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From the Editor's Desk

Dear Readers

I feel privileged to be bestowed with the honour of being the Editor-in-chief of Asia Pacific Dental Journal. I feel that with your support, this journal has been elevated to a new scale. Let us liberate ourselves from believing that we are less than our contemporaries abroad. We are immensely talented, especially in the field of scientific thinking, as we have a pool of rich resource within. Our journal tends to dip into that pool to garner the essence of scientific knowledge and impart it to our fellow colleagues and students.

We strive for providing you with the recent developments and advancements in dentistry, in order to uplift the present dental education. So, its my request to all the readers, to be a part of our knowledge sharing family and make it a big success. My heartfelt gratitude to all the contributing authors, who have submitted their precious work in our journal. I hope that through our esteemed journal, we are able to give immense justice to your credentials.

Thank you.

Dr. Bhagwant Singh
Editor

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CALCIUM LOSS FROM RADICULAR DENTIN FOLLOWING TREATMENT WITH VARIOUS IRRIGATING SOLUTIONS USING ATOMIC ABSORPTION SPECTROPHOTOMETRY- A PRELIMINARY STUDY

Dr. Naman Sharma, Dr. Kundabala M, Dr. Sukhpash Singh Sandhu, Dr. Ravneet Dhingra

ABSTRACT

Chelating agents react with calcium ions in hydroxyapatite crystals causing alterations in its chemical structure. Thus the Calcium/Phosphorus ratio of dentin is changed altering original proportion of organic and inorganic components and changing its permeability, microhardness and solubility. Demineralization of radicular dentin following use of 0.2% cetrimide, 7% maleic acid and their combination using atomic absorption spectrophotometry was evaluated. Single rooted human teeth were sectioned longitudinally and immersed in 0.2% cetrimide, 7% maleic acid and their combination. 0.2% cetrimide showed calcium loss of 1.7 ppm, whereas 7 % maleic acid and combination of 0.2% cetrimide and 7% maleic acid showed calcium loss of 426.1 ppm and 368.9 ppm respectively. All values were statistically significantly different from each other ($p < 0.09$). The combination of 0.2% cetrimide and 7% maleic acid is the best alternative as it causes significantly lesser damage to dentin when compared to maleic acid alone.

Keywords: Maleic acid, Cetrimide, Atomic absorption spectrophotometry, Smear layer, Calcium.

Introduction

The chemo-mechanical preparation of root canal represents one of the most important phases of root canal therapy. Irrespective of the method of instrumentation, an amorphous layer is formed on the root canal walls, known as the smear layer.[1] It is 1-2 µm in thickness, extends upto 40 µm into the dentinal tubules and is composed of inorganic particles of calcified tissue, and organic elements like pulp debris, odontoblastic processes, microorganisms & blood cells in dentinal tubules.[2]

Pashley proposed that a smear layer containing bacteria or bacterial products might provide a reservoir for irritants.[3] It has been shown that smear layer itself may contain bacteria, and protect those within dentinal tubules.[4] It can also hinder penetration of intracanal disinfectants & sealers into dentinal tubules and potentially compromise the seal of the root canal filling.[5,6] Orstavik and Haapasalo showed the importance of removal of smear layer and presence of patent dentinal tubules in decreasing the time necessary to achieve disinfection.[7] A recent meta-analysis of leakage studies concluded that the removal of smear layer improves the fluid tight seal of the root canal system.[8] Thus it is currently considered important to promote techniques and products that can prevent the formation or eliminate the smear layer from root canal dentin.

Complete removal of smear layer demands use of chelating agents or organic acids. Maleic acid has been used as acid conditioner in some adhesive systems, and has been reported to remove the smear layer when used in adhesive dentistry. Prabhu *et al* evaluated different concentrations of maleic acid in smear layer removal from root canal, and found that when used at concentration greater than 7%, it caused damage to intertubular dentin.[9] Ballal *et al* found that maleic acid was similar to EDTA in smear layer removal from coronal and middle third of root canal, but had a better ability at the apical third.[10]

The wettability of chelating agents like maleic acid and EDTA is limited,[11] therefore, some solutions combine chelating agents with surfactants in order to enhance their wettability and thus penetration into the dentinal tubules. Cetrimide, a cationic surfactant is, one such agent that possesses bactericidal activity along with the capacity to eradicate smear layer in concentrations of as little as 0.0312% after 1 minute of exposure.[12]

Calcium (Ca^{++}) and phosphorous (P) present in hydroxyapatite crystals are the main inorganic elements of dentin.[13,14] Dogan and Calt reported that the ratio of Ca and P is approximately 1.67M, depending on crystal type, availability of Ca, the anatomical location, and technique of determination. Chelation is a physico-chemical process that prompts the uptake of multivalent positive cations by specific chemical substances. Chelating agents react with Calcium ions in hydroxyapatite crystals and cause alterations in chemical structure of human dentin.[15] The Calcium/Phosphorus ratio of the dentin surface is changed, which alters the original proportion of organic & inorganic components. This in turn changes the permeability, microhardness, solubility characteristics of dentin, and adhesion of sealers to dentin.[16,17,18]

Therefore the aim of the present study was to evaluate and compare the demineralization of radicular dentin following use of 0.2% cetrimide, 7% maleic acid and their combination using atomic absorption spectrophotometric analysis.

Materials and methods

The present study was conducted in department of Conservative Dentistry & Endodontics. Ethical committee approval was taken from Institutional Ethics Committee.

Sample collection

Inclusion criteria: Eight human extracted single rooted mandibular premolar teeth with type 1 canal anatomy extracted as part of orthodontic treatment were included.

Exclusion criteria: Broken teeth, carious teeth, teeth with internal or external resorption, and teeth with hypoplasia were excluded.

Specimen preparation:

Soft tissue and calculus of extracted teeth was mechanically removed from the root surface. The teeth were verified radiographically as having patent and almost straight canals. Crowns were removed at CEJ using a high speed diamond bur (TF-21, Mani Inc, Japan) under water cooling. Apical portion of each tooth was removed, until a constant length of 15mm was attained for all samples. Each root was sectioned longitudinally by starting from cervical with a low speed diamond disc (Dentsply, Milford, DE) and separated buccolingually to expose entire extent of root canal, making a total of 15 segments. Each half was weighed on a precision balance and standardized to 0.22g before use.

The 15 specimens were randomly divided into 3 separate groups of 5 samples each. Specimens were grouped according to the irrigating solutions used as Groups I, II and III for 0.2% cetrimide, 7% maleic acid and their combination respectively.

Solution preparation:

For cetrimide, 0.2 grams of cetrimide powder was mixed with 100ml of distilled water in a flask to prepare 0.2% cetrimide. Similarly, 7 grams of maleic acid powder was mixed with 100ml distilled water to prepare 7% maleic acid. The combination of the two solutions was prepared by adding 50ml of 0.2% cetrimide and 7% maleic acid each.

With the pH meter, the pH was adjusted for 0.2% cetrimide to 4.22, and 7% maleic acid to 1.47 and the combination to 2.35

Calcium loss estimation:

Cemental surface of each root segment was coated with nail polish to prevent entry of irrigating solutions. The specimens were immersed in containers for 5 minutes each containing 5ml of irrigating solutions.

At the end of treatment period, samples were rinsed with distilled water and dried. After immersion in experimental solutions, the solutions were maintained under constant agitation using magnetic multistirrer to homogenize extracted calcium in solution. The level of calcium in the solutions was determined using Atomic absorption spectrophotometry (GBC 932 Plus) using an N_2O-acetylene flame at a wavelength of 422.7nm. The instrument was calibrated with known standards of 2, 4 and 6 µg/ml.

Results

Data analyzed using Statistical Package for Social Sciences (SPSS), version 11.5 (SPSS Inc., Chicago IL). Descriptive statistics were calculated for all groups using Mann−Whitney U−test. Statistical program for the calcium loss values with $p < 0.09$. Assessment of calcium liberation from radicular dentin was done using atomic absorption spectrophotometry. The data for each group was expressed in ppm of Calcium (Table 1).

Group B (7% maleic acid) showed the highest mean calcium loss from radicular dentin (426.1ppm), followed by group C (0.2% cetrimide + 7% maleic acid) (368.9ppm) and group A (0.2% cetrimide) (1.7ppm). Mean calcium loss (in ppm) from radicular dentin following treatment with various irrigating solutions is expressed in figure 1.

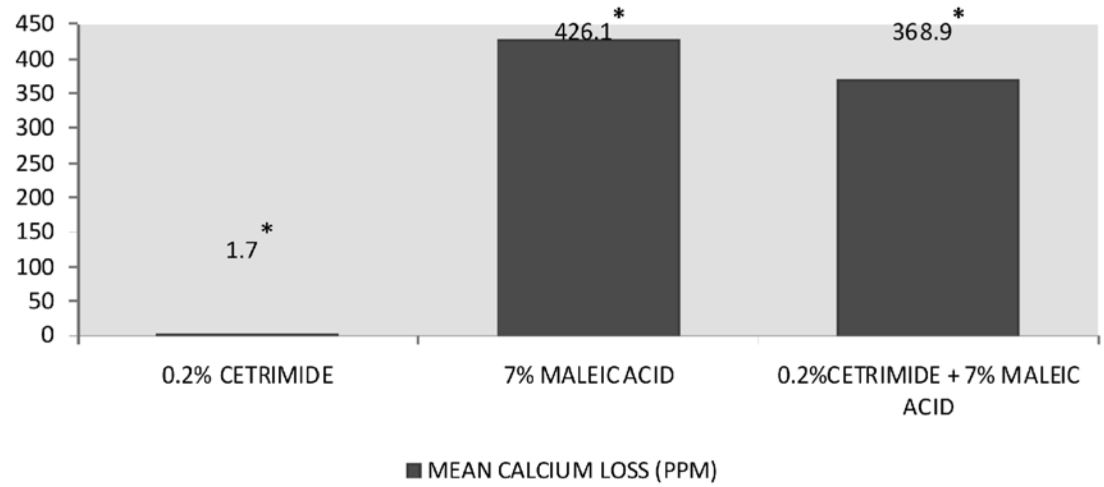
Discussion

Endodontic success depends heavily on effective chemomechanical debridement of the root canal with the use of instruments and irrigating solutions. A number of factors may present obstacles in achieving complete disinfection of the root canal system, such as the complex root canal morphology, presence of fins, cul de sacs, lateral canals and dentinal tubules. Bacteria may be present not only in these irregularities but also in the dentinal tubules at varying depths.[19]

Shovelton and Chirnside in their studies have shown that the smear layer itself may contain bacteria and may aid in the adherence of microorganisms to the root canal walls, and also prevent antimicrobial agents from gaining access to

Table 1: Calcium extract readings using atomic absorption spectroscopy (expressed in ppm of ca)

SAMPLE	CALCIUM LOSS (PPM)		
	Group A	Group B	Group C
1	2.7	423.4	361.7
2	1.6	420.7	372.4
3	1.3	427.5	370.2
4	1.0	430.4	366.9
5	2.1	428.7	373.4



* p< 0.09

Figure 1: Mean calcium loss (in ppm) from radicular dentin following treatment with various irrigating solutions

underlying contaminated dentinal tubules.[20,21] It is suggested that removal of smear layer may enhance seal of root canal filling by promoting adhesion and penetration of sealers into the dentinal tubules.[6] The presence of smear layer has reported to decrease dentin permeability by about 25-50%. This can result in reduced bactericidal effect of intracanal medicaments and irrigants due to their inability to penetrate dentinal tubules.[22] Because of these concerns; one may deem it prudent to remove the smear layer in infected root canals.

No single agent has been found capable of removing both organic and inorganic materials of the smear layer. Hence, combination of irrigants has been recommended for chemomechanical preparation of the root canal. Sodium hypochlorite has been shown to be an effective antimicrobial agent which dissolves organic pulpal tissue, but it is ineffective in removing the smear layer alone.[23] More recently, removal of smear layer by acids or chelating agents has gained a great deal of attention. The components of smear layer are very small particles with a large surface-mass ratio, which makes them soluble in acids. Because of this characteristic feature, organic acids have been used to remove the smear layer.

