbital prosthesis can also be retained in tissue under cuts, by use of medical grade adhesive and osseointegrated orbital implants.[6] Use of maxillofacial implants may not be a first option in the radical surgeries involving malignant tumors. In the present case, implants were not considered because lateral and supraorbital ridge was surgical removed.

Polymethyl methacrylate resins are one of the oldest materials used in the fabrication of facial prosthesis. They are used because they are durable, color stable, have good edge strength, economical, easily stained extrinsically or intrinsically, and can be firmly attached to mechanical aid like optical frames, but the disadvantage includes rigidity and water sorption. Medical grade

Fig. 3: Wax pattern try in

Fig. 4: Completed prosthesis

Fig. 5: Prosthesis *in situ*

silicone is another material frequently used for extraoral prostheses as it is biologically inert and has life-like appearance[7] but their disadvantages include the need of sophisticated equipments, poor edge strength as well as color deterioration on exposure to sunlight.[8] The spectacle used helped in retaining and camouflage the prosthesis.

Home care of the prosthesis includes washing the tissue surface of the prosthesis with mild soap and water twice a day. The prosthesis needs to be removed at night and a soft sterile dressing pad retained around the defect with adhesive tapes are used to cover the defect.

CONCLUSION

Extended orbital exenteration was managed with spectacle retained orbitofacial prosthesis. Prosthetic rehabilitation is preferred treatment modality for orbital defects. An early, well-retained prosthesis with good esthetics would uplift the psychosocial well-being of the patient.

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CASE REPORT

An Unusually Large Submandibular Salivary Stone

[1]Sushma Pandey, [2]Sushil Subedi, [3]Rohit Gadda

ABSTRACT

Sialolithiasis is a condition where a calcified mass forms within a salivary gland, most commonly in the duct of the submandibular gland. Commonly sialoliths measure from 5 to 10 mm in size and stones over 10 mm can be reported as sialoliths of unusual size. They rarely measure more than 15 mm. Reported here is a case of large submandibular sialolith which was diagnosed clinically and radiographically and treated with no postoperative complications.

Keywords: Submandibular gland, Sialolithiasis, Calculi, Stones.

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INTRODUCTION

Sialoliths are calcareous concretions that may be found in the ducts of the major or minor salivary glands or within the glands themselves. They are thought to form by deposition of calcium salts around a central nidus which may consist of desquamated epithelial cells, bacteria, products of bacterial decomposition or foreign bodies.[1] Sialolithiasis is the most common (50%) disease of salivary glands. Its estimated frequency is 1.2% in the adult population every year, with a slight male predominance (2:1).[3] Most salivary calculi occur in the submandibular gland (80-95%), whereas 5 to 20% occur in the parotid gland. The sublingual gland and minor salivary glands are rarely (1-2%) affected.[2] Salivary calculi are usually unilateral. Clinically, they are round or ovoid, rough or smooth with yellow in color.[2] About 40% of parotid and 20% of submandibular stones are not radiopaque, and sialography or other imaging techniques (computed tomography scan, ultrasound) may be required to locate them.[4] Commonly, sialoliths measure from 5 to 10 mm in size and stones over 10 mm can be reported as sialoliths of unusual size. They rarely measure more than 15 mm.

CASE REPORT

A 17-year-old female residing in Chitwan, reported with a complaint of a pain and swelling in the posterior part of left side of the floor of the mouth for a duration of 2 months. There were episodes of pain in the same region for last 2 years but of a moderate variety that the patient could tolerate. Her pain was intermittent, pricking type and sharp in nature and it was radiating to the tongue. The pain was aggravated during eating and relieved at rest. Swelling was gradual in onset, progressed to the presented size. There were occasions of increase in swelling during meals for the last 6 months, which the patient had been ignoring. There was no associated history of fever, malaise, weight loss, anorexia or burning sensation in the oral cavity. Her family history was non-contributory. On general examination, she appeared to be in a good overall systemic health. Extraoral examination findings were not contributory. Intraoral examination showed inflammation and sinus opening over the left floor of the mouth in the posterior aspect (Fig. 1) with absent of salivary flow from the left Wharton's duct orifice. However, no pus discharge was detected from the duct orifice. The left submandibular gland was tender on bimanual palpation. Interestingly, it also revealed yellowish mass coming out from the sinus on applying upward pressure during palpation.

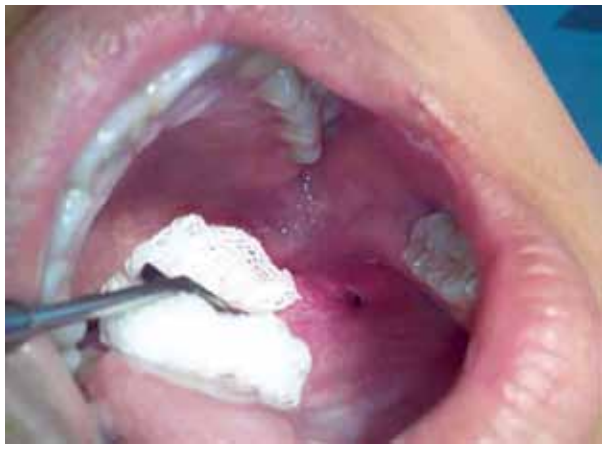

Fig. 1: Inflammation and sinus opening over the left floor of the mouth in the posterior aspect

[1-3]Assistant Professor

[1]Department of Oral Medicine and Radiology, Chitwan Medical College, Bharatpur, Chitwan, Nepal

[2]Department of Oral and Maxillofacial Surgery, Chitwan Medical College, Bharatpur, Chitwan, Nepal

[3]Department of Oral Medicine and Radiology, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Sushma Pandey, Assistant Professor Department of Oral Medicine and Radiology, Chitwan Medical College, Bharatpur, Chitwan, Nepal, Phone: 97714411393 e-mail: pandeysusma@gmail.com

A lower occlusal radiograph was advised but because of posteriorly placed lesion, nothing could be seen. Hence, CT scan was advised, and it showed a calcified lesion in left submandibular gland, measuring approximately 1.2 × 0.7 cm in size (Fig. 2). A diagnosis of left submandibular duct calculus was made and, at a subsequent appointment, it was removed under local anesthesia with sharp dissection. It was measured to be 15 mm long along its greatest length (Fig. 3). Patient was reviewed 2 weeks postoperatively to check salivary function of the gland. Healing of the surgical wound and salivary flow was found normal, postoperatively.

DISCUSSION

Submandibular sialoliths measuring less than 10 mm in greatest dimension are very common but larger sialoliths are considerably less.[5] The ability of a calculus to grow and become a giant sialolith depends mainly on the reaction of the affected duct. If the duct adjacent to the sialolith is able to dilate, allowing nearly normal secretion of saliva around the stone, it might be asymptomatic for a long period and eventually a giant calculus will be created.[6] A sialo-oral fistula develops most likely when bacteria set up an acute exacerbation in the stagnating and retained saliva located behind the stone. The inflammatory debris obstructs the residual narrowed duct lumen, further exacerbating the inflammation. The resulting inflammatory process around a large stone may lead to tissue breakdown and spontaneous stone extrusion with intraoral fistula formation.

Careful history and examination are important in the diagnosis of sialolithiasis. Pain and swelling of the concerned gland at mealtimes and in response to other salivary stimuli are especially important. Bimanual palpation of the floor of the mouth, in a posterior to anterior direction, reveals a palpable stone in a large number of cases of submandibular calculi.

CONCLUSION

Submandibular sialoliths measuring less than 10 mm in greatest dimension are very common but larger sialoliths are considerably less. Moreover, some sialolithiasis are so posteriorly placed that CT images required than common conventional occlusal radiographs. Reported here is a case of submandibular sialolith which was diagnosed clinically and radiographically and treated surgically with no postoperative complications.

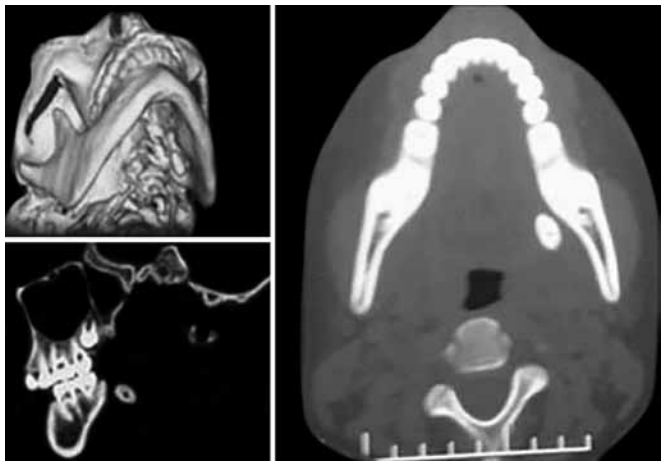

Fig. 2: CT scan images (axial, sagittal, 3D) showing a calcified lesion in left submandibular gland

Fig. 3: Sialolith with approximately 15 mm long along its greatest length

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CASE REPORT

Lingual Approach to Buccally Impacted Teeth

[1]Samay Mukesh Tahilramani, [2]Shashank Gaikwad, [3]Grish Karandikar, [4]VK Ravindranath

ABSTRACT

Orthodontic management of impacted teeth is one of the most challenging aspects in terms of diagnosis and treatment planning and execution. Treatment is usually prolonged in duration and often complicated by various local factors. This article describes a simplified method toward management of an impacted tooth through the medium of a case report. A patient reported with impacted maxillary canine and an impacted mandibular premolar, was treated orthodontically. The impacted premolar was aligned using a new approach through the modification of the lingual arch. This article describes the design, mechanism of action and the relative advantages and disadvantages of the technique used.

Keywords: Buccally impacted premolar, Lingual arch, Asymmetric malalignment.

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INTRODUCTION

The word impaction is from Latin origin—Impactus. Impaction is defined as the cessation of eruption of a tooth caused by a physical barrier or ectopic positioning of a tooth. An impacted tooth is one that is erupted, partially erupted or unerupted and will not eventually assume a normal arch relationship with the other teeth and tissues.[1]

Teeth can be impacted due to local, genetic and systemic causes.[2,3]

Local causes for impaction of teeth include lack of space due to over retained deciduous tooth, lack or space for eruption in the arch, irregular position of tooth and/or adjacent teeth, ankylosis of teeth or even soft-tissue interferences.[2]

Impaction of teeth, although not a very rare occurrence, is still perhaps one of the more challenging tasks for an orthodontist to treat efficiently.

[1]Postgraduate Student, [2]Senior Lecturer, [3]Professor [4]Professor and Head

[1-4]Department of Orthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Samay Mukesh Tahilramani, Postgraduate Student, Department of Orthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: 9833101316, e-mail: samaynhdc@gmail.com

Teeth that are more commonly involved in impaction are the permanent maxillary and mandibular third molars, the permanent maxillary canines and less frequently the premolars or the incisors.

Treatment of teeth that are impacted presents a completely different challenge to the orthodontists in terms of diagnosis, treatment planning as well as the mechanics involved.[4]

CASE REPORT

History

A 14-year-old patient reported with a chief complaint of incomplete eruption of a lower left tooth in the posterior region. There was no significant medical or dental history reported and the patient reported in good physical and mental health.

Diagnosis

A 14-year-old male patient with class I skeletal bases, average growth pattern, class I molar and canine relationship on the left side, end on molar relationship on the right side, over retained 53, overjet of 4 mm, overbite of 4 mm, palatally impacted 13 and buccally impacted 35 (Fig. 1).

Treatment Objectives

The treatment objectives included alignment of the impacted mandibular premolar and the maxillary canine and achieve a well-balanced functional occlusion.

Treatment Alternatives

The space and the cephalometric analysis of the case warranted a nonextraction therapy for both the arches. The impacted premolar could be aligned in a traditional manner by aligning the remaining teeth with a rectangular stainless steel wire in place and then bringing the impacted tooth into alignment.

Treatment Plan

Nonextraction treatment was planned, involving extraction of only the over retained deciduous tooth after the levelling and aligning of the maxillary arch as that would act as a natural space maintainer for the eruption of the palatally impacted tooth.

Fig. 1: Case MP: pretreatment photographs and radiographs

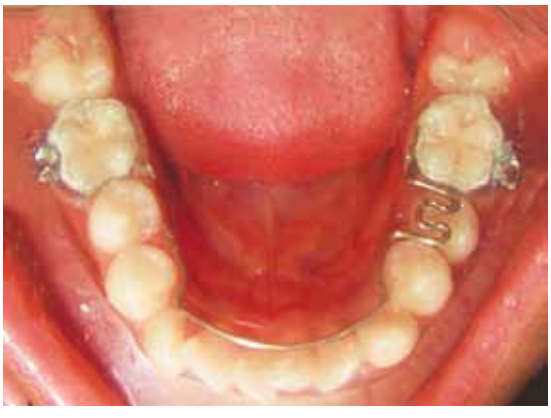

Fig. 2A: Modified lingual arch appliance design

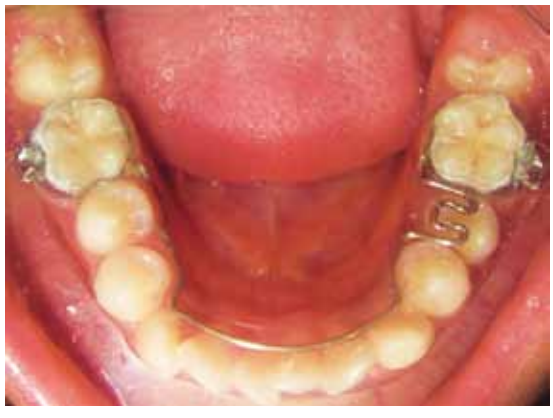

Fig. 2B: Modified lingual arch cemented intraorally

Treatment Progress

Fixed mechanotherapy using pre-adjusted edgewise appliance (PEA) with a 0.022" slot was planned for the patient. However, for the mandibular arch, the treatment was initiated for the impacted premolar (35) at the beginning itself using the modified lingual arch (Figs 2A and B).

A Begg's bracket was bonded to the impacted premolar and a force element was provided using 0.010" ligature that extended from the loops of the lingual arch to the vertical slot of the Begg's bracket (Fig. 3A). The buccal view of the premolar is seen after 10 days of application of the ligature (Fig. 3B).

Bonding of the maxillary and mandibular arches was done and 0.014" NiTi was placed. Note that the impacted premolar was not involved with the main arch wire (Figs 4A and B). The patient was recalled after a period of 3 weeks.

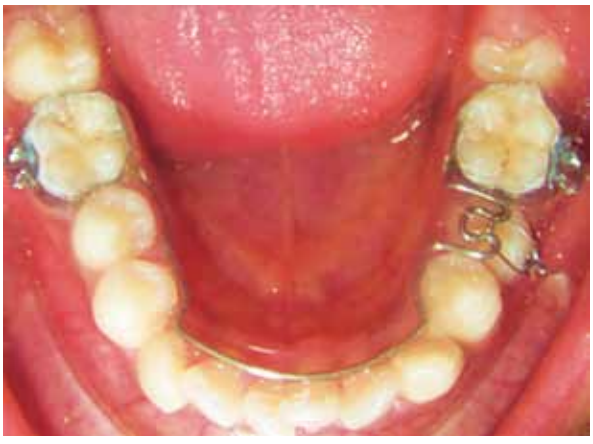

Fig. 3A: Begg's bracket bonded to 35 and traction using 0.010" ligature

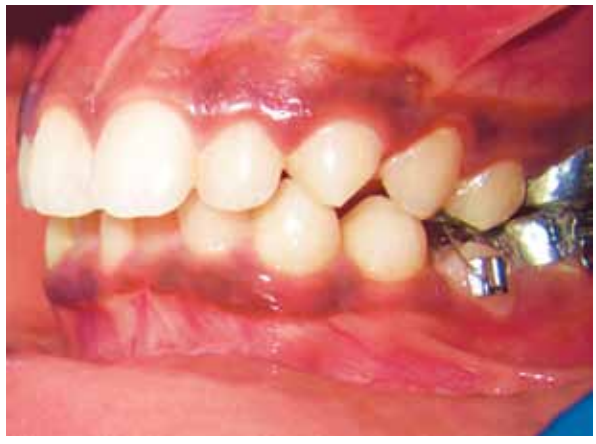

Fig. 3B: Buccal view of the premolar at the 10th day following ligature

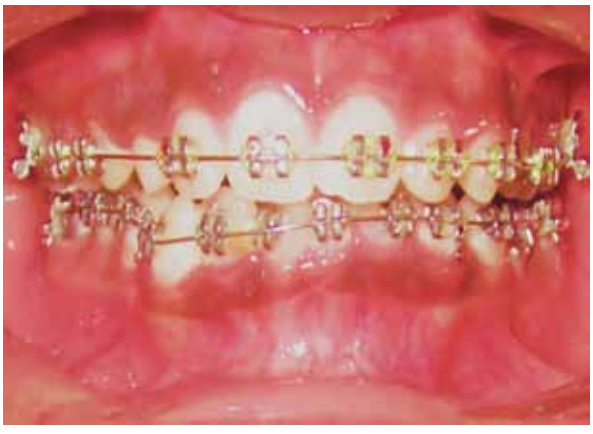

Fig. 4A: Bonding of maxillary and mandibular arches

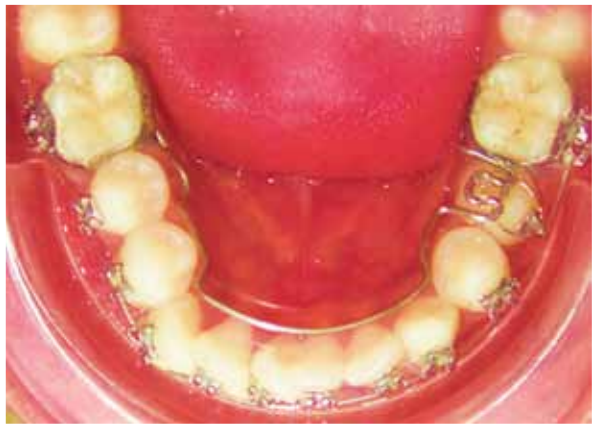

Fig. 4B: Thirty-five is not involved with the main arch wire

At the recall visit 3 weeks later, the impacted premolar was seen to have erupted considerably as a result of the ligature traction (Fig. 5).

A 0.018" NiTi was placed in the maxillary and 0.016" NiTi was placed in the mandibular arch. At this stage, the modified lingual arch was removed by separating the soldered joint between the molar bands and the wire component of the lingual arch using a carbide bur at slow speed with water coolant. The mandibular 0.016" NiTi wire was now passed beneath the vertical slot of the Begg's bracket (Figs 6A and B).

The patient was recalled after a period of 4 weeks. At this appointment, 0.018" AJ Wilcock was placed in both the arches (Fig. 7A) and the patient was appointed for a surgical exposure of the palatally impacted canine (13).

TREATMENT RESULTS

By about 8 weeks after the initiation of treatment, the impacted premolar was already aligned. While the impacted canine (13) is being scheduled an appointment for the surgical exposure, the impacted premolar (35) has already been aligned and is in occlusion with its counterpart in the maxillary arch (Fig. 7B).

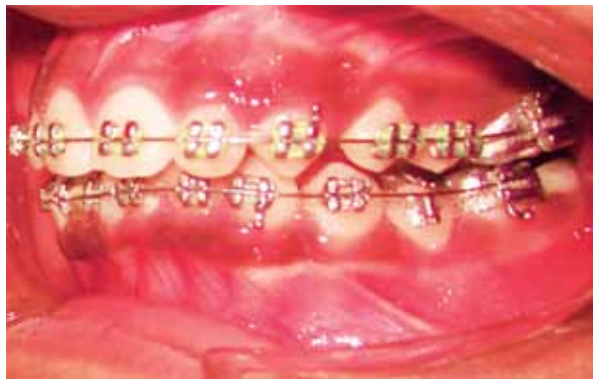

Fig. 5: Impacted 35 has erupted considerably

The palatally impacted canine was surgically exposed, a Begg's bracket was subsequently bonded and ligature was placed (Fig. 8).

DISCUSSION

An unerupted or an impacted tooth is an extreme example of an asymmetric malalignment problem, with one tooth far from the line of occlusion.[6] If a superelastic NiTi wire is tied to the impacted tooth as well as the teeth adjacent to it, then the teeth adjacent to the impacted tooth will tip into the space where the impacted tooth is

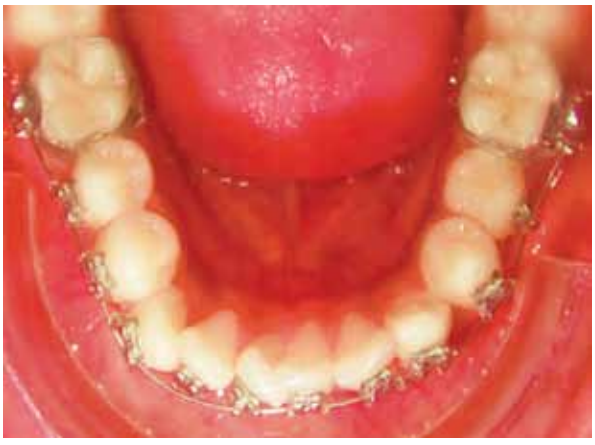

Fig. 6A: Modified lingual arch removed bracket

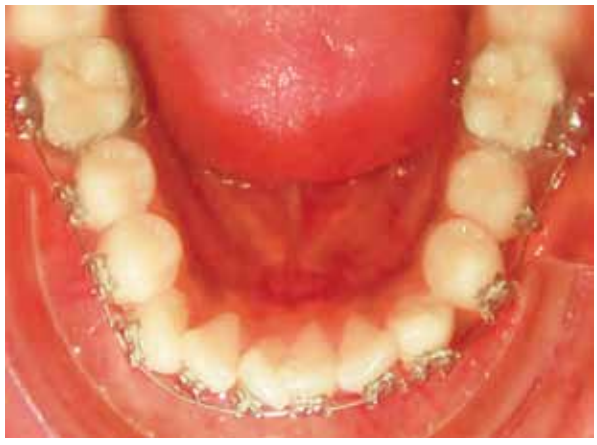

Fig. 6B: A 0.016" NiTi engaged into the slot of Begg's bracket

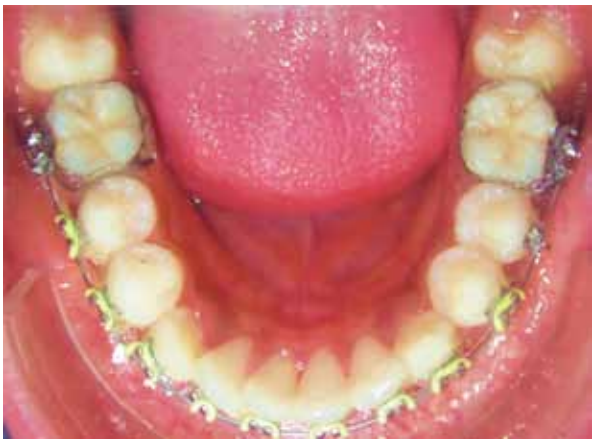

Fig. 7A: A 0.018" AJ Wilcock placed beneath Begg's bracket slot

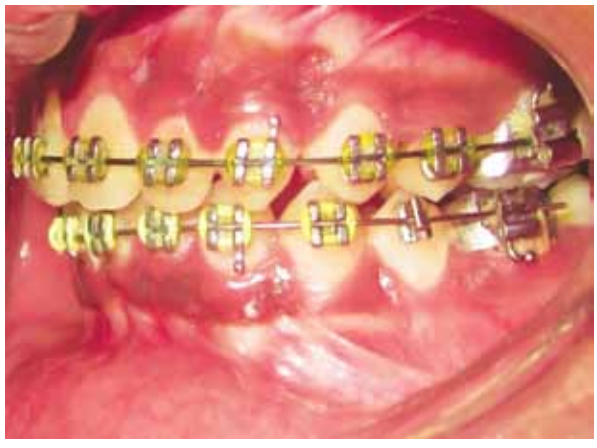

Fig. 7B: The premolar in occlusion with its maxillary counterpart

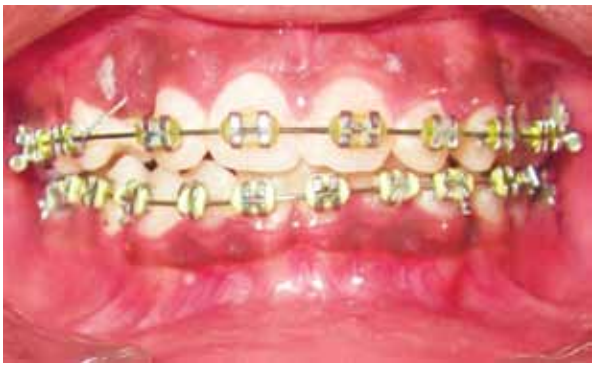

Fig. 8: Surgical exposure of maxillary canine. A 0.018" AJ Wilcock in both the arches

meant to come into alignment. Thus, a heavy stabilizing archwire must be present to allow the remaining teeth to act as the anchor unit, before the force is applied to the unerupted tooth.[5,6] This would mean alignment of the crowded teeth for about 2 to 3 months when a rigid wire like 0.018" stainless steel or a rectangular stainless steel wire can be engaged. Until then, the unerupted tooth cannot be given any force to aid eruption into the space.

The modified lingual arch precludes the need to level and align the remaining teeth, allowing the alignment of the unerupted tooth to begin at the initiation of orthodontic treatment itself.

It is essentially an example of two different mechanics acting at the same time, both of them, being independent of the other. One part of the mechanics shown in the above case report is the traditional alignment process of the crowded teeth, with brackets bonded to all teeth, and wire sequences traditionally followed for alignment. The other part of the mechanics, used exclusively for aligning the unerupted premolar is carried out with the modified lingual arch.

The modified lingual arch is fabricated using 1 mm diameter stainless steel wire (Fig. 2A). Bands are fabricated on the mandibular first molars. Then, a mandibular impression is made to fabricate the modified lingual arch to be soldered from the first molar band on one side to the first molar band on the other side. The modified lingual arch is then cemented in place after fabrication (Fig. 2B). The design is 'modified' in the region of the unerupted premolar. Extensions of the lingual arch are made (Fig. 2A) that extend toward the buccal surface of the teeth. The extensions are fabricated such that they lie at the

level of the occlusal plane, thus do not interfere with the occlusion as well as prevent the supra eruption of the opposing tooth. The above extensions, passively contact the proximal surfaces of the teeth adjacent to the premolar, thus acting as a space maintainer for the unerupted tooth as well.

With the lingual arch in place, the unerupted premolar can now be given a traction, without the risk or danger of the adjacent teeth tipping into the space or the opposing tooth supra erupting. Thus, the adjacent teeth are aligned using the traditional mechanics with the superelastic NiTi wires, and at the same time, the unerupted premolar is given traction achieving alignment of the same.

Eventually, with no tipping of adjacent teeth and no loss of space, the unerputed tooth has been completely aligned, allowing it to be engaged with the stainless steel wire as a part of the complete arch aligning mechanics.

The purpose of this article is to describe a different technique for eruption of the unerupted or impacted teeth using a modification of the lingual arch. It essentially describes the technique of having two different mechanics acting simultaneously and independent of each other, thus serves an essential tool to save treatment duration and avoid undesirable side effects. The complexity of the design could be a possible disadvantage to the operator and may contribute to patient discomfort, however we did not experience any such problems.

CONCLUSION

- The modified lingual arch, as suggested can be an effective appliance for the vertical eruption of unerpted teeth.
- The use of simultaneous, yet independent mechanics to align unerpted or impacted teeth is essential to achieve desired results in the shortest possible time without undesired tooth movement or loss of space.
- The technique described can be useful tool to save time as well as avoid undesirable side effects of aligning an unerpted or an impacted tooth.

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CASE REPORT

Management of an Unresponsive Periodontal Lesion in an Endodontic Involved Tooth Complicated by *Actinomyces* Species

[1]Abhishek Ramnik Mistry, [2]Richard Pereira, [3]Vineet Kini, [4]Ashvini Padhye, [5]LS Poonja, [6]Srivalli Natrajan

ABSTRACT

Actinomycosis is an infectious disease caused by *Actinomyces* species found as a commensal in oral flora. However, it does cause opportunistic infections with localized granulomatous and suppurative lesions intraorally once the integrity of the oral mucosal barrier is compromized and access to the underlying tissues or jaw bones is gained. The present case report highlights an unresponsive periodontal lesion associated with an actinomycotic infection in an endodontically involved tooth. The gingiva in relation to the tooth showed profuse spontaneous bleeding and suppurative discharge after multiple appointments of initial therapy which required histopathologic and microbiological assessment for diagnosis. On establishing the diagnosis of actinomycosis, treatment involved extraction of the tooth. This highlights the importance of microbiological investigations in unresponsive periodontal lesions.

Keywords: Actinomycosis, Cervicofacial, Gingiva.