Several studies have been reported regarding smear layer removal ability of maleic acid in adhesive dentistry. Erickson in 1989 reported that maleic acid when used with HEMA as a conditioner to condition the dentin surface, solubilizes and dissolves the smear layer.[24] Prati *et al* (1990) reported that maleic acid was capable of complete removal of smear layer and smear plugs coupled with extensive exposure of collagen fibrils.[25] Prabhu *et al* showed that 5% and 7% maleic acid removed smear layer more effectively than EDTA and NaOCl, whereas 10% and 15% also removed the smear layer but resulted in demineralization and damage to the intertubular and peritubular dentin.[9] Ballal *et al* (2009) found that 7% maleic acid was similar to EDTA in smear layer removal in coronal and middle third of root canal, but had a better ability at the apical third as compared to EDTA.[10] Thus in our study we used 7% concentration of maleic acid, as higher concentrations are known to produce erosion of dentin.[9]

Some endodontic irrigants are capable of altering the chemical composition of dentin by removal of calcium ions present in hydroxyapatite crystals. Thus it is important to test the effect that these irrigants have on radicular dentin, as teeth that have been structurally weakened by root canal therapy may have their fracture resistance further reduced by a decrease in the resilience of dentin on using these irrigants.[26]

In the present study, all decalcification procedures were carried out on the same day at room temperature, because an increase in temperature accelerates the demineralization process. Specimens were immersed for a period of 5 minutes. This duration is more realistic in terms of clinical practice.[27] Also; it has been shown that the main effect of chelator substances occurred after 5 minutes of application.[28] Solutions were not renewed during the 5 minute immersion. Renewal of the solution increases the effectiveness of its action compared with a single continuous application over the same time because it maintains the pH at neutral levels, thereby increasing its moisturizing and decalcifying capacity.[29]

In the present study, Calcium loss estimation is done by Atomic absorption spectroscopy. The ease and speed at which precise and accurate determinations can be made with this technique have made atomic absorption one of the most popular methods. It is a technique for determining the concentration of gas phase atoms using the absorption of light. Since samples are usually liquids, the atoms or ions must be vaporized in a flame or graphite furnace. The atoms absorb UV or visible light, and make transitions to higher energy levels. This amount of energy is specific to a particular electron transition in a particular element, and in general, each wavelength corresponds to only one element. This gives the technique its elemental selectivity. The analytic concentration is determined from the amount of absorption. Concentration measurements are usually determined from a working curve after calibrating the instrument with standards of known concentration.

In the present study, 7% maleic acid showed the highest Calcium loss from radicular dentin, followed by combination of 7% maleic acid with 0.2% cetrimide and 0.2% cetrimide alone with statistical significant differences between all groups.

Maleic acid is highly acidic, with a very low pH (1.47) and a higher etching potential (pKa-1.8), which may be responsible for its better demineralizing effect within a short periods of time.[30] Ballal *et al* in a similar study found that maleic acid reduced the calcium level significantly more than EDTA upto 5 minutes. However, at 10 and 15 minutes, EDTA caused significantly greater demineralization.[33] However, in a contrasting study, [31] Emboava Spano *et al* showed that maleic acid showed less calcium extraction from radicular dentin as compared to 10% citric acid and 15% EDTA. In addition, maleic acid has been shown to be less toxic at a comparable dose of EDTA, suggesting its potential use as a root canal irrigant.[32]

When combination of maleic acid and cetrimide was used, due to less acidic nature of cetrimide solution, the ph of combination was not as low as maleic acid alone. This explains, why lesser amount of calcium loss was seen when cetrimide was added to maleic acid. Therefore the combination would cause lesser amount of peritubular and intratubular damage to dentin. Also it has been shown in a previous study, when cetrimide is added to maleic acid, it improves the penetration of solutiom into dentinal tubules and its ability to eradicate *E. faecalis* biofilm.[34]

However further research is needed to evaluate the effect on smear layer removal using scanning electron microscopic analysis with larger number of samples.

From the results of the present study it can be concluded that combination of 0.2% cetrimide and 7% maleic acid is the best alternative as it causes significantly lesser damage to the intertubular and peritubular dentin when compared to maleic acid alone.

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POST RETRIEVAL & REATTACHMENT OF FRACTURED MAXILLARY LATERAL INCISOR WITH FIBRE POST : A CASE REPORT

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ABSTRACT

Maxillary incisors are the most frequently involved teeth in traumatic injuries. According to some authors and clinicians, in complex fractures root canal treatment followed by segment reattachment with fiber post is easy, economic and better option as compared to other treatment modalities. The treatment provides long term results with better esthetics and eventually lesser chair time. The prognosis of this treatment protocol depends on the level at which fracture has occured, periodontal health and the time elapsed between fracture and reattachment.

Keywords: Fragment Reattachment, Fiber post, Post retrieval

Introduction

Uncomplicated and complicated anterior crown fractures are a common form of injury that mainly affects children and adolescents. The most commonly affected teeth by trauma are the maxillary incisors, with a reported share of 96% of all the crown fractures observed (80% central incisors and 16% lateral incisors). The eruptive pattern of maxillary incisors and their position in the arch is attributable for this risk of increased traumatic injuries. Andreasen has classified crown fractures as enamel infractions, enamel fractures with little or no dentin involvement, enamel dentin fractures with no pulp involvement (uncomplicated crown fractures) and enamel-dentin fractures with pulpal involvement (complicated crown fractures).[1]

Management of complicated crown fractures is a multifactorial process influenced by the extent and pattern of fracture (biological width violation, endodontic involvement, alveolar bone fracture), restorability of fractured tooth (associated root fracture), secondary injuries (soft tissue status), presence/absence of fractured tooth fragment and its condition for use (fit between fragment and the remaining tooth structure), occlusion, esthetics, finances, and prognosis.

In case of complicated fractures where the fractured segments are closely approximating, root canal treatment (RCT) followed by reattachment of the fractured segment with fiber post reinforcement is a feasible option.[2] It has been suggested that fiber post luted with resin cement increases the retention of the segment and also provides a monoblock effect.[3] The advantages of reattachment techniques over restorations obtained with composite resin systems may be summarized as: better and long-lasting esthetics, improved function, immediate results, a positive psychosocial response, and faster and less complicated procedures.[4]

Case Report: A 27 year old male patient reported to the Department of Conservative Dentistry and Endodontics, Darshan Dental College & Hospital, Udaipur with the chief complaint of mobility and discoloration in left upper front tooth. Patient had undergone root canal treatment 1 year earlier in the same tooth. Clinical and radiographical examination revealed root canal treated left maxillary lateral incisor with mobile coronal fragment. Radiographic examination further revealed fiber post cementation in the same tooth. A fracture line was seen running obliquely from the labial to palatal side in an apical direction. Local examination revealed the tooth was non tender on percussion with surrounding intra oral soft tissue and alveolar bone appearing normal.

Medical history was non – contributory.

After thorough clinical examination and subsequent discussions, the following treatment modalities were presented to the patient:

a. Extraction followed by Fixed Partial Denture or Implant.

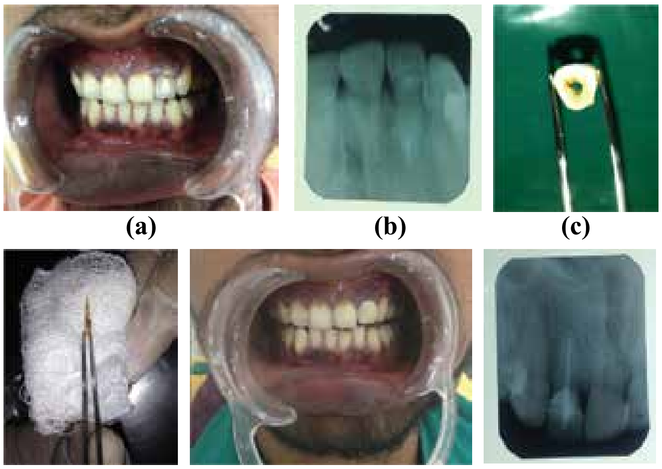
b. Reattachment of the fractured fragment.

After discussing the overall advantages, disadvantages, cost, prognosis of each treatment option, the patient agreed for **Tooth Fragment Reattachment Procedure**.

To gain access to the gingival extent of the fracture line and to better evaluate its relation to the bone crest, palatal mucoperiosteal flap was elevated using periosteal elevator. Hemostasis was achieved. Fractured fragment was then atraumatically detached and thoroughly cleaned with 2% chlorhexidine solution and stored in normal saline. Fiber post was retrieved with the help of ultrasonics, followed by post space modification to completely remove the luting cement. Light transmitted fiber post (Tenax fiber post, Coltene Whaledent) was selected and its length was verified radio graphically. Dental grooving and circumferential beveling of the fractured fragment was done for better adaptation. After verifying the fit of fiber post and fractured fragment, self etch bonding agent (One Coat, Coltene Whaledent) was applied both on post as well as canal surface and air thinned. The adhesive was then light cured for 15 seconds. Selective etching of enamel of the fractured fragment was done using 37%

phosphoric acid for 20 seconds. The etchant was then rinsed and the fragment air dried before application of the bonding agent (One Coat) which was light cured for 15 seconds. Fiber post and crown fragment were then together luted within the tooth using dual cure resin cement (Fluorocore 2+, Dentsply) and light cured for 40 seconds each from both labial as well as palatal side.

The patient was kept under periodic review and was found to be asymptomatic with acceptable esthetic results..



(a) (b) (c)

(d) (e) (f)

(a) Preoperative photograph showing fractured Maxillary lateral incisor, (b) Preoperative radiograph showing root canal treated fractured maxillary lateral incisor, (c) Removed fragment, (d) Post retrieval, (e) Post operative photograph after reattachment of fractured fragment, (f) Postoperative radiograph after fragment reattcahment.

Discussion: Crown-root fractures generally result from a horizontal impact. These fractures comprise 30%-50% of injuries to dental hard tissues, with 80% involving pulp exposure.[5] Moreover, this type of injury commonly results in functional, esthetic, and an emotional sequelae, often requiring multidisciplinary intervention.[6-8]

Reattachment of the crown fragment to a fractured tooth influences esthetics by retaining natural translucency and surface texture and should be the first choice of treatment options for crown fractures of anterior teeth. Long lasting and predictable esthetics can also be obtained in a single appointment.[9] First described by Chosack and Eidelman in 1964, restoration of fractured teeth using the dental fragment offers a fine way to reinstate the natural shape, contour, surface texture, occlusal alignment, and color of the fragment[10].

The quality of fit between the segments is clinically important factor for the longevity of the reattached crown. So the fitting of fractured fragment to the remaining tooth structure should always be thoroughly checked.[11]

The choice of treatment for complicated crown and/or root fractures which involves the pulp depends upon several factors viz the developmental stage of a tooth, time elapsed between occurrence of an accident and treatment rendered as well as concomitant periodontal injury. Success of reattachment will depend on how dehydrated the tooth fragment is, because the longer it remains dehydrated, lesser will be the fracture strength of the tooth; however fracture strength can be reinstated by hydrating the fragment.[12]

In the present case longitudinal grooves and circumferential bevel was given to enhance the retention of the fracture fragment with the crown. The resistance of the fracture segment can be directly proportional to the surface area of adhesion.[13]

Reinforcement of reattached fragments using post has been widely reported in literature. Although, many techniques with various materials have been suggested, resin based restorative materials with fiber post may be considered as best option because of suitable elastic modulus, esthetics, good bonding between post and cement and relatively less chair time.[14]

The favorable outcome of the treatment in this case was in all probabilities because of proper isolation, good adaptation of margins and extra retentive features provided at the time of attachment of fragment.

Conclusion

The clinical success in the present case has demonstrated that fragment reattachment is a relatively fast, conservative, inexpensive and psychological acceptable approach as compared to other treatment modalities for fractured anterior teeth.

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ROOT FRACTURES IN PERMANENT ANTERIOR TEETH: A REVIEW

Pinky Thakkar, Tarjani Momin, Kuldip Shah, Mohita Gupta, Sejal Modi

ABSTRACT

Injuries to the teeth of children or adults present unique problems in diagnosis and treatment. The diagnosis of the extent of the injury after a blow to a tooth, regardless of loss of tooth structure is difficult and often inconclusive. Clinical management of a root fracture depends on its position and the extent of root involvement. Conservative treatment of root fractures below the alveolar crest may require reduction of the displaced fragment, immobilization and relief of the occlusion. However, spontaneous healing of root fractures without treatment has been documented. The location of the fracture determines the prognosis of the tooth. If the fracture is close to the cervical one third, prognosis is considered to be poor due to a short mobile coronal fragment, with less probability of healing with hard tissue, and possible bacterial contamination of the root canal from the gingival crevice. The current review article discusses the various types of root fractures, their diagnosis and treatment.

Keywords: Root fracture, Anterior tooth, Splint, Repositioning, Cyanoacrylate, MTA

INTRODUCTION

Root fractures are defined as fractures involving the dentin, cementum and pulp.[1] The frequency of root fractures in permanent teeth is only 0.5% to 7%, and in deciduous teeth just 2% to 4%.[2] Root fractures occur mainly in the central (68%) and lateral (27%) maxillary incisors; in contrast; only 5% of root fractures are found in mandibular incisors.[3] Root fractures can be broadly classified as horizontal (transverse); or vertical. Vertical root fractures usually characterized by an incomplete or complete fracture line that extends through the long axis of the root toward the apex. It represent between 2 and 5 percent of crown/root fractures, with the greatest incidence occurring in endodontically treated teeth and patient older than 40 year of age. Horizontal root fractures are characterized by rupture of hard structure of the root, affecting dentin and cementum, separating the tooth into an apical segment, which is often displaced.