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INTRODUCTION

Actinomycosis is an infectious disease caused by the saprophytic *Actinomyces* species.[1,2] *Actinomyces* are anaerobic, Gram-positive and filamentous bacteria despite their fungal characteristics.[3] Actinomycosis occurs more frequently in cattle as a disease called 'lumpy jaw'.[4] In humans four clinical forms of actinomycosis are seen: the cervicofacial, thoracic, abdominopelvic and cerebral.[5] Cervicofacial actinomycosis is the most common type seen (50-60% of the cases).[6] It often presents as a slowly progressive, indolent, indurated infiltration with multiple abscesses and draining sinuses showing presence of sulphur granules.[7]

They are found as a commensal in the oral cavity often residing in calculus, periodontal pockets, carious lesions and oral mucosal surfaces.[5] However, it does cause opportunistic infections with localized granulomatous and suppurative lesions intraorally once the integrity of the oral mucosal barrier is compromized and access to the underlying tissues is gained due to poor oral hygiene, endodontic/periodontal lesions and trauma.[6] Other predisposing factors include: cancer, immunodeficiencies, such as HIV, long-term steroid therapy, diabetes and malnutrition.[8]

The present case report highlights management of an unresponsive periodontal lesion in an endodontically involved tooth associated with *Actinomyces* infection.

CASE REPORT

A 45-year-old male patient reported to department of periodontics, with chief complaint of bleeding from upper left posterior region of jaw since past 2 weeks. Patient was asymptomatic 2 weeks back after which he noticed spontaneous bleeding from gums which had a sudden onset and progressively increased over a period of time. Bleeding was not associated with any trauma and pain and was aggravated on eating hot foodstuffs and during sleep and was relieved on its own.

The clinical examination revealed, gingiva in relation to 26 was enlarged, soft and edematous in consistency, reddish pink in color with loss of scalloping and stippling. There was presence of 10 mm periodontal pocket on distobuccal aspect of the tooth. The tooth was grade I mobile and had grade II furcation involvement (Fig. 1). Patient had a poor oral hygiene with presence of supra gingival and subgingival calculus. Patient was systemically healthy and reported no relevant past dental history and medical history and all this blood investigations were normal.

[1]Postgraduate Student, [2,5,6]Professor, [3]Reader
[4]Professor and Head

[1-4]Department of Periodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

[5]Department of Oral Pathology, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

[6]Department of Oral Surgery, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Abhishek Ramnik Mistry, Postgraduate Student, Department of Periodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: 02227436604, e-mail: abhishek1561@gmail.com

The intraoral periapical radiograph with 26 (Fig. 2) revealed, periapical radiolucency involving the distobuccal root, with interradicular bone loss and angular bone loss on distal aspect of the tooth. The radiographic findings suggested combined periodontic-endodontal lesion, with primary periodontal and secondary endodontic involvement.

Based on the clinical and radiographic findings, the symptomatic therapy consisted of thorough full-mouth scaling and root planing and curettage of the inner pocket lining of 26 under local anesthesia. The procedure was performed using a combination of hand and ultrasonic instrumentation. The patient received oral hygiene instructions with prescription of amoxicillin 500 mg TDS for 3 days, chlorhexidine (0.2%) mouthrinse for 2 weeks. One week follow-up showed uneventful healing (Fig. 3). Patient was advised root canal treatment with 26 followed by periodontal flap surgery.

Patient failed to report for endodontic treatment and visited 2 weeks later, with complain of recurrence of spontaneous bleeding from the same site. Clinical examination revealed similar findings with presence of blood clot and swelling with respect to 26 (Fig. 4). The edematous soft tissue was curettaged and was sent for histopathological investigation. Patient was prescribed amoxicillin and clavulinic acid 625 mg twice daily for 5 days. The site showed uneventful healing after 1 week (Fig. 5).

The histopathological investigation comprized of hematoxylin and eosin (H & E) staining (Figs 6A and B) and special staining using periodic acid schiff (PAS) stain (Figs 7A and B) and Grocott-Gomori methenamine-silver nitrate (GMS) (Figs 8A and B).

The H&E stained soft-tissue specimen showed a chronic abscess with polymorphs, surrounding granulation tissue, fibrosis and basophilic bacterial colonies. The bacterial colonies were tangled together in a matted colony forming a granule (sulphur granule). The bacilli were filamentous, hematoxyphilic and Gram-positive. The peripheral filaments terminated in a club.

Periodic acid schiff soft-tissue specimen showed strong positivity for bacterial colonies showing magenta pink color at the center of the bacterial colony.

Grocott-Gomeri methenemine-silvernitrate stained soft-tissue section showed darkly stained black central core area and peripheral radiating filaments. Normal connective tissue stained green in color.

Histopathological diagnosis was confirmative of *Actinomyces* infection.

However, there was irregularity in follow-up visits shown by the patient. After 2 months, patient was hospitalized for bleeding episode from the same site. Bleeding

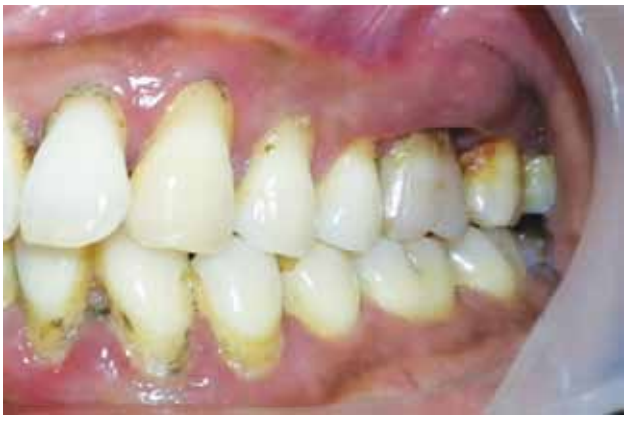


Fig. 1: Preoperative clinical view

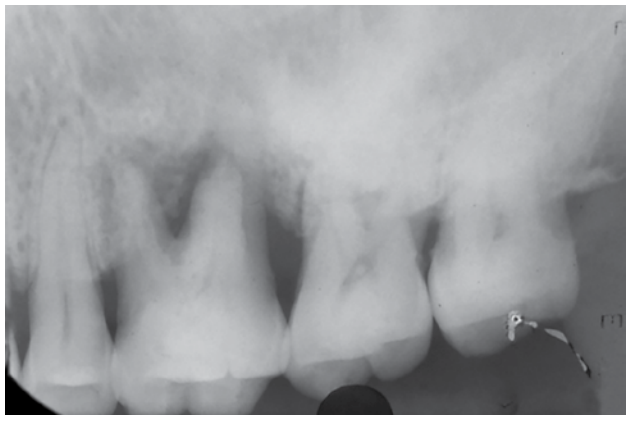


Fig. 2: IOPA with 26

Fig. 3: Clinical view 1 week following scaling and curettage

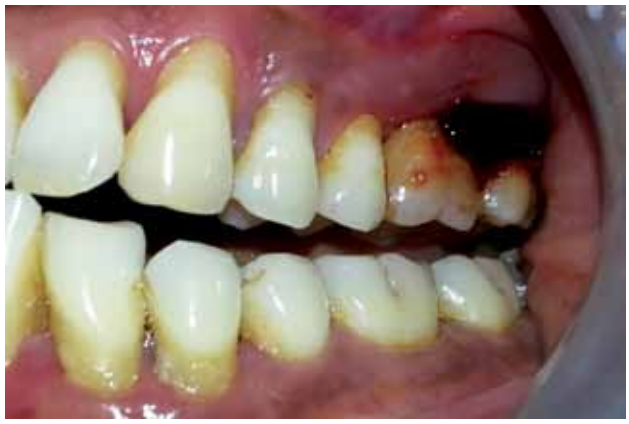


Fig. 4: Recurrence of the swelling after 2 weeks

Fig. 5: Clinical view 1 week after retreatment

was controlled using styptics and blood coagulants. The recurrence of the lesion caused a psychological trauma to the patient. Also the patient had a history of failure to comply with regular dental visits/follow-ups. Based on these parameters, it was decided to extract the involved tooth.

Extraction of 26 was carried out under local anesthesia. A buccal mucoperiosteal flap was raised. Extraction was associated with profuse bleeding and an oro-antral communication (Fig. 9). The periapical tissue was completely curetted and was sent for histopathological investigation. Absorbable gelatin sponge (Gel foam®) was placed to arrest bleeding and stabilize the clot. Buccal flap was advanced using Rehrmann's flap design for closure of oro-antral communication. Patient was prescribed injection augmentin 1.2 gm IV TDS, injection metronidazole 100 ml IV TDS and otrivin nasal drops. Patient was advised not to cough or sneeze vigorously. Patient was discharged on the following day and was recalled after 10 days for follow-up and suture removal.

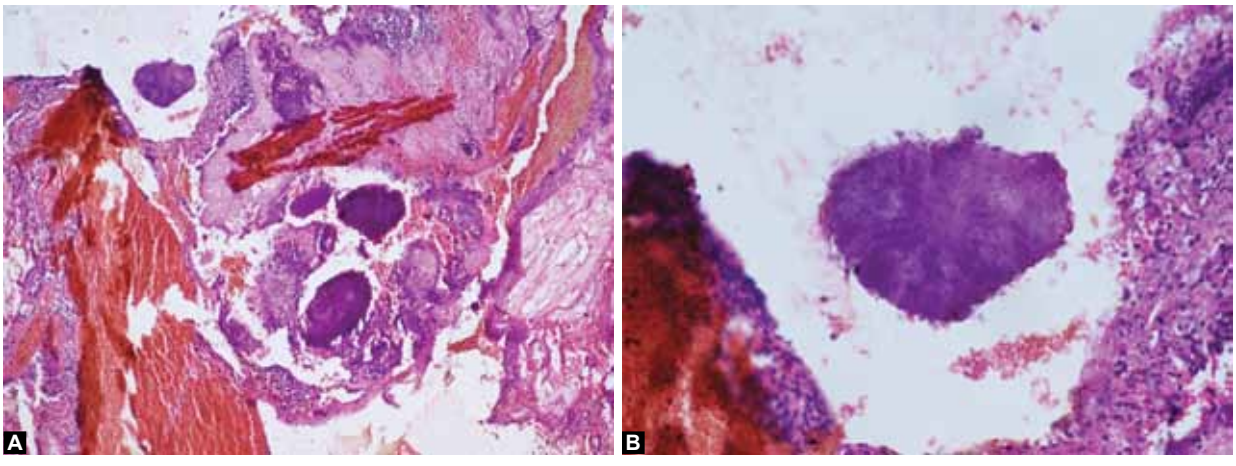
After 10 days, sutures were removed and uneventful healing was observed (Fig. 10).

Hematoxylin and easin staining of the curetted periapical tissue showed filamentous, hematoxyphilic and Gram-positive bacilli confirming the previous diagnosis of *Actinomyces* infection (Fig. 11).

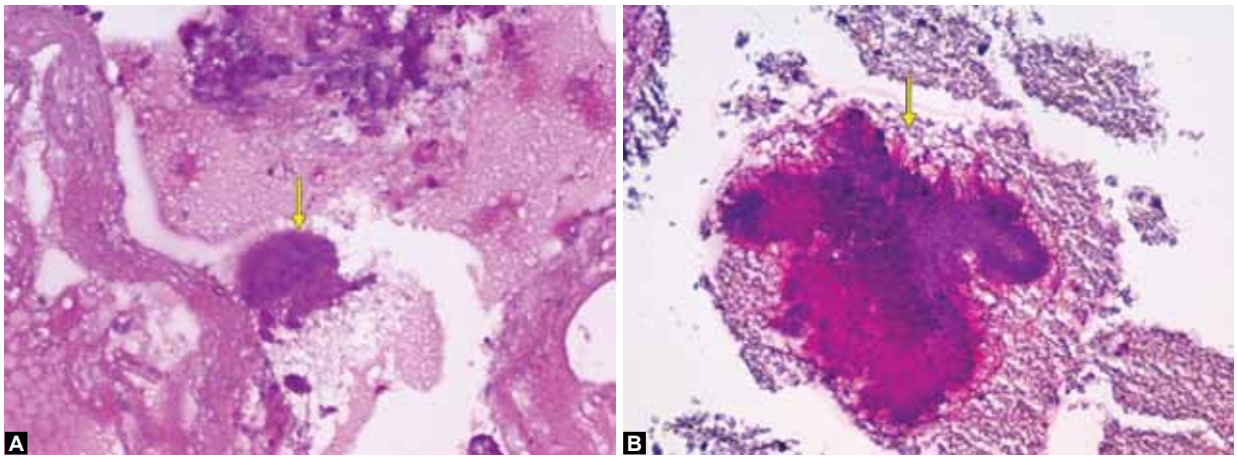
Patient reported no bleeding episodes following extraction and 6 months postoperative view revealed no pathology/recurrence (Fig. 12).

DISCUSSION

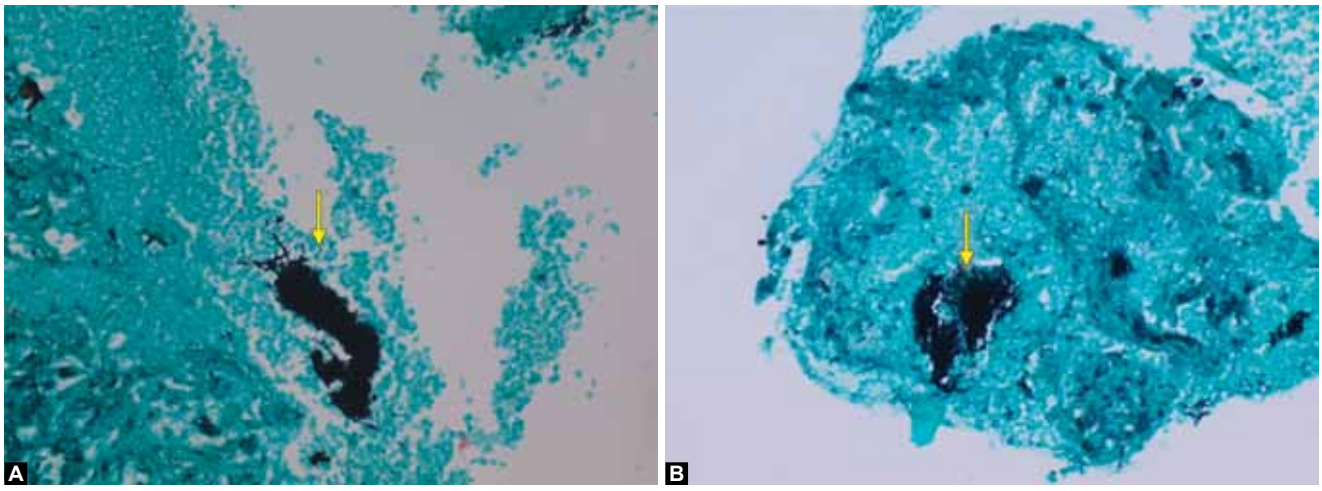
Actinomycosis is considered as 'the most misdiagnosed disease' even by experienced clinicians and is listed as a 'rare disease' by the office of rare disease (ORD) of the