ETIOLOGY

Root fractures may occasionally be caused by para-functional habits, traumatic occlusion, extensive tooth decay and iatrogenic causes as listed below.[4]

1. Endodontically treated teeth
2. Excessive canal shaping
3. Excessive restorative procedures
4. Excessive forces during obturation
5. Inappropriate choice of tooth for a bridge abutment
6. Excessive polymerization shrinkage of composite resins
7. Large metallic restoration which is stronger than tooth structure
8. Trauma from occlusion
9. Endodontic post expansion because of corrosion products
10. Inflammatory root resorption resulting from advanced periodontitis
11. Clenching or bruxism

CLASSIFICATION: Root fractures can be broadly classified as Horizontal and vertical1

Horizontal root fracture

Horizontal root fracture is usually characterized by a fracture line perpendicular to the long axis of the root of a tooth (Figure 1).

It is classified on the basis of (Figure 2): [2]

1. Location of fracture line - Cervical, middle and apical
2. Extent of fracture - Partial and total
3. Number of fracture lines - Simple, multiple and comminuted
4. Position of coronal fragment - Displaced and not displaced

Fig. 1: Horizontal root fracture of maxillary right central incisor

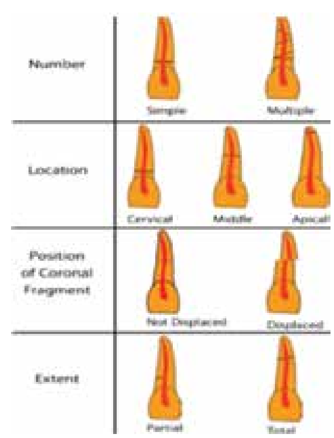

Fig. 2: Classification of horizontal root fracture

Depending upon the position of the fracture line, transverse root fractures can also be classified into three zones as follows (Figure 3):

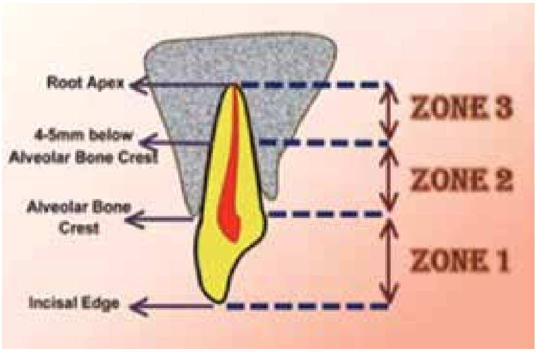

Fig. 3: Classification of transverse root fractures depending on the position of the fracture line

Zone 1: extends from the occlusal / incisal edge to the alveolar bone crest

Zone 2: extends from the alveolar bone crest to 5 mm below

Zone 3: extends from 5 mm below the alveolar bone crest to the apex of the root

These zones are analogues to crown fracture, cervical-root fracture, and middle/apical root fracture, respectively

Vertical root fracture:

A vertical root fracture is characterized as a longitudinal fracture of the root that initiates on the internal canal wall and propagates through the root dentine towards the external root surface (Figure 4).

Vertical root fractures are classified either on the basis of separation of the fragments (complete or incomplete) or on the basis of relative position of the fracture to the alveolar crest (supr-aosseous and intra-osseous) (Figure 5).

Fig. 4: Vertical root fracture

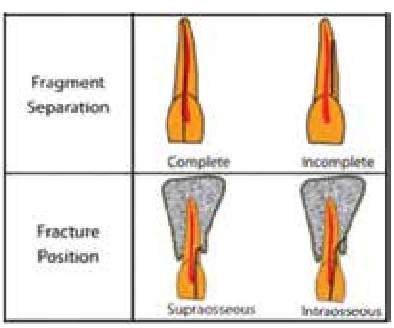

Fig. 5: Classification of Vertical root fracture

Complete fracture

Total separation is visible or fragments can be moved independently.

Incomplete fracture

There is an absence of visible separation and segments can easily be separated by an instrument.

Supra-osseous fracture

This terminates above the bone, and does not create a periodontal defect.

Intra-osseous fracture

This involves the supporting bone, creating a periodontal defect

RADIOGRAPHIC FINDINGS:

Radiographic demonstration of root fracture is facilitated by the fact that the fracture line is most often oblique and at an optimal angle for radiographic disclosure.[5] In this context, it should be remembered that a root fracture will normally be visible only if the central beam is directed within a maximum range of 15-20º of the fracture plane.[6,7] Thus, if an ellipsoid radiolucent line is seen on a radiograph, two additional periapical radiographs should be taken – one with an increased angulation of 15º to the original and the second at a negative angulation of 15º to the original.[8] (Figure 6).

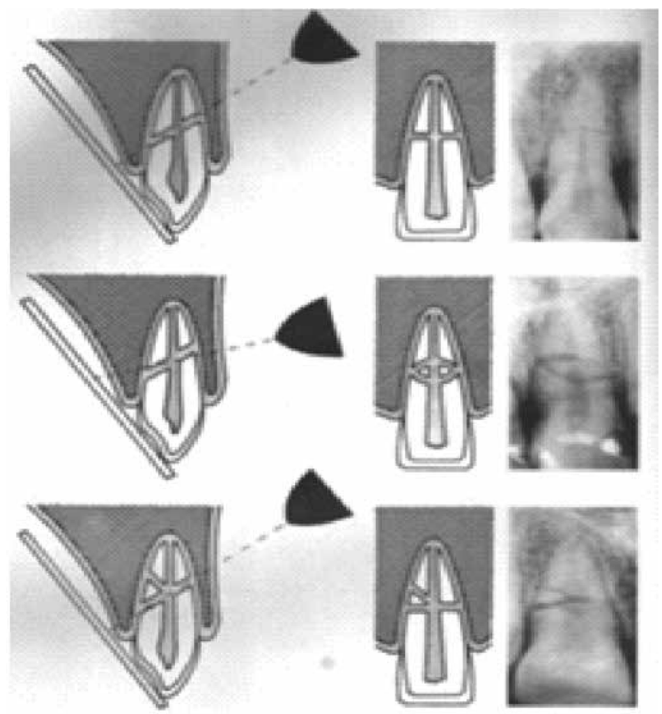

Fig. 6: Radiographic demonstration of root fractures. The normal projection angle is parallel to the fracture surface, resulting in a single transverse line on the radiograph. Decrease or increase of the projection angle results in an ellipsoid fracture line on the radiograph. The fracture line in multiple root fractures shows an irregular shape on the radiograph

CLINICAL EXAMINATION AND DIAGNOSIS: Clinical examination is based on:[2]

1. Mobility
2. Dislocation
3. Reaction to sensibility tests
4. Radiographic examination
5. Stage of root development
6. Fracture site
7. Dislocation
8. Single, comminuted fracture

Diagnosis of the location of a root fracture is done by placing the forefinger of one hand on the gingiva over the facial surface of the root of the affected tooth and gently moving the crown with the thumb and forefinger of the other hand. The clinician can often feel the movement of the incisal segment of the root. Also the arc of movement of the crown will aid in differentiating the injury. The closer the fracture is to the gingival crest, the longer will be the arc of movement of the crown; and the farther the .fracture is from the apex, the shorter the arc of movement.[9](Figure- 7)

HEALING AND PATHOLOGY:

Radiographic and histological observations in human subjects have revealed that the final outcome after root fracture can be divided into the events listed below (Figure 8):[5,10]

A) Healing with calcified tissue

B) Interposition of connective tissue

C) Interposition of bone and connective tissue

D) Interposition of granulation tissue

MANAGEMENT

Management of root fractures can be divided into treatment of apical-third, middle-third and cervical-third (Table 1).[1]

Apical-third fracture:

In the case of apical-third fractures of the root, there is usually no mobility and the tooth may be asymptomatic. Also, it has been observed that the apical segment of a transversely fractured tooth remains vital in most of the cases. Thus no treatment is required and a watch and observe policy is advocated. If the pulp undergoes necrosis in the apical fragment, surgical removal of the apical fragment is indicated.[2,11]

Middle-third fracture

The treatment advocated is immediate repositioning of the displaced passive splint is applied for a period of 4 weeks to ensure sufficient hard tissue consolidation. The advocated splinting methods include the use of stainless-steel wire resin-based composite splints or titanium trauma splints (TTS). These are 0.2 mm thick rhomboid mesh structures of titanium that can be easily adapted and stabilized on the teeth. They

Table 1

MANAGEMENT	Position of fracture line	Treatment	
	Apical	Watch and observe	
		retain the segment	pulp vital
		surgical extraction	pulp necrosis
	Middle	Reduction and Stabilization	
		healing	70-80% of intra-alveolar fracture
		root canal treatment	pulp necrosis
	Cervical	Poorest chance of healing	
		Reduction and Stabilization	coronal segment is present fracture below the alveolar bone crest
		Reattachment	coronal segment is present at fracture at or above the alveolar bone crest
		Post-crowns	coronal segment is absent (fracture above the alveolar bone crest)
		Periodontal surgery	sufficient root length fracture below the alveolar crest Aesthetic result not required
		Orthodontic extrusion	sufficient root length fracture below the alveolar bone crest
		Surgical extrusion	emergency treatment fracture below the alveolar crest
		Extraction	other conservative treatment not possible other conservative treatment failed poor prognosis

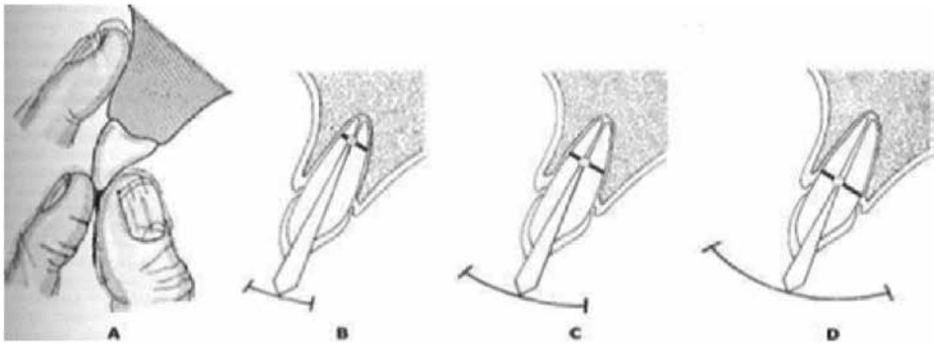

Fig. 7: Diagnosis of the location of a root fracture. A. Palpating the facial mucosa. B to D. Arc of mobility of the incisal segment of a tooth with a fractured root. As the location of the fracture moves incisally, the arc of a facial-lingual mobility of the incisal segment increases (B, apical third fracture; C, middle third; D, incisal third).

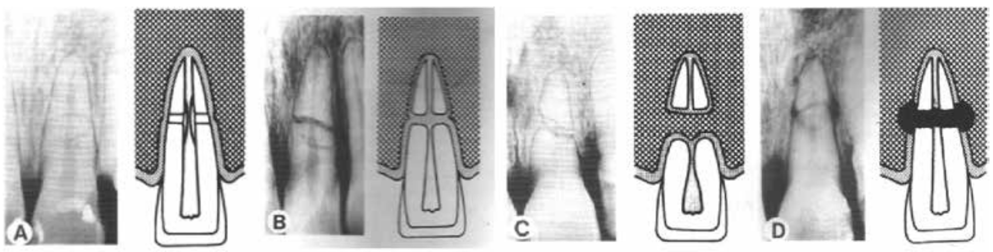

Figure 8: Four types of healing in transverse root fractures: (a) healing by hard tissue (calcified tissue); (b) healing by interposition of connective tissue (c) healing by interposition of bone and connective tissue; and (d) healing by interposition of granulation tissue

require less application time, are easy to remove and clean and have been considered to be more comfortable.[12]

Cervical-third fracture

Treatment options are decided upon by the position of the fracture line, length of the remaining root segment and the presence or absence of a coronal segment. Chances of healing with calcified tissue is poorest in cervical-third fractures.[2,13]

Conventional treatment

Cervical-third fractures below the alveolar bone crest may be treated with the conventional reduction and stabilization approach. It is shown that healing is possible with this conservative approach. Splinting for cervical-third root fracture should be carried out for a period of 4 months. In patients with optimal oral hygiene, permanent fixation of the coronal fragment to adjacent teeth at the proximal contact areas with a resin-based composite or reattachment of fractured segments can also be tried. Care should be taken that occlusal interferences and load on the injured teeth should be kept to a minimum.[2,14]

Post crowns

Post crowns with subgingival margins or false shoulders are indicated in cases where the coronal segment is absent (lost), the fracture line is above the alveolar bone crest and the apical root segment has sufficient length. In cases where exposure of crown margins is required, a simple gingivoplasty or an apical positioned flap surgery is performed.[2,11]

Treatment of vertical root fracture: Vertical root fractures are tooth fractures that run along the long axis of the tooth or deviate in a mesial or distal direction. They usually occur in older patients in posterior teeth due to iatrogenic causes. The fracture line extends through the long axis of the root towards the apex

A variety of approaches have been attempted and used to treat the VRF, including:

1. The use of cyanoacrylates[4]
2. Glass-ionomer cement with guided tissue regeneration therapy[15]
3. Adhesive resin cement (4-META/MMATBB)[16]
4. Repositioning;
5. Fixation with wire and mineral trioxide aggregate.[17]

Luebke has proposed four basic categories of treatment:

Treatment plan A

For incomplete, supra-osseous fractures with viable pulp and no radiographic changes or periodontal defects. Restore the tooth with full coverage temporary crown and evaluate after 3 months. If the patient is asymptomatic, a permanent crown is cemented with polycarboxylate or glass ionomer cement. If the pulp degenerates, additional treatment, as outlined in Plan 1B or Treatment Plan 2 may be indicated.