Figs 6A and B: Hematoxylin and eosin staining showing actinomycotic colonies: (A) 10× magnification and (B) 40× magnification



Figs 7A and B: Periodic acid schiff staining showing actinomycotic colonies: (A) 10× magnification and (B) 40× magnification



Figs 8A and B: Grocott-Gomori methenamine silver nitrate staining showing actinomycotic colonies: (A) 10× magnification and (B) 40× magnification

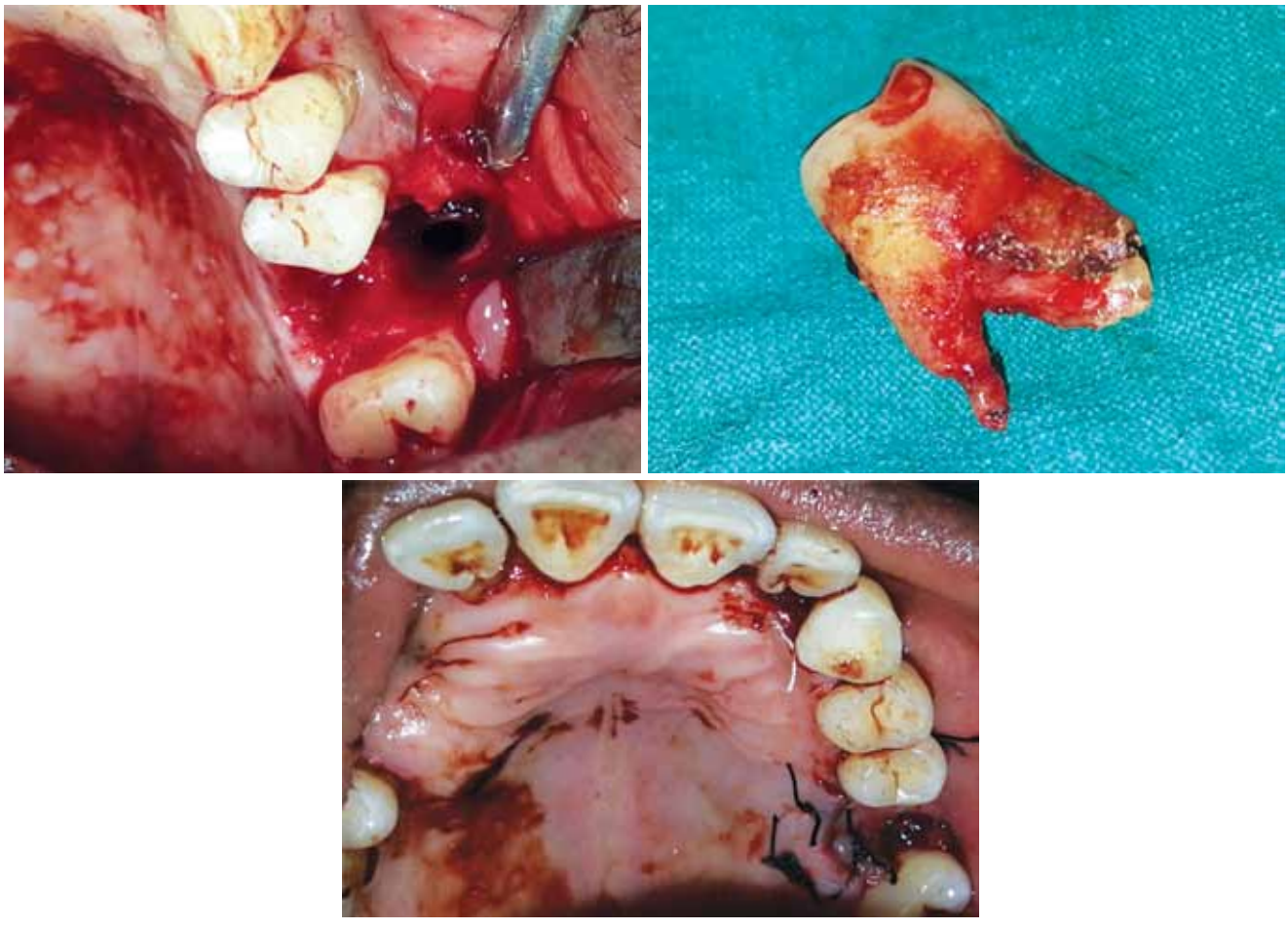


Fig. 9: Extraction of 26 with subsequent oroantral communication

National Institute of Health (NIH).[9] *Actinomyces* species can be found in calculus and in periodontal pockets. They may become pathologic due to poor oral hygiene, periodontal problems, trauma and following oral surgical procedures.[10] Relative low oxygen pressure conditions in these periodontally affected sites support their proliferation, thus providing a possible path of entry for the bacteria into the tissue.[11,12] Sinonasal, laryngeal and pharyngeal disease due to *Actinomyces* species is rarely encountered. Nagler et al presented a case limited to the left mandibular molar region representing a juvenile periodontitis—like lesion and emphasized the importance of early diagnosis of actinomycosis by dental professionals.[13] In a recent case reports, Rodan and Nam Ryang Kim reported presence of actinomycosis in periodontally affected sites.[14,15] In the present case, the *Actinomyces* species affected tooth was periodontally and endodontically involved and patient showed poor oral hygiene which

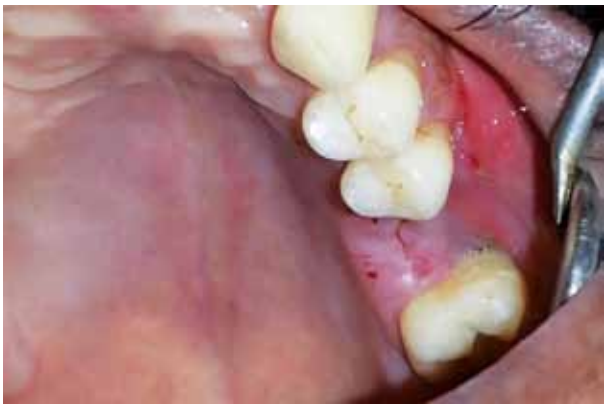


Fig. 10: 1 week postextraction

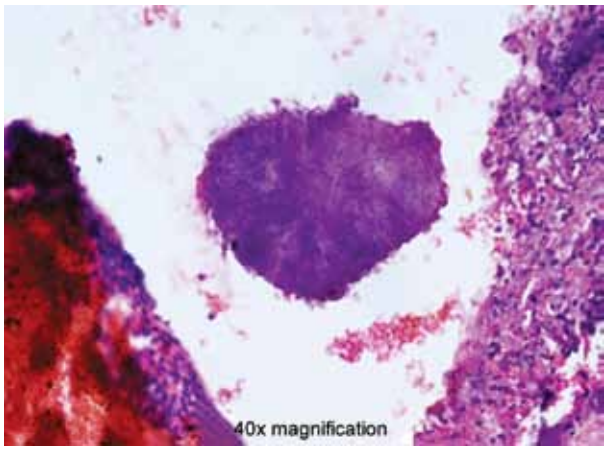


Fig. 11: Hematoxylin and eosin staining showing actinomycotic colonies

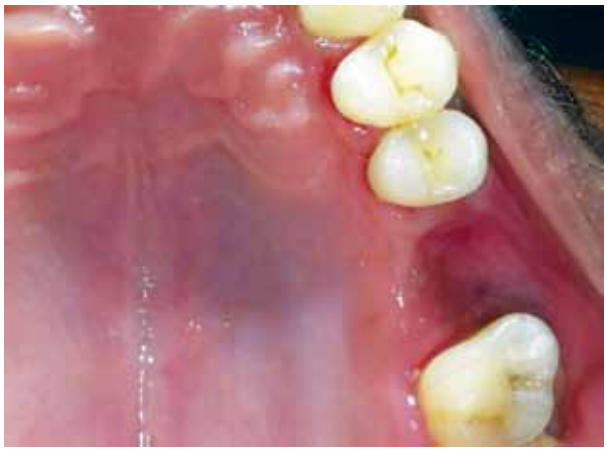


Fig. 12: 6 months postoperative view

could have resulted in proliferation and growth of this bacterial species. Also, the colonies were associated with inflammatory response which presented as granulation tissue with frequent episodes of bleeding. Actinomyces colonies can be identified using hematoxylineosin staining, Gram staining, PAS staining, GMS nitrate staining, exhibiting mass of filamentous bacteria, with variations in the color between the center and periphery of the colony, the so called 'sun-ray' effect.[16] In present case, H & E, PAS, and silver stains showed positive results.

The treatment for actinomycosis includes combination of surgical debridement of the involved tissues and the prolonged administration of antibiotics. The traditional treatment is usually a long-term course of penicillin, which includes 1 month of intravenous penicillin G (1 to 6 million units per day for cervicofacial type and 10 to 20 million units per day for thoracic and abdominal type), followed by weeks to months of oral penicillin.[17] A combination of amoxicillin and clavulinic acid (625 mg three times a day for 5 days) has also been used as it offers the advantage of coverage against penicillin-resistant aerobic and anaerobic copathogens.[13] Although comparatively lesser effective tetracycline, doxycycline (100 mg, 1st day-bid followed by once daily for 3 weeks) have also been administered because of their additional positive effects on periodontal tissues and gingival crevicular fluid.[6,18] In the present case, we prescribed the patient amoxicillin on 1st visit and amoxicillin and clavulinic acid combination on the 2nd visit. However, the frequent recurrence of the lesion could be attributed to the incomplete debridement of the lesion due to deep periodontal involvement. Eventually, the tooth was extracted and the parenteral amoxicillin and clavulunic acid combination was administered to the patient keeping in mind the histopathological diagnosis of *Actinomyces* infection. The oro-antral communication which was encountered at the time of extraction could be attributed to the chronicity of the lesion. As patient had received amoxicillin and clavulinic acid combination intermittently pre- and postoperatively, orally as well as parenterally, short-term dosage of antibiotic was prescribed after extraction. The patient did not present any recurrence of *Actinomyces* infection, because the infected tissue was totally excised.

CONCLUSION

Actinomycosis should be included in the differential diagnosis in cases where symptoms do not respond to the appropriate periodontal treatment. The importance of thorough microbiological and histopathological investigation cannot be overstressed in helping us to diagnose such an unresponsive periodontal lesion.

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CASE REPORT

Efficiently Plumping the Deficient! Pontic Site Development

[1]Aditi Ashok Rathod, [2]Ashvini Mukul Padhye, [3]Sabita Ram, [4]Saili Chandavarkar

ABSTRACT

Replacing a missing tooth in a maxillary anterior esthetic zone displaying a Seibert's class III ridge defect is a big challenge in the field of perioesthetics. In order to achieve maximum esthetics, form and function, an ideal pontic should have a natural emergence profile and support the labial soft tissue as well as the adjacent papillae. This is of paramount importance, especially if the patient has a high smile line. Augmentation protocols differ based on the treatment plan for implants or fixed prosthesis. The most popular techniques for soft tissue ridge augmentation for Seibert's Class III ridge defects include the roll technique, the wedge technique and the pouch technique among others. This article presents a case of an 18-year-old female patient with a challenging Seibert's Class III ridge defect treated for pontic site development using a combination of the pouch and the roll technique followed by a fixed prosthesis with ovate pontics.

Keywords: Pontic site development, Connective tissue graft, Pouch technique, Seibert's class III ridge defect.

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INTRODUCTION

Esthetics of the restorations is impaired when ridge defects are found in the anterior maxillary esthetic zone. These defects could result from trauma, improper tooth extraction, advance periodontal diseases or may be congenital in nature. Seibert in 1983 classified these ridge defects as, class I: Buccolingual loss of tissue, class II: apicocoronal loss of tissue and class III: combination of buccolingual and apicocoronal loss of tissue.[1] Allen in 1985 modified Seibert's classification with a quantification of the amount of tissue lost, where, type A-apicocoronal loss of ridge, type B-buccolingual loss of ridge contour and type C-combined buccolingual and apicocoronal loss of the ridge. The ridge is further described by assessing the depth of the defect: Mild less than 3 mm; Moderate 3 to 6 mm; severe is greater than 6 mm.[2]

The pontic designs used earlier in the anterior region were the ridge lap and modified ridge lap. They gave the impression that they rest on the top of the ridge rather than emerge from within the alveolar process. They also lack interdental papillae due to which the black triangles appear in the embrasure area between the abutments and the pontics, leading to an unaesthetic restoration and an unsatisfied patient. To get a good emergence profile and help in building up the interdental papilla, the ovate pontic is the choice of pontic in the anterior esthetic zone. In order to achieve maximum esthetics, an ideal pontic should appear to emerge from the gingiva like a natural tooth. But when there is a hard and soft tissue defect, it may not be possible unless the tissue is built and contoured around the emerging pontic.[3]

Ridge defects can be overcome either restoratively or surgically. Restorations could include elongated pontics with gingival ceramics. However, these may not be esthetically acceptable especially in a patient with a high smile line. Therefore surgical ridge augmentation becomes the treatment of choice. This can be done using both soft and hard tissue procedures according to the morphology of the defect to complement the bridge or implant prosthesis. The various soft tissue procedures are, the pouch procedure including the roll flap technique, interpositional (inlay) grafts, the onlay graft procedure and the combination onlay-interpositional graft procedure.[4-10]

In the following case report, an ovate pontic site development was done using a combination of pouch technique using subepithelial connective tissue graft and a palatal roll flap technique in order to prepare the site to receive a fixed partial denture with an ovate pontic design to achieve maximum esthetics.

CASE REPORT

An 18-year-old female patient was referred to the department of Periodontics for an opinion with respect to 11 and 23 (Figs 1 to 3) as they presented with grade I mobility. The history revealed that the patient had suffered trauma to the facial region 1 month back resulting

[1,4]Postgraduate Student, [2,3]Professor and Head

[1,2]Department of Periodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

[3,4]Department of Prosthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Aditi Ashok Rathod, Postgraduate Student, Department of Periodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: 02227436604, e-mail: aditirathod88@gmail.com

in avulsion of 21, 22. Scaling and root planing was carried out and the patient was recalled after a period of 2 weeks. On re-evaluation a reduction in the mobility with 11 and 23 was observed.

Since, the patient was young, she desired a fixed restoration for the missing teeth. Study models, bone mapping and radiography revealed a knife edge ridge and a Seibert's class III ridge defect in the 21 and 22 regions. A Seibert's class III defect can be augmented using a block graft technique followed by implant placements. This would require a waiting period of 5 to 6 months. Since, the patient wanted early replacement of teeth and was reluctant to undergo through a block graft harvesting procedure it was decided to go for a fixed partial denture with an ovate pontic design. To get an ideal emergence profile, a subepithelial connective tissue graft with pouch and tunnel technique was planned on the buccal aspect of the defect. Blood investigations were done to rule out any systemic medical condition. As the pulp chambers were large, intentional root canal treatment was carried out with 11 and 23 to prevent sensitivity. A wax up for the fixed partial denture was done on the study cast to get proper contour of the restoration. A putty index was made for the fabrication of provisional fixed partial denture which would be placed immediately post grafting for the development of the pontic sites. A Hawley's device was fabricated to protect the donor site during the postoperative recovery phase.