Treatment Plan 1B

For incomplete supra-osseous fractures with non-viable pulp but no radiographic changes or periodontal defects. Restore the tooth with a full coverage stainless steel crown and initiate calcium hydroxide therapy. Recall the patient at 3-month intervals. Following 9–12 months of calcium hydroxide therapy, if the bone level is unchanged, endodontic therapy is performed and a permanent crown is placed. In case a pocket develops along the fracture line, endodontic therapy is performed and a permanent crown is placed. In case a pocket develops along the fracture line, switch to Treatment Plan 2

Treatment Plan 2

For incomplete intra-osseous fractures with non-viable pulp and a periodontal pocket along the fracture line. Exploratory surgery is indicated for the visualization of the fracture line and the osseous defect. If the fracture line stops short of the osseous defect, the required periodontal surgical procedure may be carried out to restore the defect. Depending on the status of the pulp, Treatment Plan 1A or 1B is initiated. In the case in which the fracture line extends beyond the osseous defect, Treatment Plan 3 can be initiated.

Treatment Plan 3

For complete intra-osseous fractures with non-viable pulp, bone loss and periodontal pocket. For single-rooted teeth, extraction is indicated. In a multi-rooted tooth where fracture is confined to one root, or if it passes through a furcation, either root amputation, hemi section or extraction is indicated.

PROGNOSIS:

Several clinical reports have demonstrated successful treatment of root fractures. However, follow-up examinations can disclose deviations in pulpal and periodontal healing. In this context, radiographic findings, such as pulp canal obliteration, external and internal surface resorption have been found to be related to specific healing modalities.

Pulp canal obliteration: Partial or complete obliteration of the pulp canal is a common finding after root fracture. Thus, in clinical studies of root-fractured permanent incisors, pulp canal obliteration was found in 69-73% of the teeth. Partial pulp canal obliteration is seen most often in the fracture region and the apical fragment. In addition, partial obliteration extends 1-2mm into the coronal fragment. Complete pulp canal obliteration is seen as an even decrease in the size of the entire pulp cavity, leading to total obliteration. Both obliteration types progress at the same rate and are normally well advanced after 9-12 months and approach full density 1-2 year later. Obliteration of the apical root canal alone is commonly seen in cases with interposition of connective tissue, as well as in teeth with interposition of the connective tissue and bone[18]

Root resorption: Root resorption has been found to occur in approximately 60% of root-fractured permanent incisors and can usually be detected within 1 year after injury. This process often precedes fracture healing and obliteration of the coronal and/or apical aspects of the root canal and should be distinguished from resorption of bone at the level of root fracture which is indicative of coronal pulp necrosis. Root resorption appears in the following types:

1. External surface resorption: It is characterized by the rounding of the fracture edges medially and/or distally (internal and/or external), is considered to be a link in fracture healing, and requires no treatment.
2. External inflammatory resorption and ankylosis: This is seen to occur very rarely and needs treatment (pulp extirpation and root filling).
3. External replacement resorption: This type of resorption (ankylosis) cannot be treated.
4. Internal surface resorption, manifested as rounding of the fracture edges centrally, in the apical and coronal root canals, at the intersection between the root canal and fracture line. This type of resorption just requires observation.
5. Internal tunneling resorption, going behind the pre-dentin layer and burrowing along the root canal walls of the coronal fragment. This type of resorption just requires observation.

Pulp necrosis: Pulp necrosis with subsequent peri-radicular involvement occurs with relatively low frequency in about 25% of root fractured teeth.[2]

CONCLUSION:

The treatment of root fracture may be a painstaking job for both dentists and patients. Therefore, an evidence-based clinical approach should be followed for the successful treatment of root fractures. The clinician should have a thorough knowledge of etiological causes of fracture, the classic signs and symptoms of fracture, availability and applicability of diagnostic methods, differential diagnosis, and factors determining the prognosis, so as to arrive at an appropriate diagnosis and design a suitable treatment protocol. This helps in distinguishing between restorable and non-restorable fractures. A functional and aesthetic outcome following treatment is achieved by a combined therapy, including restorative, endodontic, prosthodontic, periodontal and orthodontic therapies. A regular follow-up of teeth is required to evaluate the success of treatment and to do the necessary alterations in the suggested treatment protocol, if indicated.

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"RAPID PROTOTYPING-ANEW DIMENSION IN DENTISTRY" REVIEW ARTICLE

Arpit Sikri, Sakshi Gupta, Pankaj Sharma, Mohit Gautam

ABSTRACT

Rapid Prototyping is an upcoming trend in the field of prosthodontics and has revolutionized the whole dentistry with its major applications. Dentists have used rapid prototyping (RP) techniques in the fields of oral maxillofacial surgery simulation and implantology. With new research emerging for moulding materials and the forming process of RP techniques, this method is becoming more attractive in dental prosthesis fabrication; however, few researchers have published material on the RP technology of prosthesis pattern fabrication. This article reviews and discusses the application of RP techniques for prosthodontics including: (1) fabrication of wax pattern for the dental prosthesis, (2) dental (facial) prosthesis mold (shell) fabrication, (3) dental metal prosthesis fabrication, and (4) zirconia prosthesis fabrication. Many people could benefit from this new technology through various forms of dental prosthesis production. Traditional prosthodontic practices could also be changed by RP techniques in the near future.

Keywords: Rapid Prototyping, Stereolithography, Selective laser sintering, Inkjet printing

INTRODUCTION

Rapid Prototyping (RP)also known as additive manufacturing is a process in which the final desired part is manufactured by adding multiple layers of material on top of one another. The key idea of this innovative method is that the three dimensional CAD (3D-CAD) model is sliced into many thin layers and the manufacturing equipment uses this geometric data to build each layer sequentially until the part is completed[1]. Hence, additive fabrication is often referred as "layered manufacturing", "direct digital manufacturing", "three-dimensional printing", or "solid freeform fabrication".

WHY RP IS PREFERRED OVER CAD-CAM???

Subtractive methods i.e. CAD-CAM have some limitations in comparison with additive techniques (RP)[2]:

1. A considerable amount of raw material is wasted because the unused portions of the mono-blocks must be discarded after milling and recycling of the excess ceramic material is not feasible.
2. Milling tools are exposed to heavy abrasion and wear, therefore, withstanding only short running cycles.
3. Microscopic cracks can be introduced into ceramic surfaces due to machining of this brittle material.
4. It is neither easy nor economic for big, full undercuts and/or complex milling parts.

Rapid prototyping (RP) techniques, the so-called "generative manufacturing techniques", exhibit the potential to overcome the described shortages.

RP simply consists of two phases: virtual phase (modelling and simulating) and physical phase (fabrication). Virtual prototyping is development of model by dynamic and interactive simulation. The course of forming the physical model is formation of 3D physical model by CAD.

CLASSIFICATION OF RP TECHNOLOGIES IN DENTISTRY[3]

The frequent technologies that are adopted in dental practice are stereolithography (SLA), inkjet-based system (3DP), selective laser sintering (SLS), and fused deposition modeling (FDM). While various materials can be employed in these technologies; wax, plastics, ceramics, and metals are commonly used by several studies in dentistry.

Stereolithography (SLA)[4]

This method includes a photosensitive liquid resin bath, a model-building platform, and an ultraviolet (UV) laser for curing the resin. The layers are cured and bond successively to form a solid object for impression rationales, exploited in reconstructive surgeries and subperiosteal surgery in dental implant therapies. Fabrication of surgical drilling templates during insertion of dental implants is the current foremost purpose for using SLA models in dental practice. SLA-made surgical drill guides have been proved to benefit from high precision by several well-documented researches. (**Figure 1)**

Inkjet-based system or 3DP[5]

In this technique, a measured amount of the raw powder-form material is initially dispensed from a container by a moving piston. A roller then distributes and compresses the powder at the top of the fabrication chamber. A liquid adhesive is then deposited from the multi-channel jetting head in a 2D pattern onto the powder, make it bond and form a layer of the object. When a layer is completed, the piston helps spread and join the next powder layer. This incremental (layer-by layer) method is gradually continued to achieve a complete built up of prototype. Unbound powder is swept up subsequent to a heating process, leaving the fabricated part sound and intact. (**Figure 2)**

Selective Laser Sintering (SLS)[6]

In SLS method, layers of particular powder material are fused into a 3D model by adopting a computer-directed laser. A roller distributes the powdered material over the surface of a build cylinder. Powder is spread layer-by-layer on top of the preceding hardened layer and sintered repeatedly. To hold the new fresh layer of powder, the supporting platform relegates one object layer thickness. The surface of this firmly compressed powder is then exposed to a beam of laser. The procedure is self-sustaining and all parts can be bond layer-by-layer. SLS technique has significant advantages in dentistry. (**Figure 3**)

Fused Deposition Modelling (FDM)[7]

The FDM is a rapid prototyping technique in which a thermoplastic material is extruded layer by layer from a nozzle, controlled by temperature. In this technique, a filament of a thermoplastic polymer material suckles into the temperature-controlled FDM extrusion nozzle dome. It is then heated to a free-flowing semi-liquid form. The motion of the nozzle head is controlled by a processor and traces and deposits the material in extremely thin layers onto a subsidiary platform. The head leads the material into place with an ample precision. A portion of the subject is built up layer by layer and the material solidifies within 0.1s after being ejected from the nozzle and bonds to the layer below. The supporting structures are contrived for overhanging geometries and are later removed by cutting them out from the object.

THE APPLICATIONS OF RP TECHNIQUES IN FACIAL AND DENTAL PROSTHESIS[8]

RP techniques are now regarded as a promising alternative for dental prosthesis production. This review particularly focuses on fabrication of wax pattern of prosthesis, all-ceramic crowns, metal prostheses (in clouding FPDs and framework for removal partial dentures) and casts for prostheses.

Dental prosthesis wax pattern fabrication

With the introduction and attractiveness of RP technology, a new style is possible for automatic wax-up construction. After the wax pattern is fabricated by RP, the traditional lost-wax process is still needed. The process is more affordable than laser melting or sintering direct manufacturing processes, which still remains financially unattainable for most dental laboratories.

Rapid prototyping of dental (facial) prosthesis mold (shell) for metal casting

3D printing produces ceramic casting molds for metal casting using an incremental printing method. With RP techniques many labor-intensive and timeconsuming steps of the traditional investment casting technique is eliminated. The technique also skips the process of design and manufacturing of wax and core tooling, wax and core molding, wax assembly, shell dipping and drying, and wax elimination.

Mold for facial prosthesis

RP techniques have been employed effectively for fabrication of facial prosthesis over the past decade. Pattern fabrication with, the aid of RP, has been a feasible procedure, although, the conventional flasking and investing procedures were still crucial to make the actual prosthesis[9]. Using a mold would remove the conventional flasking and investment procedures, and would shorten the process of making the prosthesis. Moreover, the generated resin mold can be kept since the mold is long-lasting and allows the pouring in multiple times.

Mold for complete dentures

The limited available research articles reveals that advanced manufacturing technologies have not been successfully implemented in this field yet. The technology briefly is comprised of the instituting a 3D graphic record of artificial teeth for parameterization positioning, yielding 3D data of edentulous models and rims in centric relation, finding a CAD route and emergence of a software for complete dentures, fabricating physical flasks (molds) by 3DP, and finishing the complete denture using a traditional laboratory procedure.