SURGICAL PROCEDURE

Patient was given a presurgical rinse using 0.2% chlorhexidine. After analgesia was achieved using 2% lignocaine with 1:200,000 adrenaline, a vertical incision was made at the mesiobuccal line angle of the maxillary left canine (23) using a #15 blade and a pouch was prepared by partial thickness dissection extending horizontally till the mesiobuccal line angle of the maxillary right central incisor.[11] Once the defect dimensions were gauged using a UNC #15 probe, a subepithelial connective tissue graft was harvested from the palate in the region between the canine (23) and first molar (24) using the trap door technique. The graft was immediately tucked into to the pouch prepared at the recipient site and secured in place using 5-0 (polyglactin 910) synthetic absorbable

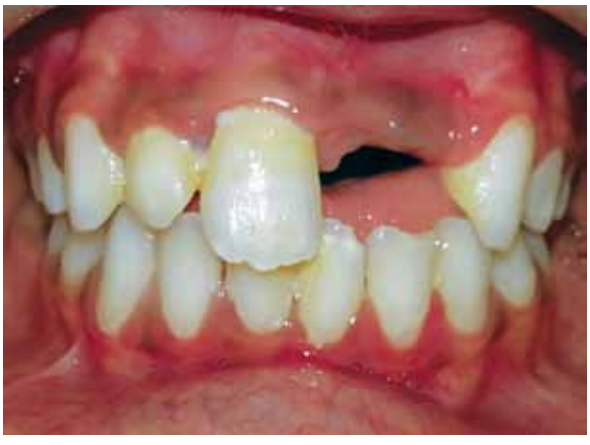

Fig. 1: Preoperative buccal view

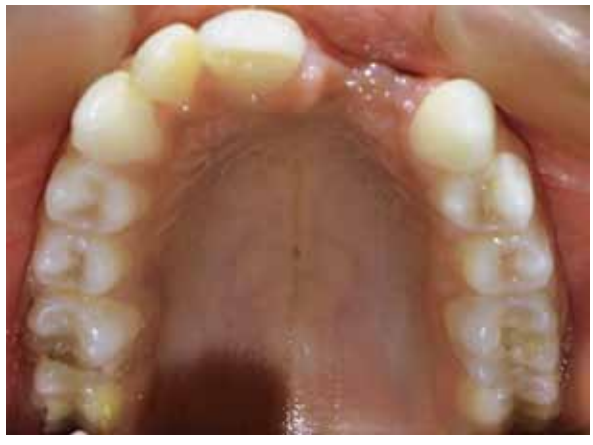

Fig. 2: Occlusal view

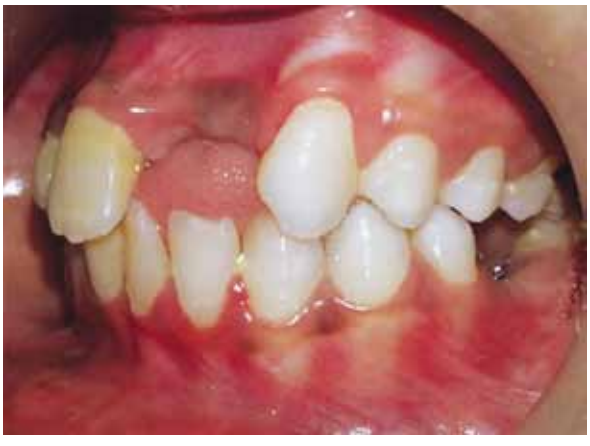

Fig. 3: Left lateral view

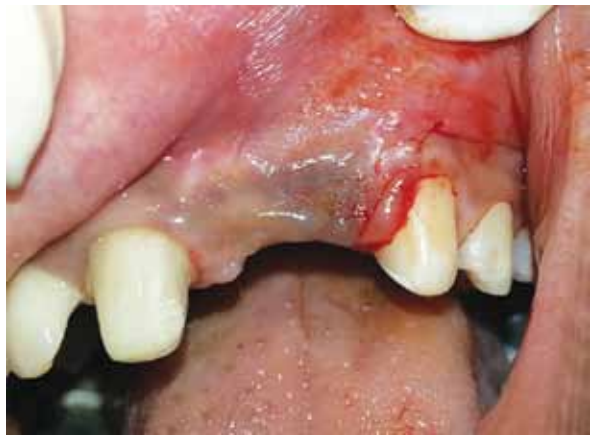

Fig. 4: Papilla sparing vertical incision given on mesial aspect of 23

sutures to stabilize the graft during healing. Since, the amount of graft procured from the palate was inadequate due to lack of thickness of palatal tissue, an additional palatal roll technique was performed a connective tissue graft was harvested from the adjacent palatal mucosa and rolled into the pouch prepared earlier. The graft was sutured using 5-0 (polyglactin 910) synthetic absorbable sutures using interrupted and pressure sutures. The partial thickness palatal flap was sutured back to the donor site using interrupted black silk sutures and the patient was given a Hawley's device to for 7 days to protect the donor site. The provisional fixed partial denture with the ovate pontic design was placed in order to develop the pontic site during the healing phase (Figs 4 to 11).

The patient was given a prescription for analgesics (diclofenac sodium 50 mg, paracetamol 500 mg, serratiopeptidase 15 mg) and antibiotics (amoxicillin 500 mg) to be taken thrice daily for 5 days. She was advised to follow scrupulously all the normal oral postoperative hygiene instructions. She was instructed not to brush or floss the surgical site for 2 weeks and rinse the oral cavity with 0.2% chlorhexidine mouth rinse twice daily for at least 2 weeks. Suture removal at the donor site was done after 7 days and the healing was uneventful. Healing of the graft and the donor site was observed after 2 weeks followed by intervals of 1, 3 and 6 months.

Postoperative evaluations after 6 months revealed well developed papillae between 21 and 22 and a significant increase in the buccolingual width and complete epithelialization of the donor site (Figs 12 and 13). The patient was referred for fabrication of the final prosthesis using porcelain fused to metal crowns. There was a good emergence profile, no black triangles and the patient was pleased with the esthetics achieved (Fig. 14).

DISCUSSION

Ridge defects pose a restorative challenge especially in the anterior esthetic zone. In order to achieve maximum esthetics, an ideal pontic should appear to emerge from the gingiva and support the labial soft tissue as well as the adjacent papillae. This is of paramount importance, especially if the patient has a high smile line. Due to lack of palatal tissue procured after the subepithelial connective tissue harvesting technique, an Abrams roll technique was performed to increase the buccal bulk

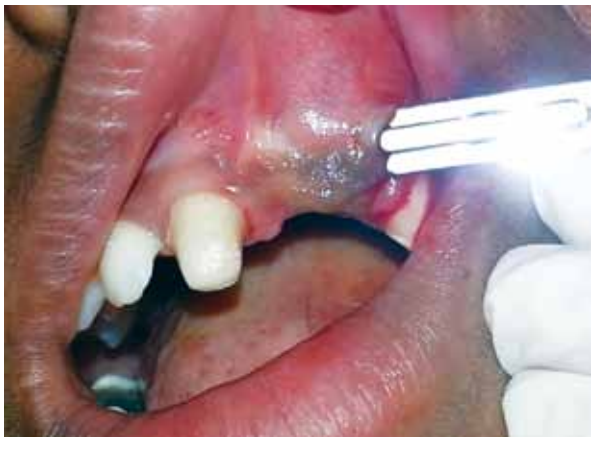

Fig. 5: Pouch being created using #15 blade

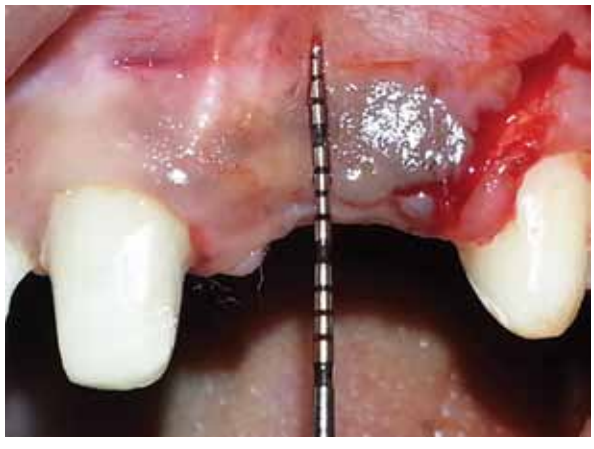

Fig. 6: Vertical calibrations for obtaining the graft

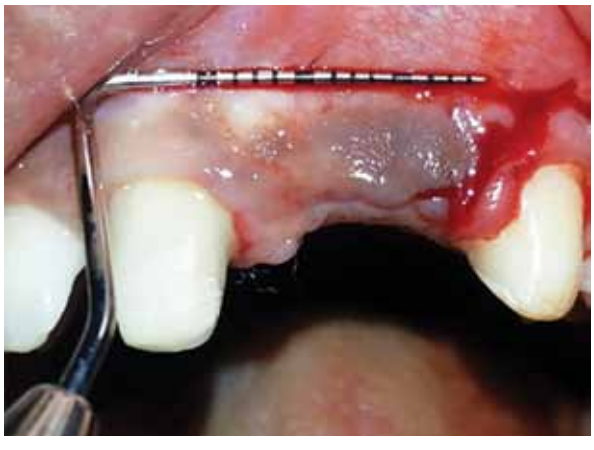

Fig. 7: Horizontal calibration for obtaining the graft

Fig. 8: Subepithelial connective tissue graft obtained from the palate

of the defect.[4] A provisional restoration was given in order to develop and shape the pontic site for emergence profile and interdental papilla. The location and shape of the proximal contact areas in provisional prosthesis determines where the papillae are molded on the healing ridge. The developed papillae along with the buccolingual width of soft tissue results in excellent emergence profile thus eliminating the appearance of black triangle between the pontics.[3]

CONCLUSION

In this case report, a combination of the pouch technique and the palatal roll technique were used to create a satisfactory result in the anterior esthetic zone. The resulting soft tissues closely mimicked normal anatomical gingival contours and form a concave contour to receive a convex pontic. However, more clinical studies with long term follow-up evaluation are needed to determine the predictability of this technique.

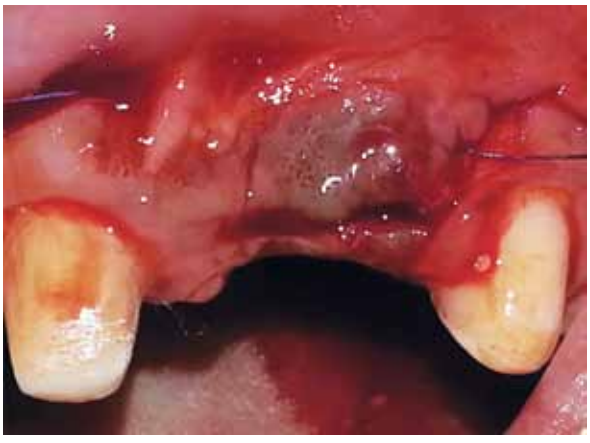

Fig. 9: Graft transferred to the recipient site

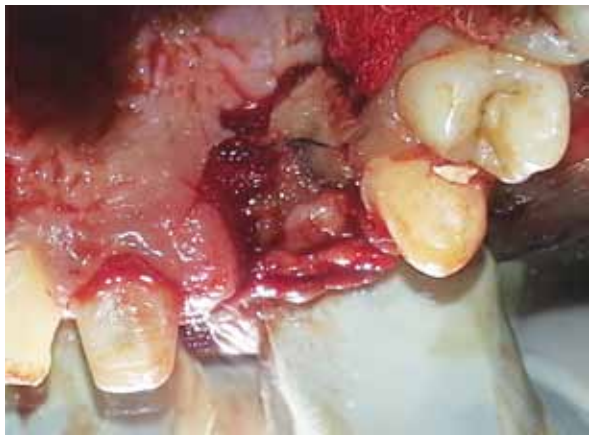

Fig. 10: Palatal roll technique performed

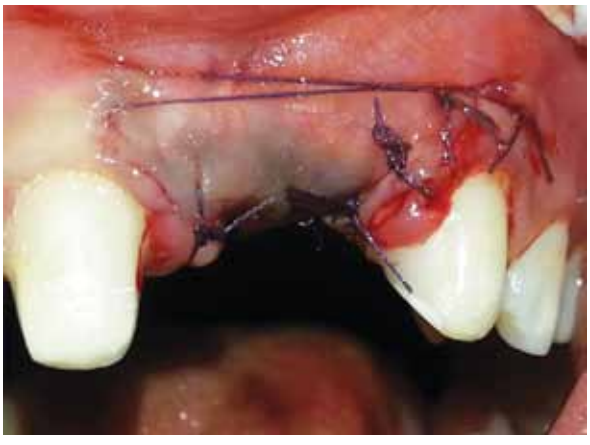

Fig. 11: Suturing done using absorbable sutures

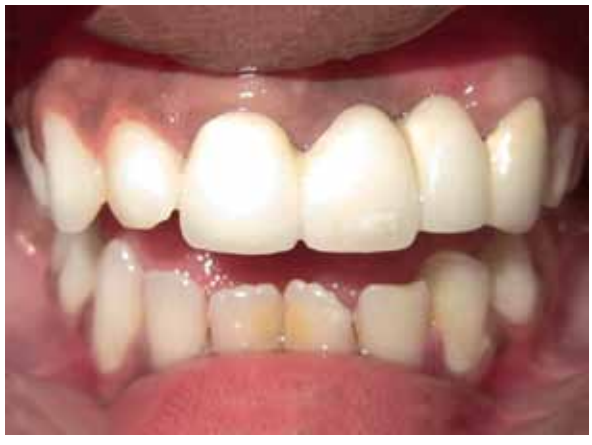

Fig. 12: Postoperative healing after 6 months

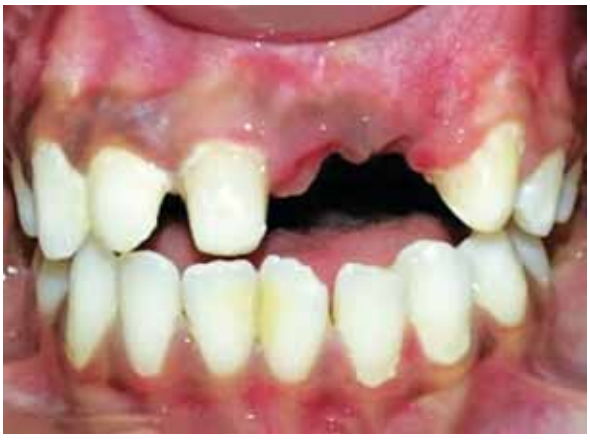

Fig. 13 : Postoperative healing after 6 months

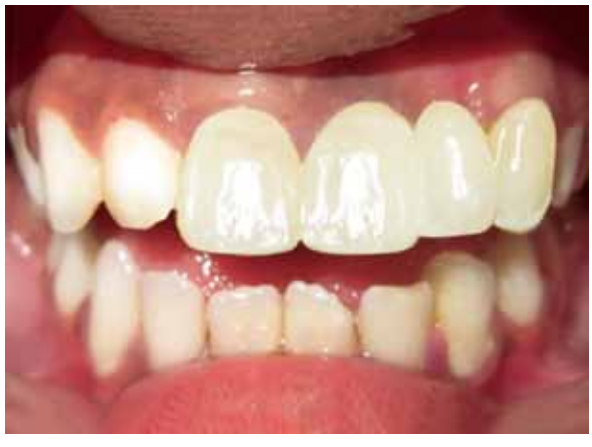

Fig 14: 6 months postoperative view with final prosthesis

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CASE REPORT

A Dependable Device to Secure Condylar Position into Glenoid Fossa during Orthognathic Surgery

[1]Pratik Dipak Shah, [2]Srijon Mukherji

ABSTRACT

A change in condylar positioning is one of the area of concern following orthognathic surgery which may occur due to numerous reasons like paralysis of the muscles of mastication, fixation methods, malalignment of the bone segments and more commonly due to inadvertent force used to bring the jaws in to occlusion. Deranged position of condyle may lead to relapse following surgery and also causes TMD sequelae. Condylar position in the glenoid fossa can be secured during orthognathic surgery by using condylar positioning device. The role and design of the condylar positioning device has been discussed in detail in this technical note.

Keywords: Orthognathic surgery, Condylar positioning device, Inadvertent force.

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INTRODUCTION

A change in the position of the condyle may occur during orthognathic surgery for number of reasons. The recumbent position of the patient, paralysis of muscles of mastication, joint edema, malalignment of the bone fragments, methods of positioning the condyle, fixation methods and most commonly inadvertent force used to bring the jaws in to occlusion.[1,2] The condylar positioning device has ability to reproduce condylar position in all three planes. It is a rigid device between the proximal segment of the mandible and a stable structure as maxillary dentition/splint or zygomaticomaxillary buttress. One would say it is obvious that condylar positioning devices to be used in orthognathic surgery. However, most surgeon do not prefer to use them routinely because, they are not easy to use and they require additional time. The first of such devices was developed by Luhr who adapted a bone plate between ramus and interocclusal splint. The purpose of this article is to discuss the role and unique design of condylar positioning device which we routinely use in our orthognathic surgery practise.

[1]Senior Lecturer, [2]Director and Chief Consultant

[1]Department of Oral and Maxillofacial Surgery, College of Dental Sciences and Research Center, Ahmedabad, Gujarat, India

[2]Department of Oral and Maxillofacial Surgery, Calcutta Institute of Maxillofacial Surgery and Research, Kolkata, West Bengal, India

Corresponding Author: Pratik Dipak Shah, C/o Dipak Shah Bungalow no. 37/B, Navyug Society, Opposite Manik Baug Hall Ambavadi, Ahmedabad, Gujarat, India, Phone: 09173828279 e-mail: pratikdshah_2711@yahoo.in

MATERIALS AND METHODS

Preoperatively we mold 2 mm width 10 hole titanium plate and secure over the skull and mandible (Fig. 1). Two bands are usually given. One at zygomaticomaxillary buttress region and the other at the proximal segment of the ramus of the mandible (Fig. 2). One Helicopter band is usually incorporated either at buttress or proximal

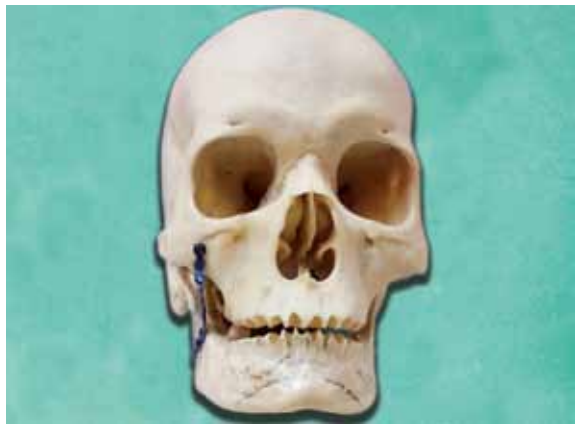

Fig. 1: Preoperatively titanium plate id molded over the skull and mandible

Fig. 2: Bone plate adaptation at zygomaticomaxillary buttress region and proximal ramus segment of the mandible

ramal segment region (Fig. 3). Same design is transferred over the patient while performing orthognathic surgery. Before beginning with the osteotomy, patient's jaws are brought in to a centric occlusion using acrylic wayfer which is prepared preoperatively. After bringing the jaws in to centric relation maxillomandibular fixation is performed using tie wires. Once occlusion is achieved in centric relation, it is made sure that condyles are in the glenoid fossa. Then molded titanium plate is secured over the zygomaticomaxillary buttress region and proximal ramal segment of the mandible with minor modifications for precise adaptation. After that bone plate is removed and osteotomy is performed. Once distal segments of the jaws are brought into desired position after placing prefabricated acrylic splint, maxillomandibular fixation is performed. Again the same molded plate is secured to previously drilled holes before fixing the distal and proximal segments with miniplates and it is made sure that condyles are within the glenoid fossa.

A 19-year-old female patient reported to Calcutta Institute of Maxillofacial Surgery during the year June 2014 with complain of flattening of face. Patient had already undergone presurgical orthodontics. After cephalometric analysis, model analysis and clinical examination, treatment plan was established to perform high level Le Fort I advancement osteotomy. Bone plate was molded over the skull preoperatively and same design was transferred over the patient during surgery. Bone plate was secured before beginning of osteotomy and then removed. After Le Fort 1 advancement again bone plate was secured to previously drilled holes (Fig. 4).

RESULTS

Postoperatively, there were no significant changes in the occlusion which clearly indicates condyles were within the glenoid fossa.

DISCUSSION

Studies have shown, with autorotation of the mandible after superior maxillary repositioning, the mandibular condyles were positioned more posteriorly in to glenoid fossa.[3,4] Tuinzing and Swart, studying dry mandibles showed that intercondylar distance decreased with bilateral sagittal ramus osteotomy to move the mandible backwards and increased when the mandible was advanced also using dry specimens, showed that condylar displacement tends to occur more frequently with screw fixation than with wire osteosynthesis after sagittal ramus osteotomy.[5] In 1972 Mcmillen concluded that the muscles, especially the mandibular elevators are important in seating the condyles into their fossae. With paralysis of these muscles, the condyles could drop vertically out of fossae, and this allowed the mandible to be positioned more posteriorly. Posterior displacement of the condyle has been cited as an etiological factor in the development of Temporomandibular joint dysfunction syndrome.[6-8] Renzi et al used condylar positioning device in 15 patients who underwent Le Fort osteotomy and bilateral sagittal split osteotomy for correction of dental-skeletal class III and found change in condylar position of more than 2 mm or 2° were not found in any of the patient while other group consisting of 15 patients who underwent surgery without use of condylar repositioning device, change in condylar position between 2 and 4 mm and between 2 and 4° were observed in 6 patients.[9]

Distraction of the condyle from the fossa during surgery consistently causes relapse, which is usually immediate, irrespective of the method of fixation used. This relapse can be prevented using Bone plate which is shown above.

Condylar positioning device should be used in Le Fort osteotomies, bilateral sagittal split osteotomy and bimaxillary osteotomies. While securing the condylar

Fig. 3: Helicopter band incorporation in plate design

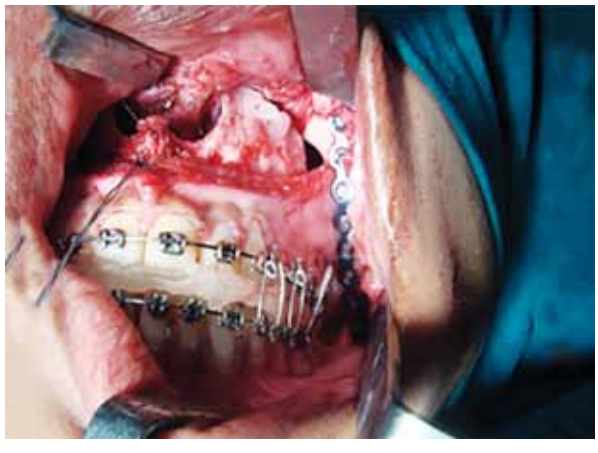

Fig. 4: Preoperatively molded plate transferred over the patient in Le Fort 1 advancement osteotomy

positioning device in Le Fort 1 osteotomy, it is made sure that it is fixed above the osteotomy line.

A change in condylar position less than 1 mm seems very good irrespective of the method used to achieve it. In the present case, there was no change in the occlusion from the desired position which clearly indicates condylar position change was less than 1 mm which is not significant.

CONCLUSION

Even though, condylar positioning device is difficult to use, too time consuming and considering the fact some adaptability of condyle that takes care of any malpositioning in most of the patients, It is still recommended to use for precise repositioning, harmonious, long lasting and stable results and to prevent TMD sequelae. Preoperatively molded titanium plate is comparatively easy to use as its adaptation to facial skeleton on patient becomes easy and saves additional time required for bending and adaptation.

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CASE REPORT

Verruciform Xanthoma-Histopathologically: A Distinct Entity

[1]Vipul Mohan Pawar, [2]Shilpa Patel, [3]Jigna Pathak, [4]Niharika Swain

ABSTRACT

Verruciform xanthoma (VX) is an uncommon benign muco-cutaneous lesion of unknown etiology. It is essential to diagnose this lesion as a varied entity of utmost importance as clinically their appearance could range from a simple leukoplakia or papilloma to as grave as squamous cell carcinoma SCC. Although this lesion is of multifactorial pathogenesis, a viral etiology like human papilloma virus (HPV) has been suggested in some cases. This rare, harmless lesion usually presents as a sessile or pedunculated, pale yellowish-to-red, papillary, granular or verrucous mucosal growth. Histopathologically, VX is characterized by the presence of parakeratinzed epithelium showing papillary or verrucous growth with thin rete ridges and connective tissue papillae extending up to the surface. The papillae characteristically consist of foam cells, also called xanthoma cells. We report two cases of VX of varied clinical appearance but very similar and characteristic histopathological presentation to be diagnosed as VX. The clinical diagnosis, though may be challenging; the histopathological features are diagnostic and well-defined. It is also noteworthy that in an improper biopsy, xanthoma cells may be scanty and their presence can be missed, especially if one is unfamiliar with the existence of this lesion.

Keywords: Verruciform xanthoma, Foam cells, Masticatory mucosa.

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INTRODUCTION

Verruciform xanthoma (VX) is an uncommon benign, hyperplastic lesion primarily of the oral mucosa, first described by Shafer in 1971.[1] Verruciforms xanthomas are usually asymptomatic, solitary and slow-growing lesions. Verruciforms xanthoma appears as a well-defined, sessile growth having smooth margins with papillary, granular or verrucous appearance.[2,3] Males are affected slightly more than females and the most frequently affected intraoral sites are gingiva, alveolus and hard palate.[2-4] The lesion probably represents an unusual reaction or immune response to localized epithelial trauma or damage. The hypothesis of an unusual reaction or immune response to localized epithelial trauma is supported by cases of VX that have developed in association with disturbed epithelium like lichen planus, lupus erythematosus, epidermolysis bullosa, epithelial dysplasia, pemphigus vulgaris, warty dyskeratoma, graft-*vs* host disease.[5] Clinically, it is seen as a well demarcated, soft, painless, sessile, elevated mass with papillary or roughened surface with an average size of 2 cm.[4] Histopathologically, foam cells are the characteristic of the lesion along with hyperplastic parakeratinzed squamous epithelium with elongated rete ridges of relatively uniform depth.[3,4]

Here, we report two cases of VX of varied clinical appearance but very similar and characteristic histopathological presentation.

[1]Postgraduate Student (3rd year), [2]Professor and Head [3]Professor, [4]Lecturer

[1-4]Department of Oral Pathology, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Vipul Mohan Pawar, Postgraduate Student (3rd year), Department of Oral Pathology, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: 09822387600, e-mail: vipul242428@gmail.com

CASE REPORTS

Case I

A 30-year-old male patient complained of gingival growth in his upper front region of the jaw since 2 to 3 months. Patient was apparently normal 2 to 3 months back after which he developed a painless small triangular gingival growth on the labial aspect of interdental papilla of 11 and 21 which had gradually increased to the present size. There was no pain, bleeding or trauma associated with the gingival growth. No aggravating or relieving factors were associated with the growth. Root canal treatment was done with 11 and 21 and porcelain fused metal bridge given from 14 to 22, 4 to 5 years back. All vital signs were within the normal range. Medical history was noncontributory. Intraorally, on inspection a localized gingival enlargement was present in the interdental papilla of 11 and 21 region approximately 1 × 2 cm in size and reddish-pink in color (Fig. 1). The localized gingival enlargement was well-defined, sessile having smooth margins and rough pebbly surface. On palpation, the enlargement was nontender, soft to firm in

consistency and was clearly demarcated from the adjacent apparently normal attached gingiva. There was no bleeding on probing, pockets or any other secondary changes. Considering the clinical features, a provisional diagnosis of papilloma, pyogenic granuloma, peripheral giant cell lesion, fibrous epulis and VX was made. An excisional biopsy was performed and sent for histopathological analysis.

H & E stained soft tissue section shows parakeratinized stratified squamous epithelium with papillary surface (Fig. 2). The connective tissue stroma comprises collagen fibers, blood vessels and numerous foam cells which are restricted to papillary layer of lamina propria. Moderate degree of chronic inflammatory cell infiltration is also seen (Fig. 3). Correlating the clinical and histopathological features, we arrived on the diagnosis of VX.