Direct dental metal prosthesis fabrication

RP technology, particularly selective laser melting (SLM) and selective laser sintering (SLS) technology have been on the focus of attention of scientists for the brisk fabrication of high-precision metal parts with various resources and shapes[10]. Dental prostheses are very appropriate to be processed by employing SLS/SLM technique, regarding their complex geometry and their capability to be customized without the extensive manual pre- or post-processing steps[11].

All-ceramic restoration fabrication

A direct inkjet fabrication process has been anticipated for the fabrication of the green-zirconia all-ceramic dental restoration using a slurry micro extrusion process[12]. This innovative method is a favourable CAD/RP system with great ability to produce all-ceramic dental restorations with high precision, cost competence, and minimum material intake. This method is still in the experimental phase.

CONCLUSION

The literature review depicted that rapid prototyping (RP) techniques have been substantially employed in dentistry. A combination of dental sciences and manufacturing technologies is the notion behind use of RP in fabrication of dental prosthesis. Multiple steps should be taken in fabrication of prosthesis or restoration in conventional methods which would abide manual errors and spends lot of time of dentist, laboratory technician and patient to obtain a good fitting prosthesis. With the aid of computer in RP, the numbers of steps are reduced, time is saved and dental models are reconstructed with high level of accuracy, precise form and shape with pertinent reproducibility.

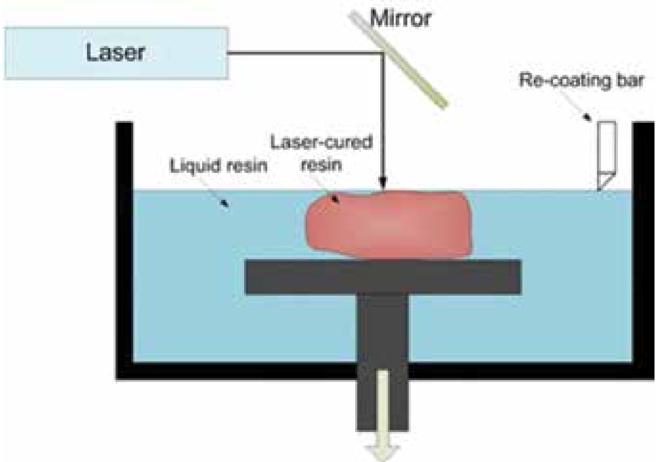

Fig. 1: Stereolithography (SLA)

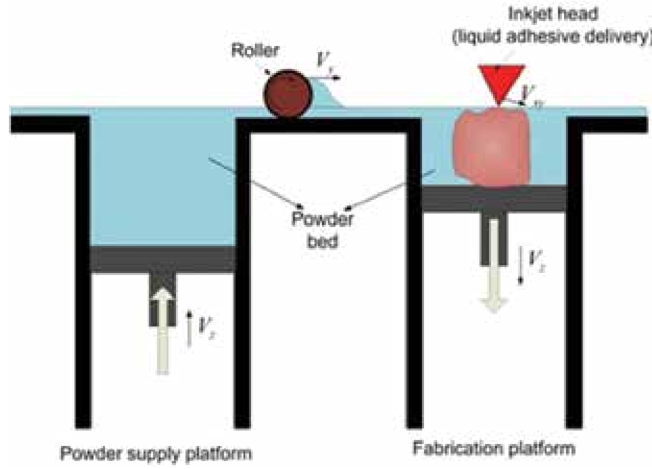

Fig. 2: 3D – Inkjet Printing

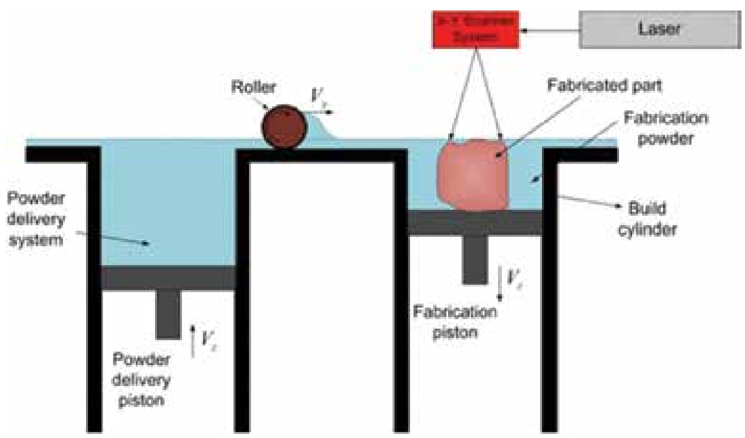

Fig. 3: Selective Laser Sintering (SLS)

With advancement in various RP systems, it is possible to benefit from this technique in different dental practices, particularly in implementing dental prostheses for different applications. With research and development on a variety of RP systems and correspondingly built materials, it is possible to generate different kinds of dental prostheses for different applications.

The limited confines of the RP technology include the high cost of the tools, complicated machinery engaged and dependency on an expertise to run the machinery during production. The authors believe that RP techniques are increasingly playing an imperative role in prosthodontics and will become one of the mainstream technologies for digital fabrication of dental prostheses in near future.

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RESTORATION OF GROSSLY DECAYED PRIMARY ANTERIOR TEETH USING GLASS FIBRE-REINFORCED COMPOSITE POST: A CASE REPORT

Tarjani Momin, Kuldip Shah, Pinky Thakkar, Disha Patel

ABSTRACT

Aesthetic requirement of severely mutilated primary anterior teeth as is seen in early childhood caries has been a challenge to the pediatric dentist. Restorative treatment options mentioned in the literature include prefabricated crown and biological and resin composite restoration by direct or indirect techniques. This paper presents a case of early childhood caries with grossly decayed maxillary anterior primary teeth. Endodontic treatment was followed by placement of a glass fibre-reinforced composite resin (GFRC) post and crown reconstruction was done with composite material using strip crowns. GFRC posts possess the best elasticity, translucency, adaptability, tenaciousness, resistance to traction/impact as compared to other posts and ease of application, making them a suitable alternative to traditionally-used materials in the management of early childhood caries.

Keywords: Glass fibre-reinforced resin posts, primary anterior teeth, early childhood caries

INTRODUCTION

Despite the fact that it is largely preventable, dental caries is the most common chronic disease of childhood.[1] Early childhood caries (ECC) is a specific form of severe dental caries that affects infants and young children. Beltrami (1930) characterized this pattern of early caries in young children and has been defined by the American Academy of Pediatric Dentistry as the presence of 1 or more decayed (cavitated or noncavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.[2] The teeth most often involved are the maxillary central incisors, lateral incisors and the maxillary and mandibular 1st primary molars.[3,4] The maxillary primary incisors are the most severely affected with deep carious lesions usually involving the pulp. In extreme cases, ECC can even lead to total loss of the crown structure.[5,6]

Earlier, the most pragmatic treatment was to remove the involved teeth. However, the importance of preserving the integrity of the anterior teeth can be realized from the fact that loss of these teeth can lead to space loss, masticatory deficiency, phonetic challenges, disturbances in the development of pre-maxilla and resulting malocclusion, development of para-functional habits and mainly psychological problems that interfere with the personality and behavior of the child.[7]

Restoring the primary anterior teeth to its previous function, form and esthetics presents a challenge to the pediatric dentist. The children who require this treatment are usually the youngest and the least manageable group of patients.

Restorative treatment options include prefabricated crowns, biological restorations and resin composite restorations. When there is not enough tooth structure to properly retain a crown, a post-and-core build up may be done.[8] Posts may be constructed of a variety of materials, including resin composite, metal and biologic materials.[9] The introduction of fibre posts in 1990 has provided the dental profession with the first true alternative to cast/ prefabricated posts, pins and orthodontic wires.[10] The advantages of a reinforced-fibre post include resin composite crown reinforcement, translucency, and relative ease of manipulation.[11]

This article presents a case report of a 31/2-year-old child with severely decayed maxillary anterior teeth that were restored with glass fibre-reinforced composite resin posts (GFRC).

CASE REPORT

A 3½ year-old male patient was brought by his parents to the Department of Paediatric Dentistry, Pacific Dental College and Hospital, Udaipur, with a complaint of decayed upper front teeth. The mother gave a history of at-will breast feeding for a year. Following this, the child was bottle and breast-fed for 2 months and then only bottle-fed for 2 years, till the time of this dental visit, during which time the child was fed sweetened milk at night and fruit juice twice during the day. There was no history of consumption of medications in the form of sweetened syrups or of pain, pus discharge, sinus opening in relation to the affected teeth. The child's previous medical and dental histories were not contributory. The child exhibited whining behavior with evidence of slight negativism (Frankl's rating 3).

Intraoral examination revealed a full primary spaced dentition without any visible space loss. The child brushed his teeth independently once a day with a toothbrush and toothpaste and his oral hygiene was fair. All teeth with the exception of the 55, 65 and 73 were affected by dental caries. The maxillary incisors and the maxillary and mandibular first molars presented with extensive destruction of the crowns.

The maxillary and mandibular right canines and the mandibular right lateral incisor presented with deep dental caries, the mandibular 2nd molars with pit and fissure caries and the mandibular central incisors and left lateral incisor and the maxillary left canine with the presence of smooth surface caries. (Fig. 1)

Intraoral periapical radiographs revealed dental caries involving the pulp with no periapical pathology in the 54, 53, 52, 51, 61, 62, 64, 74, 82, 83 and 84. (Fig. 2)

The treatment objective was parent counseling to wean the child from the bottle followed by full mouth rehabilitation. The parents were advised to gradually stop bottle feeding the child and to slowly train him to drink from a glass. During the weaning period it was recommended that the parents stop sweetening the bottled milk or fruit juice. Every intake of milk or juice was to be followed by a drink of water to cleanse the oral cavity. The parents were also advised to brush the child's teeth with a smear of fluoridated toothpaste twice a day.

Next, oral prophylaxis was done. The grossly decayed first molars were treated by pulpectomy, followed by stainless steel crown placement. The maxillary and mandibular right canines and the mandibular right lateral incisor were treated by pulpectomy and composite resin build-up. The mandibular 2nd molars, central incisors and left lateral incisor and the maxillary left canine were restored with composite resin.

The maxillary central incisors were treated by pulpectomy, followed by glass fibre-reinforced composite resin posts and composite build-up using strip crowns. The procedure is described below.

Phase 1 - Endodontic phase: The maxillary incisors were anaesthetized using infiltration anaesthesia and isolated using rubber dam. Gross caries was removed with a no. 330 round carbide steel bur (Mani Dia-Burs, Prime Dental, Thane, India). The pulp chamber was opened and working length determined using IOPAs. Pulp tissue was extirpated and the canals cleaned and shaped using #20 – #45 H-files (Mani Inc, Japan) with irrigation using copious amounts of 2.5% NaOCl and normal saline. After drying with paper points, the root canals were obturated with Metapex paste injected directly with the syringe. The obturating material was allowed to set for 10 minutes and temporary restoration was placed.

Phase 2 - Restorative phase: The post space for each of the four teeth was prepared in the second appointment, 7 days after the endodontic treatment, by removing approximately 4mm of Metapex paste using a thin straight fissure bur with rubber stopper attached to a contra-angle handpiece. The diameter of the straight bur used was less than that of the root canals. All visible Metapex on the walls of the post space was removed. The post space was air-dried and a 1 mm base of glass ionomer cement (Fuji 2, GIC Corp, Tokyo, Japan) was placed to isolate the obturating material from the rest of the post space.

The prepared post space was then cleaned with saline, air-dried, and acid-etched with 37% phosphoric acid (Prime Dental, Thane, India) for 15 seconds. This was followed by rinsing and air-drying with oil-free compressed air. A light-cured bonding agent (3M ESPE, Adaper™ Single Bond, USA) was brushed on the etched surface, uniformly dispersed by a compressed air blas and light-cured for 20 seconds (LA 500 Blue light, Apoza enterprise, Taiwan).

Light-cured flowable composite resin (3M ESPE, MN, USA) was injected into the post space and was followed by insertion of the glass fibre-reinforced composite (GFRC) post (Tenax, Fibre Trans™ Esthetic Post System, Coltene, Whaledent®) into the space. The GFRC post and the flowable composite were light-cured for 60 seconds. The coronal portion of the GFRC post was splayed with a bur to increase the surface area for retention of the core material. (Fig. 3)

The coronal enamel surrounding the post was etched for 20 seconds, rinsed with water and air-dried. Next, bonding agent was applied and light-cured. The coronal part of the post was covered with the composite resin for core build-up, followed by light-curing for 60 seconds.

A strips crown of appropriate size (3M ESPE, MN, USA) was selected and trimmed to create an arched interproximal margin to accommodate the interdental papilla. The strip crown was then filled with composite resin and placed on the tooth. The composite resin was cured for 60 seconds and the strip crowns peeled off with a sharp explorer.(Fig. 4) The composite build-up was finished and polished with finishing burs (Soflex, Shofu). Occlusal interferences in normal and paranormal mandibular movements were checked for and removed. (Fig. 5)

DISCUSSION

Esthetic restoration of primary anterior teeth has long posed a special challenge to pediatric dentists, with conventional glass ionomer restorations have demonstrating high failure rates in the primary dentition.[12] When there is severe loss of coronal tooth structure, the use of posts placed inside the canal after endodontic treatment will give retention, provide stability to the reconstructed crown and withstand masticatory forces in function.[13] There are a variety of root posts used in pediatric dentistry - direct resin composite post build-up, resin composite short posts, alpha- or omeg-shaped orthodontic wires, stainless steel prefabricated posts, nickel-chromium cast posts with macro-retentive elements, natural teeth from a tooth bank, reinforced fibres etc.[8] Prefabricated posts are fast, cheap, and easy to use, but they do not take into account the shapes of individual root canals. While metal posts may be indicated for primary teeth, they do not meet esthetic requirements owing to their color. Moreover these may cause problems during the course of natural exfoliation.[14] The use of omega-shaped stainless orthodontic wire as an intracanal post is also simple; however, the wire is unable to adequately adapt to the canal form.[8] Although biologic posts may be

Figure 1: Pre-operative dental status

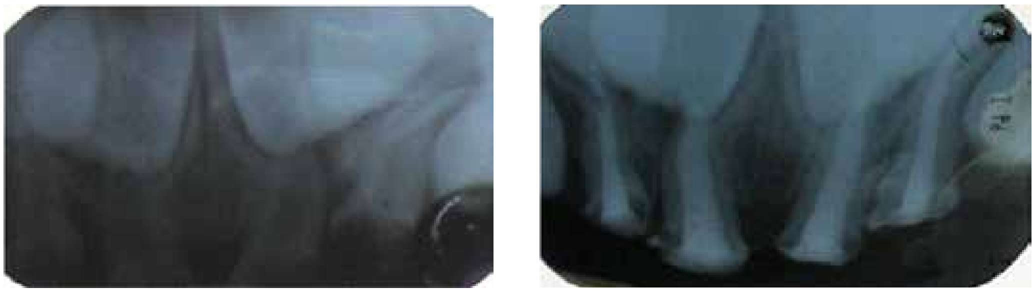

Figure 2: Pre-operative and postoperative radiographs of maxillary incisors

Figure 3: GFRC post placement in canals of maxillary incisors

Figure 4: Composite build-up using strip crowns

Figure 5: Post-operative status of the dentition

an esthetic option for such cases, acceptance and stringent infection control policies may be issues as is the need for a tooth bank.[15] Composite posts provide satisfactory esthetics; however, there is risk of loss of retention and low-strength loading owing to polymerization shrinkage.[16]

Regardless of the post system used, the teeth should first be treated endodontically and root retention should fill about 1/3rd of the root length.[17] These posts are placed in the cervical one-third of the canals, to avoid interference with the process of permanent tooth eruption.[13, 18]

The development of the fibre-reinforced composite technology has brought a new material into the realm of metal-free adhesive esthetic dentistry. Different fibre types such as glass fibres, carbon fibres, Kevlar fibres, vectran fibres, polyethylene fibres have been added to composite material. Carbon fibres prevent fatigue fracture and strengthen composite materials, but they have a dark colour, which is undesirable esthetically. Kevlar fibres, made of an aromatic polyamide, increase the impact strength of composites but are unaesthetic, and, hence, their use is limited. Vectran fibres are synthetic fibres made of aromatic polyesters. They show a good resistance to abrasion and impact strength, but they are expensive and not easily wielded. Polyethylene fibres are esthetic but their flexural strength is less as compared to glass fibre-reinforced composite posts.[19]

Glass fibre-reinforced composite resin posts (GFRC) are new to the pediatric world and can be used as an alternative to the other post systems. The properties of fibre- reinforced posts are dependent on the nature of the matrix, fibres, interface strength and geometry of reinforcement.

The advantages of these fibres over the older fibres include i) greater flexural strength (1280 MPa over 650 MPa of the older fibres), ii) lack of fraying and, hence, ease of handling, iii) parallel arrangement of fibres in a unique interpenetrating polymer matrix which allows use in high stress-bearing areas, iv) bonding to any type of composite material v) fibre surfaces which can be re-activated.[10] Scanning electron microscopic evaluation has shown clearly the formation of a hybrid layer, resin tags, and an adhesive lateral branch. Successful bonding minimizes the wedging effect of the post within the root canal, requires less dentin removal to accommodate a shorter and thinner post, and leads to lower susceptibility to tooth fracture. Additionally, these fibres are almost invisible in the resinous matrix. Hence, they may be the most appropriate and the best esthetic strengtheners of composite materials.[19]

The fibre post technique offers certain advantages such as the utilization of fibre posts that are ready to use, homogenous mechanical and chemical bonding of all components, reduced risk of root fracture, because of its modulus of elasticity (similar to that of root dentine) and its low diametric tensile strength, and no potential hazards of corrosion and hypersensitivity.[10]

CONCLUSION

Restoration of teeth after endodontic treatment is becoming an integral part of the restorative practice in dentistry. The treatment described in the case report is simple and effective and represents a promising alternative for rehabilitation of grossly destructed or fractured primary anterior teeth. The use of glass fibre-reinforced composite resin posts for restoring teeth affected by early childhood caries has shown promising results and has presented the pediatric dental world with an additional treatment option.

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CUTTING EDGE- OVERCOMING THE HURDLES OF PLACEMENT AND ACTIVATION OF OPEN COIL SPRING IN CLINICAL PRACTICE.

Dr. Trishika Dhiman, Dr. Gaurav Sepolia, Dr. Shipra Sepolia, Dr. Vishal Seth, Dr. Paramjot Singh Jagdev, Dr. Sukhpash Singh Sandhu, Dr.Kanwar Sidharth

INTRODUCTION

The use of coil springs as an alternative to archwires for orthodontic tooth movement have been proposed by many workers[1].Coil springs were introduced for orthodontic tooth movement in 1931[2].Coil spring serves as best option to open space for teeth that are displaced from arch is by compressing nickel titanium open push coil spring on a continuous archwire[3].

With the use of superelastic Niti open coil spring a more constant force can be reached by overactivation before setting the spring to desired activation[4].But placing an overactivated open coil spring over an archwire can be tricky ;the spring can pop the wire out of the bracket slot before ligation, and compressing the spring with fingers is cumbersome, especially in the posterior region[5].After the coil spring is placed ,occasionally it is not long enough to open the entire space needed for alignment of a displaced tooth , such as a lingually blocked premolar or a canine in buccoversion. In such cases the base arch wire and coil spring are usually removed so that a new longer spring can be placed[6].

This study is aimed at eliminating these problems of placing and reactivation of open coil spring by using a device for the placement and a C- ring for the activation of the open coil spring.

ARMAMENTARIUM AND TECHNIQUE

Armamentarium *:*

Following are the material and instruments used in the study(figure 1).

a) Weingart plier
b) Bird beak plier
c) Arch wire cutter

Figure 1

d) Ligature tucker
e) Straight 0.017”X0.025” stainless steel wire
f) Open coil spring (3 M Unitek)

TECHNIQUE:

a) Sterlize all the instruments.

Open coil spring placement*:*

b) Take a 3cm segment of 0.017”X0.025”stainless steel wire and form a helix with the help of bird beak plier . Then bend each end into a hook . Close the helix of the spring so the the legs form an acute angle (figure 2 and 3).

Figure 2

Figure 3

c) Now place an open coil spring over the archwire at the desired location.Engage one of the hooks of the spring holder over the archwire at one end of the spring , closing the hooks gently with a plier to prevent it from sliding on the wire.(Figure 4 and 5).

Figure 4

Figure 5

d) Compress the coil spring and engage the second hook to the wire at the other end of the spring. Ligate the archwire in the patient’s mouth as usual. (Figure 6 and 7).
e) Carefully open the spring holder hooks one at a time , releasing the compressed spring between the brackets (figure 8)

Reactivation of open coil spring:

f) Form a C- shaped section from the end of a straight 0.017”X 0.025” stainless steel wire with the help of a

Figure 6

Figure 7

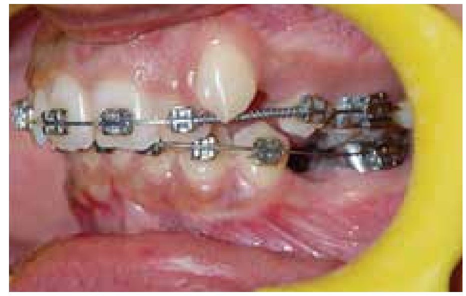

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14 After placing the C-ring in the archwire.

bird beak plier and cut it with the help of an arch wire cutter (figure 9 and 10).

g) Now expose the arch wire by pushing the open –coil spring to one side with a ligature tucker (figure 11).

h) Grasp the C-ring with artery forcep so that the opening faces toward the archwire , place the ring over the wire. Crimp it slightly with the weingart plier to secure (figure 12 and 13).

CONCLUSION

Open coil spring is a most useful and frequently used adjunct in orthodontic practice.But placing and reactivation of an open coil spring was always a complex and time consuming procedure.

The present study of placement and reactivation of open coil spring with C-ring solves these problems and have an additional advantage of being simple ,inexpensive,less time consuming and ease of fabrication over conventional technique.

So use of this device to place the open coil spring and a C-ring to reactivate the spring can increase the skillfulness and efficiency of an orthodontist.

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HYBRID DENTURE / IMPLANT SUPPORTED HYBRID PROSTHESIS: A REVIEW

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ABSTRACT

Implant-supported hybrid prosthesis is an acrylic resin fixed removable dental prosthesis which is supported by implants and extensively used in cases that require the need of a prosthetic restoration for esthetics, function, lip support, and speech. The hybrid denture also works to replace the gums and loss of alveolar bone due to lost teeth. Dental implants are placed in the appropriate locations of maxillary and mandibular jaw bone and the prosthesis is screwed into place in a casted framework. Hybrid dentures are recommended in cases of advanced alveolar bone loss prognathic mandible and retrognathic maxilla where crossbites in processed denture. This type of denture gives a more natural appearance and better maintenance due to it being removed on dentists' will for cleaning, etc.

INTRODUCTION

The main objective in implant therapy is either to avoid complete removable dentures by placement of implant-supported fixed prostheses or to improve the retention and stability of removable complete dentures.[1]

Basically, two approaches for an implant-supported fixed prosthesis exist. The first one is a metal-ceramic implant-supported fixed prosthesis consists of a ceramic layer bonded to a cast metal framework that can be cemented to transmucosal abutments or secured with prosthetic retention screws.[1] An alternative to this type of fixed prosthesis is an implant-supported hybrid prosthesis.[2] Implant supported metal-acrylic resin complete fixed dental prosthesis, originally referred to as a hybrid prosthesis was introduced to address the problems caused by unstable and uncomfortable mandibular dentures.

According to GPT -8 "*Hybrid denture* is any modification or alteration in the usual form of a dental prosthesis. *Hybrid prosthesis* is any form of nonspecific term applied to any prosthesis that does not follow conventional design. Frequently it is used to describe a dental prosthesis that is composed of different materials, types of denture teeth (porcelain, plastic, composite), variable acrylic denture resins, differing metals or design etc. It may refer to a fixed dental prostheses, removable dental prostheses, or maxillofacial prostheses".

So in easier means hybrid denture is a cross between a regular denture and a fixed bridge or a "Hybrid". A regular porcelain bridge that doesn't replace any of the gum tissue would give the teeth the appearance of being "too large" for patients' mouth. A hybrid denture solves this problem by replacing the gum tissue with pink acrylic between the teeth to allow the teeth to be of normal size and appearance.

The primary factor that determines the restoration type is the amount of intra-arch space.[2] In addition, other patient-relevant clinical parameters such as lip support, high maxillary lip line during smiling, a low mandibular lip line during a speech or the patient's greater esthetic demands should be evaluated.[2] Studies suggest that implant-supported hybrid prostheses can be a reliable alternative treatment procedure when a conventional complete denture, overdenture or porcelain-fused metal fixed restoration does not satisfy a patient's requirements for esthetics, phonetics, oral hygiene, and oral comfort.