Case II

A 37-year-old male patient complained of growth in his upper left back region of the jaw since 1 to 2 months. Patient was apparently normal 1 to 2 months back after which he noticed a growth in left posterior palatal region involving the palatal gingiva and extending onto the hard palate. The growth had not increased in its size since its first appearance. Patient also experienced mild, intermittent type of pain since 15 days. No aggravating or relieving factors were associated with the growth. All vital signs were within the normal range. Medical history was noncontributary. Intraorally, on inspection, a well-defined, sessile nodular growth was present on palatal gingiva in relation to 26, extending on to the hard palate, with rough and pebbly surface measuring about 1 × 2 cm in size and reddish in colour (Fig. 4). On palpation, lesion was soft, tender with rough surface texture. Considering

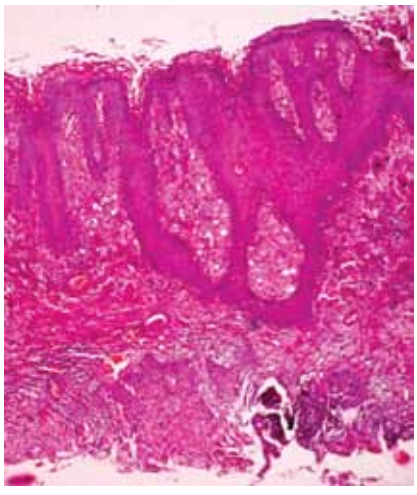

Fig. 1: Intraoral view shows localized gingival enlargement in the interdental papilla of 11 and 21 regions

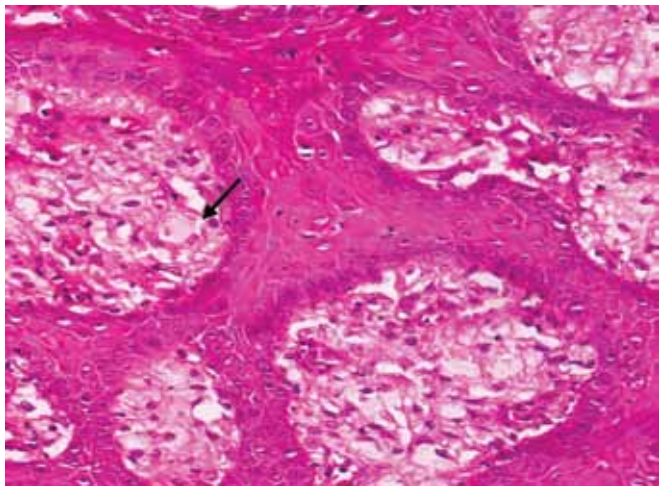

Fig. 2: H & E (40x) stained soft tissue section shows parakeratinized stratified squamous epithelium with papillary surface along with connective tissue papillae of variable length and thickness

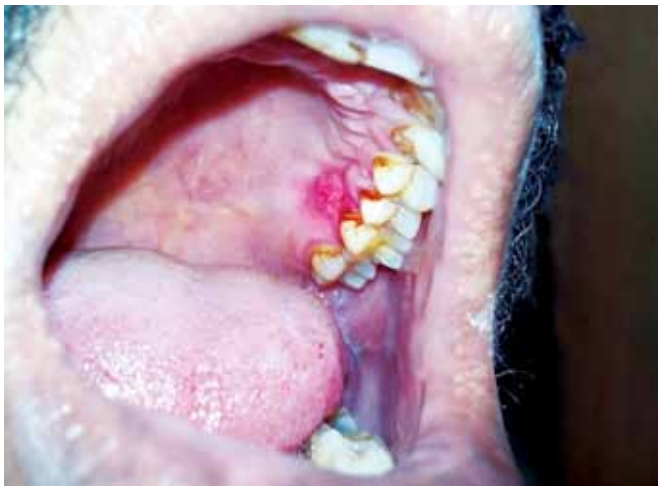

Fig. 3: H & E (400x) stained soft tissue section shows foam cells with clear-to-granular eosinophilic cytoplasm and eccentrically placed nuclei. Moderate degree of chronic inflammatory cell infiltration is also seen

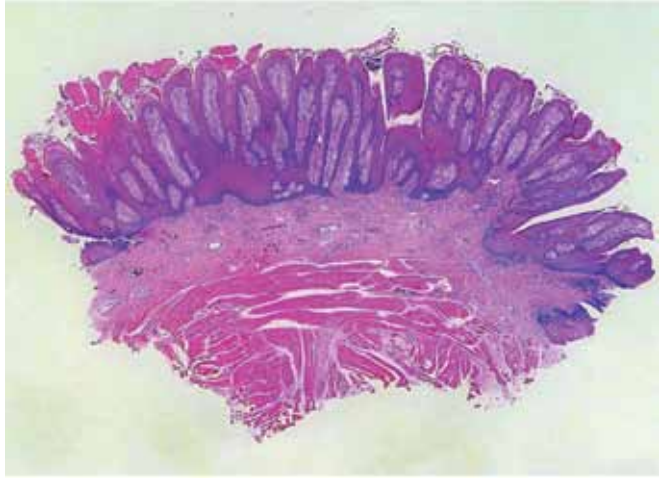

Fig. 4: Intraoral view shows well-defined, sessile nodular growth present on palatal gingiva in relation to 26 and extending onto the hard palate

the clinical features, a provisional diagnosis of non-homogenous leukoplakia, mucocutaneous lesion and VX was made. An excisional biopsy was performed and sent for histopathological analysis.

H & E stained soft tissue section shows parakeratinized stratified squamous epithelium with papillary surface (Fig. 5). Shallow clefts filled with parakeratin are seen between the epithelial projections. Uniform and elongated reteridges with foam cells entrapped in the connective tissue papillae are evident (Fig. 6). The sparse connective tissue shows few blood vessels and scanty inflammatory cells. Clinicopathologically, the diagnosis of VX was made.

DISCUSSION

Verruciform xanthoma manifests as a solitary, asymptomatic, slow-growing plaque or nodule with a papillary, granular or verrucous surface and sharply delineated margins that may appear pink, red, yellow, or white in color.[6] Approximately 75% of all oral VX lesions occur on the masticatory mucosa of the palate, gingiva or alveolar ridge. In the largest series of 282 cases of oral VXs reported by Philipsen et al, the most commonly affected site was the gingiva (57.4%), followed by the tongue (10.3%), hard palate (7.1%), buccal or vestibular mucosa (6.7%), floor of the mouth (4.6%), and soft palate (3.2%). Oral lesions of VX are mostly seen in males, with a male-to-female ratio of 1.1:1. Both our cases are in accordance with the literature as VX appeared in male patients and presented on the masticatory mucosa.

The etiopathogenesis of VX is unclear but appears to be associated with localized inflammation. Immunologic factors and viral etiologies have been also suggested. The prevailing theory is that epithelial tissue damage results in the breakdown of the phospholipid-rich cell membranes releasing lipids that are then taken up by the macrophages within the connective tissue that become lipid-laden or foamy in appearance. An immunologic pathogenesis has been suggested because of the predominant T cells infiltrate and decreased number of Langerhans cells in oral VX compared to normal tissue. Human papillomavirus (HPV) has not been demonstrated in VX lesions and viral particles have not been identified ultrastructurally.[7]

Based on light and electron microscopic studies, Zegarelli et al proposed that foam cells are lipid-laden macrophages and oral VX may develop as a consequence of epithelial entrapment with subsequent degeneration and lipid accumulation.[8] They suggested a local irritant as the initiator of the disease process, because oral VX is frequently found on masticatory mucosa where localized trauma is very common. The predominant cells in the inflammatory infiltrate were T cells (51.8 ± 2%), and (43.3 ± 2)% were positive for human leukocyte antigen DR antigens. They suggested that an immune response may play a role in VX pathogenesis.[7,8] Zegarelli et al introduced the concept that the cause of accumulation of lipid-containing macrophages is epithelial degeneration. The products of epithelial breakdown elicit an inflammatory response which is manifested by a predominant neutrophil infiltrate in the epithelium and a subsequent release of lipid material through the epithelium which finally is scavenged by the macrophages. They also suggested that a 'local irritant' could act as the initiator of this process. The fact that 70% or more of all VXs are located on the masticatory oral mucosa which is constantly subjected to trauma from mastication as well as to the sensitizing agents of foodstuffs, this theory seems quite plausible.[8,9]

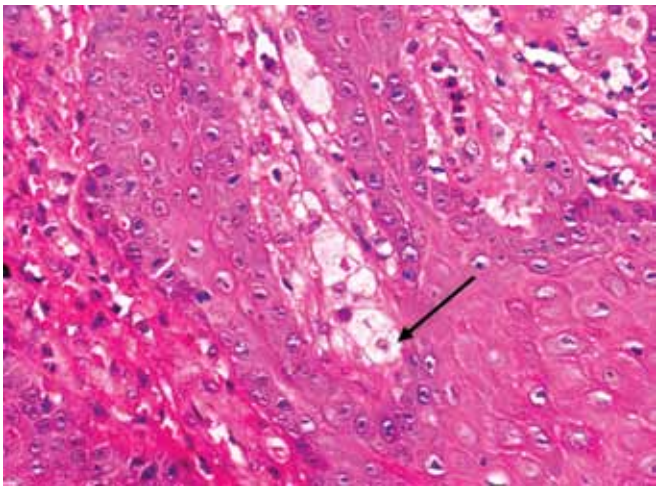

Fig. 5: H & E (40x) stained soft tissue section shows parakeratinized stratified squamous epithelium with papillary surface and elongated rete ridges uniformly extending into the underlying connective tissue

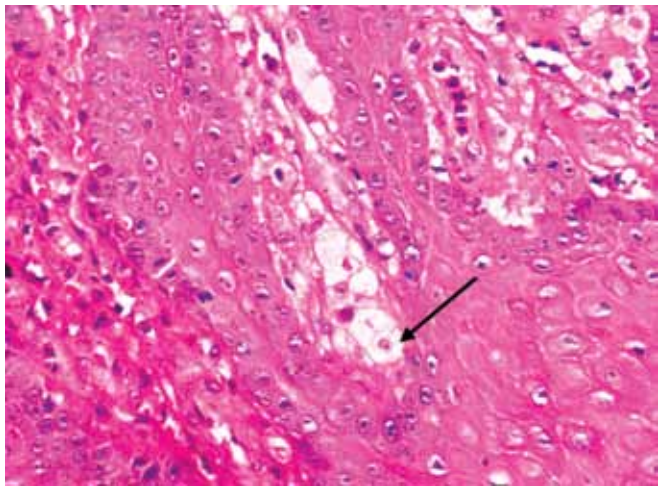

Fig. 6: H & E (400x) stained soft tissue section shows uniform and elongated rete ridges with foam cells entrapped in the connective tissue papillae are evident. The sparse connective tissue shows few blood vessels and scanty inflammatory cells

The differential diagnosis of VX includes: squamous papilloma, verruca vulgaris, condyloma acuminatum, verrucous carcinoma (VC) and squamous cell carcinoma (SCC). The presence of foamy macrophages, distinctive papillary epithelial proliferation, brightly eosinophilic parakeratin with keratin squames and neutrophilic infiltration are the characteristic features of VX that would help it in distinguishing from the above mentioned lesions.[10] Histologically, the differential diagnosis from VC is clearly an important one. The marked acanthosis with minimal or no atypia, and the presence of keratin-filled crypts are among the shared features. Squamous papilloma does not contain lipid-laden macrophages (foam cells) like VX, thus can be differentiated histologically. Xanthoma cells are also not a feature of either verruca vulgaris or condyloma acuminatum. The vacuolation of epithelial cells in the upper epidermis that is prominent in verruca vulgaris and condyloma acuminatum, is either absent or inconspicuous in VX. Presence of invasive epithelial proliferation, parakeratin plugging, pushing border and the lack of foamy histiocytic infiltrate would help in distinguishing VC from VX. Absence of cellular architectural atypia and breach in basement membrane as in SCC, exclude the possibility of VX.[3]

Surgical excision is treatment of choice for VX. The prognosis for VX is excellent and recurrence is extremely rare.

CONCLUSION

We report two cases of VX of varied clinical appearance but very similar and characteristic histopathological presentation. The clinical diagnosis, though may be challenging; the histopathological features are diagnostic and well-defined. It is also noteworthy that in an improper biopsy, xanthoma cells may be scanty and their presence can be missed, especially if one is unfamiliar with the existence of this lesion.

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CASE REPORT

Comprehensive Treatment of a Partially Edentulous Patient with Overdentures

[1]Ganesh Pandurang Mengal, [2]Sabita M Ram, [3]Jyoti Nadgere, [4]Naisargi Shah

ABSTRACT

Treatment of partially edentulous patients with few remaining teeth is very challenging. These cases can be successfully treated with natural teeth supported overdentures. Comprehensive treatment plan with natural teeth supported overdentures saves the proprioceptive response of the teeth, along with other benefits such as improved masticatory efficiency, better retention, stability, support as compared to conventional tissue supported complete dentures. The other most important benefit of overdentures is the psychological security of well retaining dentures which increases patient's confidence level. This article presents a case report in which a partially edentulous patient was successfully rehabilitated with comprehensive treatment of maxillary natural teeth supported overdenture with locator attachment (Zest Anchors) and mandibular partial denture.

Keywords: Overdenture, Locator attachment, Preventive prosthodontics.

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INTRODUCTION

Preventive prosthodontics emphasizes the importance of any procedure that can delay or eliminate future prosthodontic problems. Natural tooth supported overdentures is one of the best comprehensive treatments available today in preventive prosthodontics. Overdenture treatment is a notion which precluded the inevitability of 'floating plastics' in edentulous mouth.[1] It has always offered a sensible and prudent appeal for dentists and numerous patients have benefited by it.[1] The concept of overdenture is far from new. It is almost 150 years back when Ledger (1856) suggested the idea of leaving roots of natural teeth to support a complete denture.[2]

Today, the use of overdenture is one of the most feasible treatment plans available for rehabilitating the partially edentulous patients with very few teeth remaining. It provides better function than conventional tissue supported complete denture through a variety of parameters, such as improved masticatory efficiency, preservation of proprioceptive response, better stability, support, retention, and less trauma to the supporting tissues.[1,3] The other most important benefit of overdentures is the psychological security of well retaining dentures which increases patient's confidence level. This article describes a case report in which a partially edentulous patient was successfully rehabilitated with comprehensive treatment of maxillary natural teeth supported overdenture with locator attachment (Zest Anchors) and mandibular partial denture.

[1]Postgraduate Student, [2]Dean, Professor and Head, [3,4]Professor

[1-4]Department of Prosthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Corresponding Author: Ganesh Pandurang Mengal, Postgraduate Student, Department of Prosthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: 9028546321, e-mail: dr.ganeshmengal@gmail.com

CASE REPORT

A 62-year-old female patient residing at Panvel, reported to the Department of Prosthodontics of MGM Dental College and Hospital with the chief complaint of missing teeth and difficulty to masticate the food. Past medical history was not contributory. Patient had no habits. Patient gave history of earlier dental treatment for upper and lower missing teeth with fixed restorations 6 years back. However, she explained the loss of the bridges in both upper and lower left quadrant 2 years back.