Despite the favorable long-term outcomes achieved with prosthetic rehabilitations with implants, biological and technical complications such as surgical complications, implant loss, bone loss, peri-implant soft-tissue complications, mechanical complications, and aesthetic/phonetic complications are frequent.[3] The authors implied that such complications are affected by many factors, including the operator's skills and judgments in treatment planning, prosthesis design, materials, patient-specific factors, and local and systemic conditions and habits such as bruxism, smoking, presence of periodontal disease, and maintenance.[1] Furthermore, the communication between the prosthodontist and surgeon is emphasized as critical to ensure adequate restorative space for the various prosthetic designs, appropriate implant angulation, and minimizing cantilevers.[1]

PROCEDURE

Stage I Implant Surgery:

A full thickness mucoperiosteal flap is raised in the maxillary and mandibular arch. A mimimum of four implants are placed in either of the arches. The number of implants can be increased depending on the amount and quality of the bone available. The flaps are then closed with sutures. After 1 week, the sutures are removed.

Stage 2 : Implant Surgery :

After a waiting period of 1 month, an OPG (Orthopantomograph) is obtained to evaluate the bone to implant contact percentage and later stage II surgery is performed under local anesthesia cover screws are exposed and healing abutments are placed.

Prosthetic Phase :

Step 1: Evaluating the Current Situation

When evaluating a patient for the final prosthesis, the first thing to do is to evaluate the current esthetics and function with the provisional in place. This is the time to document any noticeable issues that may arise surgically or restoratively. Examples of issues that may need to be corrected before moving the final prosthesis are:

- An abutment position that causes a screw access hole to be too far palatal
- An abutment that causes the screw access hole to be too far facial
- Vertical space that is less than 12mm, as measured from the top of proposed implant to the occlusal plane of the opposing dentition, or on double arch restorations 24mm from maxillary implant interface to mandibular implant interface.

Step 2: The Master Impression

Different abutments are used on implants such as Straight, 17° Angle, or 30° Angle Multi-Unit Abutment. This allows for correcting any implant angle for the prosthesis and simplifies the final impression. All impressions should be made with open tray impression copings.

After the impression copings are placed and firmly seated, the transfers can be luted together using light cure material or pattern resin. It is suggested to wrap dental floss around the transfers to create a matrix upon which the pattern resin can be applied. This technique is highly recommended, doing it at this phase avoids the need for a fit verification jig in subsequent appointments.

Once the impression copings are placed a medium or heavy body impression material can be used for making the impression. This final impression with the impression copings, implant analogues and castable abutments are sent to the lab for fabrication of a master model. A screw-retained bite rim is fabricated which provides a stable platform to take bite registration. In addition, if the impression transfers are not luted together with pattern resin then a Fit Verification Jig is made to verify the accuracy of the implant model.

Following are the instructions for trying in the jig:

Step 1 Remove healing collars

Step 2 Screw in the duralay jig on one end - hand-tighten.

Step 3 Verify the remaining posts are engaged and not encumbered by tissue, visually or with an explorer.

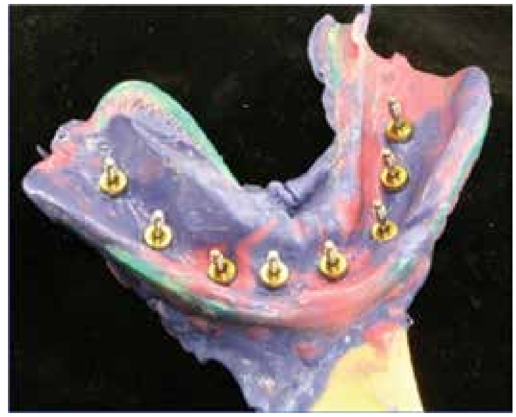
Step 4 If there is a question about engagement, capture an x-ray.

Step 5 If a post(s) is not engaged, section the jig and engage.

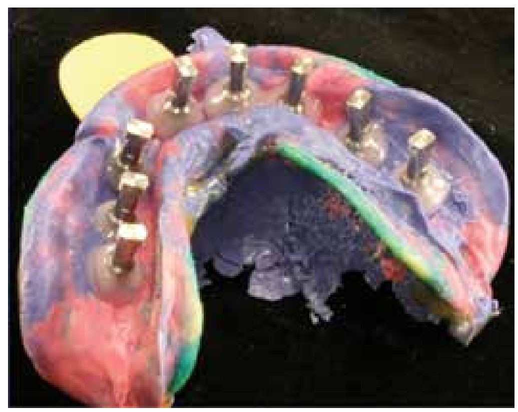
Step 6 If sectioned, pick up the jig in a new impressions (no blockout under the bar) using long screws if possible.

Step 7 The new pick-up impression will be poured and used as the new, verified master cast.

Now replace the provisional prosthesis, and, in most case, fill the screw access hole with light-body impression material for easier retrieval during this process.



Master impression after removal from the mouth



Master impression with implant replicas

The master cast

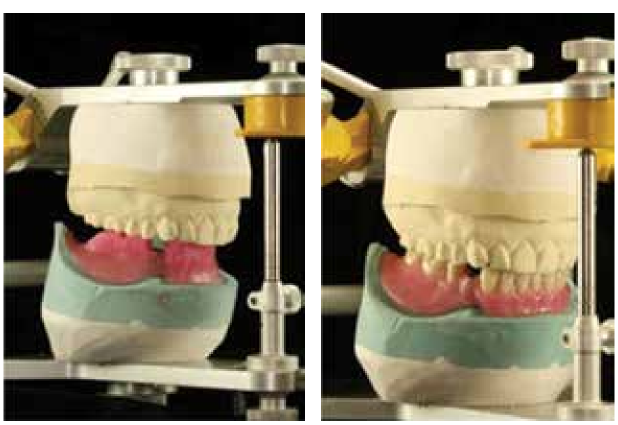
Step 3: Bite Registration & Model Verification

There should be at least two copings embedded in the rim in order to stabilize and affix the rim in the correct position. From this point forward, other than dealing with screwing and unscrewing the prosthesis, everything is essentially basic denture work. Midlines need to be marked, shades taken, and moulds selected. In most cases the palate of the occlusal rim will be removed (maxillary) so that this more closely resembles the final prosthesis. Once the occlusal rim is affixed bite registration is taken using bite registration material. After registering the bite, reinsert the provisional and place light-body impression material in the screw access holes once again. Take the impression of the opposing arch.

Stabilized occlusion rim to capture the jaw relations. The holes are to screw the rim directly to the implants, which insures an exact measurementof the proper position that the teeth should be in.

Step 4: Framework & Tooth Try-In

The titanium substructure is milled (metal substructure is casted) and teeth are set in wax for a final try-in. Seat the try-in to ensure fit, take an x-ray to confirm the bar is seated to each implant interface when screwed into place. Like a typical denture check phonetics, esthetics, and lip support. One noticeable difference here is that all of the lip support is provided by the gingival third of the tooth. There is minimal denture flange on these prosthesis. If more support is required than what is provided by the wax try-in, then the necks of the teeth can be moved labially.

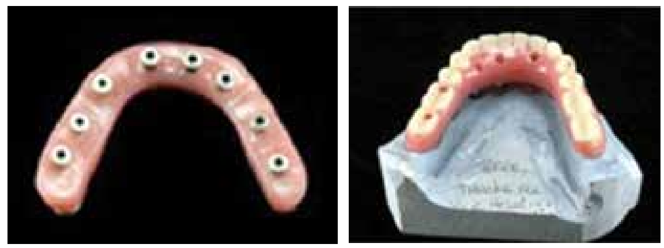


Rims transferred to an articulator and the teeth arrangement done.

Clinical try-in of teeth

Step 5: Placement of Final Appliance

When the appliance is placed, it should seat firmly against the soft tissue. The design of the tissue interface of the hybrid should be such that it causes the tissue to roll over the prosthesis on the buccal and lingual aspects.



The final fixed prosthesis .

RISKS AND BENEFITS

Fixed implant-supported prostheses provide wide-ranging benefits for edentulous patients. Fixed restorations have demonstrated superior impact on oral health, dental function, patient satisfaction, and quality of life. [4,5] For this reason, the acrylic hybrid denture has long been considered the optimal choice for full-arch restorations. Often, they don't require a flange because the support comes from the implants. More implants provide greater stability, and when they're fixed, as in a hybrid, or cemented, they perform like natural teeth.

On the downside, there is a higher cost associated with implant-supported prostheses because they involve more implants and, therefore, more surgery, particularly if significant grafting is required. Those screwed into place or cemented are harder to clean. Treating a gummy smile may require significant bone removal to hide the margin of the prosthesis, which may require pink porcelain to avoid abnormally long teeth.

The biggest disadvantage being the acrylic base and prosthetic teeth that form the body of the hybrid denture are prone to wear, chipping and fracture.[6] In many cases, a high degree of maintenance is required over the life of the restoration. This is because fixed full-arch implant restorations are subject to substantial forces associated with masticatory function, parafunctional habits, and bruxism. In the long term, this often causes hybrid dentures to break down, requiring ongoing maintenance and replacement of the prosthetic teeth or acrylic base

DISCUSSION

Accurate and precise planning in dental implantology includes detecting any existing clinical difficulties prior to the treatment and foreseeing the final results before the treatment.[7] Different diagnostic perspective is required while planning for esthetic cases ; it should include additional factors such as smile patterns and lip size, etc.[7] In addition, the restorative space for the prostheses, which is measured from the platform of the implant to the opposing occlusion, is often overlooked when implant positions are planned. The intra-arch distance which implant components, metal substructure, the acrylic resin, and the denture teeth are placed plays a major role on selecting appropriate restoration. With mandibular implant-supported fixed prostheses, a minimum of 12–15 mm of space has been suggested.[2] When more intra-arch space is present, a hybrid restoration is recommended.[3]

Cantilever length is an important parameter that is to be evaluated when deciding to fabricate implant supported acrylic screw-retained hybrid prosthesis.[8] The researchers suggested a mandibular extension of between 15 and 20 mm to minimize the risk of framework fracture.[8] Other authors recommended a cantilever length of 1.5 or 2 times of the anterior, posterior curve of the implants.[2] Besides, the opposing occlusion and the number and distribution of implants should also be considered, before the determination of cantilever length.[1]

Obtaining a passive fit of the framework is another important factor. Mechanical or biological complications such as peri-implant bone loss, screws loosening or fracture of abutment or the implant were reported in cases without passive fit.[2] So, verification index with pattern resin for the prosthesis is fabricated, and checked intraorally to confirm the accuracy of the master cast.

It is found that lost fillings in screw-access openings and mobile prostheses were the most common complications associated with the mandibular hybrid prosthesis.[9] In addition, it is reported that, although implant and prosthesis survival rates remained high, the wear and fracture of denture teeth has been a significant problem.[9] Moreover, the researchers found that anterior tooth fracture was more common than posterior tooth fracture.[9]

Another important aspect to consider when fabricating implant supported fixed complete prosthesis is the framework material. Frameworks are made using a spectrum of metal alloys ranging from conventional high noble to titanium or base metal alloys.[9] Additionally, zirconia frameworks are proposed to be a promising alternative. However, veneering porcelain fracture and chipping has emerged as a reported complication for the bilayered ceramic restorations.[9] Furthermore, relevant studies have argued that a rigid material can minimize the bending moment of the framework thus, they have shown that cobalt-chromium frameworks generate the least amount of strain on the implants as a result of the accuracy of fit of the framework.[10]

The other important aspect to consider is the maintenance of prosthetic rehabilitation as well as the implants by supporting the structure. Regular checks are recommended every 6 or 12 months to avoid complications and to assess the status of the peri-implant tissue.[2] Moreover, the measurement of radiographic peri-implant marginal bone loss during the follow-up period is also recommended.

CONCLUSION

Implant supported hybrid prosthesis can provide satisfactory results where esthetic and functional requirements are demanding and challenging as in increased intra-arch space that remains following conventional implant replacements, the dentist needs to plan for an alternative treatment procedure that best suits the situation. The patients' acceptance of the prosthetic treatment plan and restorative solution are certainly promoted by the fabrication of implant supported hybrid prosthesis.

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ORAL PIERCING – A REVIEW

Manoj Kumar, Sonakshi Chugh, Lalit Baweja

ABSTRACT

Oral piercing has become increasingly popular among young adults in recent years. This is of concern to dental and medical professionals because of the risks and complications to their health. Health care professionals are encouraged to educate their patients concerning risk factors, ways to reduce risk factors, and home care to promote optimal oral health when piercings are present. This paper provides an overview of oral piercing and potential complications associated with piercings.

Body Piercing and Society

Although it has an ancient history, body piercing has only recently attained popularity in Western society. For centuries, body piercing was part of many cultures and religious rites.[1] Ancient Egyptians pierced their navels to signify royalty, Roman centurions wore nipple rings as a sign of virility and courage, and Mayans pierced their tongues for spiritual purposes. In North America, body piercing was also a tradition of the Sioux.