On extraoral examination, patient had an ovoid facial form with straight facial profile, average facial features. Patient had short length of lips and was having a high smile line (Fig. 1). Patient did not complain of any pain, tenderness, clicking associated with temporomandibular joint.

Intraoral examination revealed a long span fixed partial denture on maxillary right side with 13 and 17 as abutments with 12, 14 to 16 as pontics. On examination 23 was previously prepared tooth. In mandibular arch porcelain facing full metal crowns were present on 32, 33, 41 and bridge on 42 to 45 with 42 and 45 as abutments and 43, 44 as pontics (Fig. 2). Both upper and lower fixed partial dentures fabricated were not in proper occlusal plane due to which patient complained of pain and difficulty while chewing. The vertical dimension of occlusion was decreased and bite was collapsed due to loss of posterior teeth.

Fig. 1: Preoperative extraoral view

Fig. 2: Preoperative intraoral view

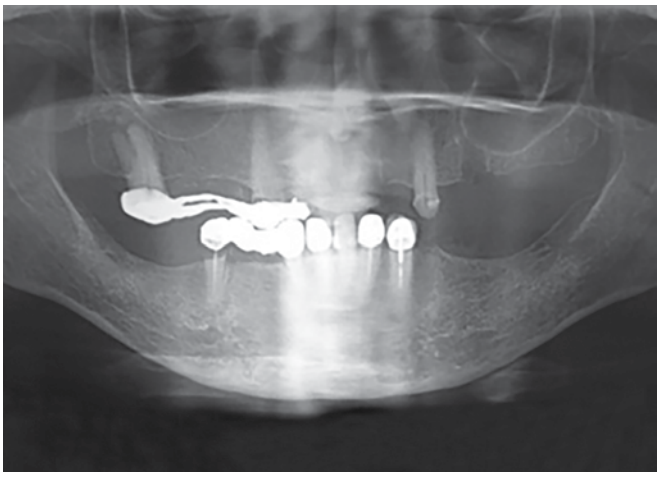

Fig. 3: Preoperative panoramic view

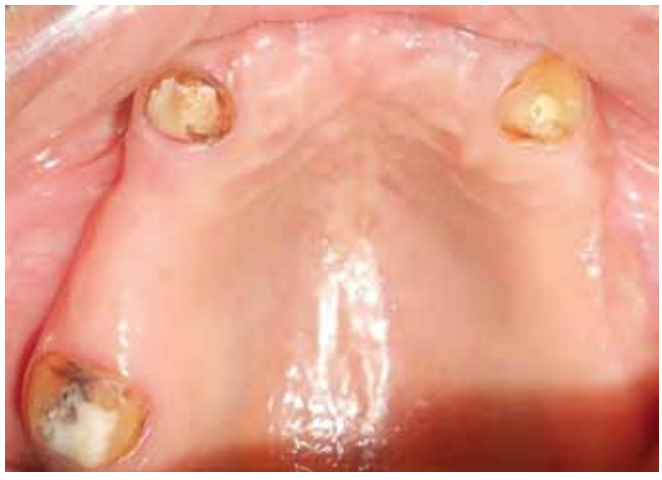

Fig. 4: Maxillary intraoral view after removal of faulty prosthesis

Radiographic examination revealed 32, 33 and 45 were root canal treated and caries were seen in 45 below the restoration (Fig. 3).

Patient was diagnosed having partially edentulous condition with restorations which needed to be replaced. The diagnostic impressions were made and casts were mounted with a tentative jaw relation to enable planning the final treatment.

TREATMENT PLAN

The fixed partial restorations and crowns were removed from both upper and lower arches (Figs 4 and 5). It revealed that 45 was grossly carious and unrestorable, so it was extracted. Diagnostic jaw relations were recorded and diagnostic try in was done.

After diagnostic try in, various treatment options like implant supported fixed partial denture for both the arches, overdenture in maxillary arch, a partial denture to replace missing teeth in mandibular arch were discussed with patient. Patient refused the treatment plan of implant supported prosthesis due to financial reasons and decided to go ahead with comprehensive treatment plan of maxillary natural teeth supported overdenture with locator attachment in 13, 23 and amalgam plug in 17. In mandibular arch porcelain fused to metal crowns on 31 to 33, 41, 42 were planned with acrylic partial denture to replace mandibular missing teeth, which would be later replaced with a cast partial denture.

PROCEDURE

Root canal treatment of 13, 17, 23, 41 and 42 were done. Decoronation of 13, 23 and 27 was done maintaining 1 mm of tooth structure supragingivally. Post space preparation was started with the pilot drill available in the Locator kit (Fig. 6). After preparation with the pilot drill, the countersink diamond bur was used. The preparation with the countersink diamond bur was only limited to prepare a very shallow recessed seat on the root surface in which female part of the attachment seats. After finishing the preparation in 13, paralleling post was placed in the prepared post space of 13. Parallelism was maintained between both the preparations by using these paralleling posts which were available in the kit (Fig. 7). After finishing the preparation with both 13 and 23, the teeth were cleaned with 0.2% chlorhexidine Gluconate (Hexidine, ICPA

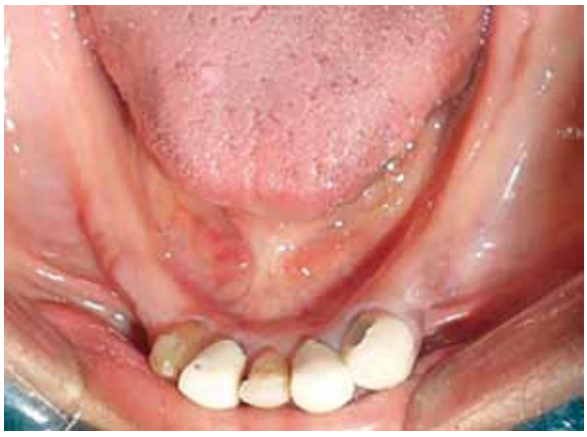

Fig. 5: Mandibular preoperative intraoral view after removal of faulty prosthesis

Fig. 6: Locator attachments with the drills

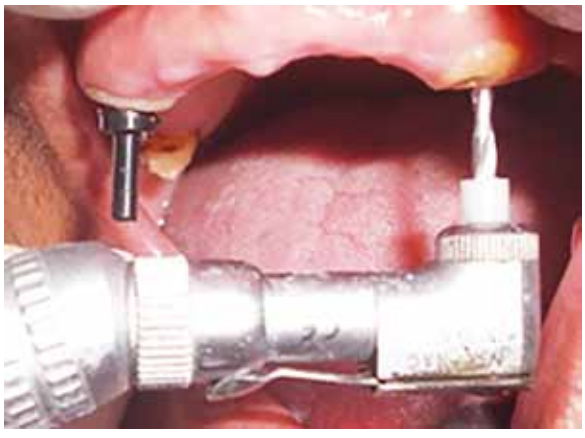

Fig. 7: Post-space preparation

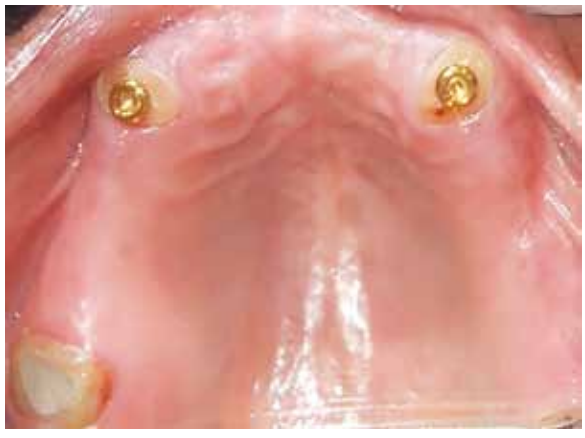

Fig. 8: Female components cemented

Fig. 9: Jaw relation

Fig. 10: Try in of waxed up dentures

Health Products Ltd). The locator attachments were then cemented with dual cure resin cement (RelyX U200, 3M ESPE). While cementation, paralleling pin were used as a handle for cementing the locator attachment into the completed preparation. Amalgam plug was given in root canal treated 17. After the cement and amalgam had set completely, final contouring of the remaining tooth structure was done in all three abutments (Fig. 8). In mandibular arch crown preparation was done with 31 to 33, 41, 42, final impression was made and porcelain fused to metal crowns were fabricated and cemented with zinc phosphate cement (ZinCem, Medicept Dental). On the next appointment conventional impression procedure was followed for making primary impression of both maxillary and mandibular arches. Final impressions were made with special trays. Border molding was done with low fusing impression compound and final impression was made with medium bodied polyether (Impregum

Soft, 3M ESPE). While making maxillary final impression the male part of attachments were placed on the cemented female attachments in both 13 and 23, so that space will be maintained in the denture to pick up the male parts in the denture after fabrication. Jaw relations were recorded (Fig. 9), try in was done (Fig. 10) and denture was fabricated in heat cure acrylic resin (DPI Heat cure, Mumbai). Both maxillary and mandibular dentures were inserted and recall was done after 24 hours.

One week post-insertion, when patient was comfortable with both the dentures, space was created in the maxillary denture in 13 and 23 regions, with acrylic trimmer to pick up the locator male assemblies in the denture. Locator male assemblies with black processing caps were placed into cemented females in 13 and 23 (Fig. 11). These processing caps set up the vertical resiliency needed for the final male assembly. It was verified that the denture is seating perfectly on the maxillary tissue surface without any interferences due to the locator attachments in 13 and 23. White processing sleeves were placed on the attachment which prevented blocking of the attachment with auto-polymerizing acrylic resin while picking up the attachments. Auto-polymerizing acrylic resin (DPI- Repair Resin, Mumbai) was mixed with the monomer and placed in the denture base in 13 and 23 regions in dough stage, and the denture was placed in mouth and patient was instructed to close the teeth in centric occlusion. Minimum acrylic resin was used to prevent the excess flow of resin on intaglio surface of the denture. Once the acrylic resin was completely set, excess acrylic was trimmed off. After finishing and polishing of the denture it was placed in patient's mouth to evaluate the complete sitting of the denture and occlusion. The black processing cap was replaced with white retentive cap (Fig. 12). Denture insertion was done (Figs 13 and 14). Instructions were given to the patient about placement and removal of the overdenture, hygiene maintenance and periodic visits for professional cleanings and attachment evaluation.

DISCUSSION

Many of the patients who have complete dentures are dissatisfied with the limited retention and stability of their dentures. They always have fear of loosening of the denture while talking and eating. Resorption of the alveolar ridges, decline in the patient's neuromuscular function, decrease in proprioceptive response resulting from the loss of teeth, eventually leads to failure of

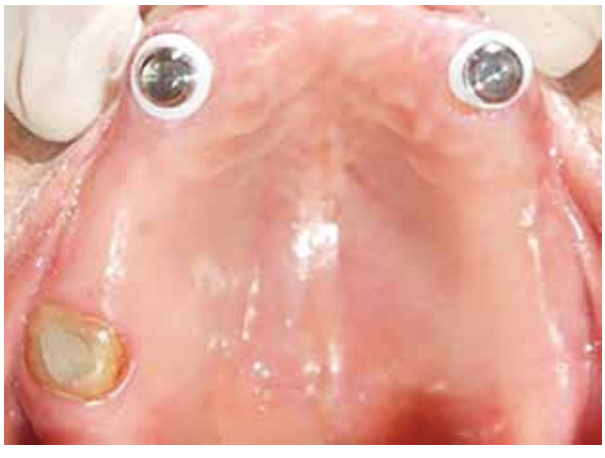

Fig. 11: Preparation for pick up of the attachment in the denture

Fig. 12: Attachments picked up in the denture

Fig. 13: Preoperative photograph

Fig. 14: Postoperative photograph

dentures. These problems can be overcome with the help of overdentures. It provides better function than conventional tissue supported complete denture through a variety of parameters such as improved masticatory efficiency, preservation of proprioceptive response, better retention, stability, support and less trauma to supporting tissues. Alveolar bone resorbs at a faster rate without the support of natural teeth. But in case of overdentures, retained teeth will maintain the alveolar bone support and also prevent the rapid bone loss.[4] Rissin and House[5] analyzed the masticatory performance of three dental patient groups- those with natural dentition, those wearing complete dentures, and those wearing overdentures. Food was chewed by each patient, then passed through a No. 12 sieve. The chewing efficiency of patients with natural dentition was measured at 90%, complete denture wearers 59%, and patients with overdentures 79%. Chewing efficiency with a root-supported overdenture was 34% higher in patients who previously wore a complete denture. This increase in function, retention, and stability leads to better health and phonetics in denture wearers. These factors also elevate patients' self-esteem and increase their confidence level. In this case patient desired the dentures which will serve her main requirement of mastication. She wanted her denture to be well retained without loosening while speaking and chewing and she also wanted to save her remaining natural teeth. Natural tooth supported overdentures fulfills the requirements of the patient.

Root-supported overdentures gain their retention and stability from the use of attachments. There are mainly three types of overdenture attachment designs: bar type, supraradicular type, and intraradicular type. The bar type spans an edentulous area and connects two or more teeth with rigid fixation. Supraradicular type attachments are placed on top of the existing root structure. Intraradicular attachments are placed within the endodontically treated root structure of natural teeth. All three designs can be used in the construction of maxillary and mandibular overdentures.[6,7] But overdentures require careful assessment of vertical space. There must be sufficient room for the possible attachments, together with an adequate thickness of denture base material and artificial teeth, all this without jeopardizing the strength of the denture.[8] Locator attachment (Zest Anchors) requires least vertical space with a total attachment height of 3.17 mm which is least among available attachments for natural teeth. The pivoting locator male allows a resilient connection for the prosthesis. The retentive nylon male remains completely in contact with the female socket while its metal denture cap has a full range of rotational movement over the male. The unique dual retention provides the locator attachment with a greater retention surface area than other attachments. Locator attachment creates a longer lasting, more retentive attachment for natural teeth supported overdentures. The supraradicular design includes a choice of a straight post or two angled posts (10 and 20 degrees) to accommodate divergent roots. Locator male attachments are available in varying amounts of retention. The black male attachment provides the least amount of retention at 1.0 pound: the pink male attachment provides 3.0 pounds of retention; and the white male attachment provides 5.0 pounds of retention and is considered the regular or standard for this system. With two to four abutment teeth, the maximum retention should be used (the white male at 5.0 pounds per attachment). In this case, in diagnostic jaw relation it was observed that the available vertical space for attachment is minimal. Locator attachment fulfills all the requirements.

CONCLUSION

A comprehensive treatment was planned for the patient. Replacing crowns to achieve the proper occlusal plane was important. Maintaining few teeth in the maxillary arch enabled the fabrication of the overdenture with locator, this enhanced the retention of the dentures with long-term preservation of the edentulous ridges keeping in mind the patients interest.

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