Today, popular sites for body piercing include the ears, eyebrows, lips, nose, nipples, navel, penis, scrotum, labia, clitoris and tongue.[2] Of significance to the dental community is the recent increase in intraoral piercing. It is critical that the dental profession become aware of the recent interest in this type of body piercing, of the impact this trend may have on dentition and speech, and of the health risks that are associated with piercing.

The literature on the effects of tongue piercing is limited. What there are points to the risk of tooth damage, the possibility of aspiration of jewellery , speech modification, and an increased risk of infection.

Type of piercing

There are several types of oral piercings; however, piercing the tongue is the most common practice. There are two types of tongue piercing, dorsoventral and the dorsolateral. Dorsoventral is most commonly practiced and safer procedure. In dorsoventral piercing, the jewelry is inserted from the dorsal to the ventral surfaces of the tongue. This piercing is commonly located in the middle of the tongue and major blood vessels must be avoided during the procedure. Some individuals may choose to have multiple dorsoventral piercings.[3]

The dorsolateral piercing is not a safe procedure due to the vascularity of the tongue; therefore, dorsolateral piercing is not usually performed by professional piercers. In the dorsolateral piercing, both spheres of jewelry are on the dorsum of the tongue at the lateral borders and located about halfway in an anteroposterior direction.[2,4] The barbell is placed dorsally, curves down toward the ventral side of the tongue and resurfaces at the dorsal aspect. Four types of piercing jewelry are applied in the oral area. One type is the labret, a bar with ball, disc or point at one end and flat closing disc at the other. Another type is the barbell, a straight or curved bar with balls at each end. Barbells are the most popular form of jewelry placed in the dorsoventral piercing. A third type is an unclosed ring with a ball at one or both ends. In a fourth type, two components of the stud are held together by a magnetic force 10-fold greater than that of a conventional magnet.[5]

Perioperative and postoperative complication

In a case series report a young female patient was described who had her tongue pierced and showed gingival recessions with no symptoms at the lingual surface of the mandibular central incisors. She presented with reasonable oral hygiene and probing depths, whilst her gingiva were erythematous (moving to the alveolar mucosa) with partly white appearance at the gingival margin.[6] The symptoms described above imply the negative repercussions of tongue piercing, including gingival recession and erythematous gingiva on the periodontal tissues.

a) Categorization of the Complications according to Their Acute or Chronic Nature

In a review paper by Campbell et al., the sequelae of piercing were categorized into acute and chronic and the postoperative complications of oral piercing were analyzed.[3] Trauma of the mucosa may include immediate responses for example, pain, swelling, hemorrhage, and local infection or postoperative complications including dysphonia, dysphagia, problems with mastication, and the occurrence of galvanic currents as well as contact dermatitis.[7] However, the aforementioned defects have not been proved to be deleterious to the tissues.

Pain has been reported as the most common consequence of oral piercing and the most common cause for the patients to seek consultation (52% of the examined cases) . López-Jornet et al. have indicated that the mean pain intensity score based on a 0–10 scale visual analog scale (VAS) is 4.[8] Furthermore, it is mentioned that in only 6 percent of the cases did the patients present with granulation tissue around the piercing and 20 percent exhibited increased levels of salivary flow. They also mention that harm to the ear (perichondritis and deformity) has been observed but not in their case report .[8]

Some of the chronic consequences may involve postoperative hemorrhage and hyperplastic tissue. Vessels and vascular nerves may be cut during piercing procedure. Significant absence of blood may lead to hypotensive collapse. It is stated that prolonged bleeding, hematomas, and disturbance to the healing of the injuries are consequences of oral piercings.

Other chronic postoperative outcomes may include widening of the piercing hole, chemical burns related to excessive aftercare, paresthesia, sialadenitis, lymphadenitis, sarcoid-like formations granulomas, and scar tissue formation. Short shanks may result in overgrown tissues, whereas long shanks may result in hyperplastic tissue reaction and the presence of plaque and tartar.[9]

Intraoral piercings seem to be the culprit for the formation of hypertrophic keloid tissue, characterized by the production of an interstitial mucinous material on the collagen of connective tissue.[7] Streptococcal pharyngitis, unpleasant itching sensation, and eczematous skin rash have also been reported as systemic complications.

b) Categorization of the Consequences according to the Nature of the Tissue Involved

1) Consequences to the Hard Tissues

Damage to the hard tissues of the mouth has been suggested.

In 1997, DiAngelis was the first to state that tongue piercings contribute to abrasion resulting in cold sensitivity at the lower first molar teeth as a result of the cracked-tooth syndrome . Tongue jewellery, habitual biting or chewing of the device, barbell stem length, the size of the ornament attached to the barbell, and the type of material used in it may all cause trauma to the teeth. This trauma may involve the enamel, the dentin, or even the pulp.[10]

Moreover, four cases have been reported that showed fracture of some cusps of the teeth . In a tongue piercing case report of German soldiers who were only included in the clinical examination, it has been cited that the pierced group exhibited more carious teeth than the nonpierced group (P), more enamel fissures (P), more enamel cracks (P), and more recessions especially at the lingual surfaces of mandibular anterior teeth (P).[11] Opposed to this important difference is the ratio of groove-shaped abrasions that is almost the same in both groups.

It is underlined that excessive playing with the piercing may cause misaligned teeth and diastema

2) Consequences to the Soft Tissues

Damage to the soft tissues has been presented as well.

The most prominent aftermath of piercing is gingival recession that is measured by using Miller's classification of marginal tissue recession. Gingival recession is usual on the labial aspect of the lower central incisors[9] and on the lingual aspect of mandibular central incisors. Campbell et al. have pointed out that gingival recession of the lingual side occurs after 2 years of piercing insertion.[12]

In addition, Brooks et al. state that logistic regression modeling indicated that age was a significant predictor of the prevalence of lingual recession with the possibilities of presenting lingual recession increasing by 1.17 for each year older than 14. Furthermore, Poisson regression indicated that age was the most important foreteller of the number of lingual sites with regression[13]. The most common form of recessions is as a narrow, cleft-like defect on the lingual and buccal sides of the mandibular incisors, with depths of recessions of 2-3 mm or more frequently extending to or beyond the level of the mucogingival junction. Even when the recession is short, serious attachment loss may still occur. Kieser et al. provide a table that consists of the numbers and percentages that indicate the proportions of gingival recession and abnormal tooth wear by site of piercing and type of recession. This table suggests that the majority of people with lip piercing had at least one labial part with gingival recession, whereas 33% of people with tongue piercing showed at least one lingual site with gingival recession.[14] All the people with lip and tongue piercing presented with at least one part with gingival recession and their average number of recession increased. No important discrepancies were found regarding abnormal tooth wear and piercing type. It has been reported that the clinical picture of the tissues near the piercings was excellent in 66% of the cases. Three of the eight students showed trivial alterations in soft or hard tissues: chipping of four premolars (three on the right side and one on the left side), gingival recession of the labial side of lower central incisors, scar on the skin from the removed labrette in the midline of lower lip, and irritation of the skin around the ring in lower lip.

Moreover, irritation of the skin around the opening of the mouth has been observed along with redness and light swelling, caused either by saliva flowing or contact allergy.[15,16] Inchingolo has grouped the complications to immediate and delayed ones. Some effects after piercing include persistent mucosal atrophy, erythematous palatal mucosa, transient alteration in taste, and leakage of blood and serum. In a case report Antoszewski et al. have detected a lip piercing that had caused decubitus and necrosis of the mucous membrane. The explanation to this finding was that the mucous membrane is more prone than the skin to mechanical injuries. Necrosis occurred at the place of oral vestibule and brought about embedding of the stud into the tissues of the lip.[14]

Aftercare for piercing

The average healing period for oral piercings varies from 1-6 months with 2-4 months being more typical. Unexpected or exacerbated reactions or delayed healing may extend the healing beyond 6 months.[15,17]

Conclusion

Piercing invades subcutaneous areas and has a high potential for infectious complications. The number of case reports of endocarditis associated with piercing is increasing. Tongue and lip piercings represent a significant risk for direct and indirect damage to soft and hard oral tissues. Although much less prevalent, lethal systemic infections may also occur. Considering the growing popularity of oral piercings, dental professionals should be aware of the potential complications associated with this practice and be able to identify those at high risk for adverse outcomes. Together with parents and educators, dental professionals should play an active role in warning patients of the serious consequences of oral piercing and should provide appropriate guidance.

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RECENT ADVANCES IN CARIES DIAGNOSIS: A REVIEW

Dr Mihir Desai, Dr Jitendra Lohar, Dr Yogender Choudhary, Dr Karishma Pathak

Introduction

According to WHO caries has been defined as a localized post-eruptive, pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity.

The archaeological evidence shows that tooth decay is an ancient disease. Skulls dating from a million years ago through the Neolithic period show signs of caries, including those from the Paleolithic and Mesolithic ages [(1)] In 1924 in London, Killian Clarke described a spherical bacterium in chains isolated from various lesions which he called Streptococcus mutants.[(1)] In 1960s it became generally accepted that the Streptococcus isolated from hamster caries was the same as S. mutans described by Clarke.[(1)] Accurate diagnosis of any disease is of utmost Importance for its correct curative modality . The primary objective of caries diagnosis is to identify patients with lesion that require invasive treatment, patients with lesion that require noninvasive treatment (remineralization procedures), and to identify patients who are at a high risk of developing carious lesions. [(3)]

METHODS FOR DIAGNOSIS OF DENTAL CARIES:

The time tested traditional modalities for caries diagnosis may be summarized as

- The visual method used by many general practitioners,
- Dye penetration test.
- The conventional radiographic method.
- The bitewing radiographic method.
- Xeroradiography
- Digital imaging
- Subtraction radiography

Certain diagnostic procedures which had gained acceptance in the last two decades may further be summarized as:

- Electric resistance
- The computer aided radiographic method (Digora system)
- Ultraviolet illumination
- Endoscope/Videoscope

The Most Recent Of The Caries Diagnostic Methods And Techniques Propagated In The Last Decade May Be Described As :

1a) The fiber optic trans illumination method

1b) Digital imaging fiber optic trans illumination method

2a) The quantitative laser fluorescence method.

2b) Laser fluorescence (diagnodent)

3) The alternating current impedance spectroscopy technique (ACIST).

4) Ultrasound/ Ultrasonic Imaging

5) Optical Coherence Tomography

6) Infrared thermography

7) Terahertz Pulse Imaging

8) Multi photon Imaging

9) Magnetic Resonance Micro Imaging

10) Cone Beam Computed Technique

Recent advance in caries diagnosis

FOTI AND DIFOTI

The differential transmission of light through healthy tooth structure as compared to carious tooth structure can be detected. When using fiber optic light the operator is able to use a more focused and higher intensity light beam instead of an operatory light, thereby increasing the potential to detect [(4-6)]

Figure 1 DIFOTI

Quantitative Light-Induced Fluorescence

It has been shown that tooth enamel has a natural fluorescence.[14] by using a CCD-based intraoral camera with specially developed software for image capture and storage, quantitative light-induced fluorescence (QLF) technology measures the refractive differences between healthy enamel and demineralized, porous enamel. Areas of caries and demineralization show less fluorescence (Figure 2). With the use of a fluorescent dye which can be applied to dentin, the QLF system can also be used to detect dentinal lesions in addition to enamel lesions.[15] A major advantage of the QLF system is that these changes in tooth mineralization levels can be tracked over time using the documented measurements of fluorescence and the images from the camera [(6)].

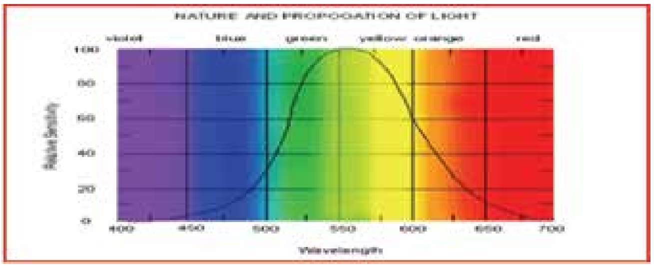


Figure 2

Laser fluorescence

Laser fluorescence detection techniques such as the DIAGNOdent®, (KaVo USA) rely on the differential refraction of light as it passes through sound tooth structure versus carious tooth structure. As described by Lussi et al in 2004, a 650 nm light beam, which is in the red spectrum of visible light, is introduced onto the region of interest on the tooth via a tip containing a laser diode. As part of the same tip, there is an optical fiber that collects reflected light and transmits it to a photo diode with a filter to remove the higher frequency light wavelengths. This leaves only the lower frequency fluorescent light that was emitted by the reaction with the suspected carious lesion. This light is then measured or quantified, hence the name 'quantified laser fluorescence·[16-17] One potential drawback with the laser fluorescence is the increase incidence of false-positive readings in the presence of stained fissures, plaque and calculus, prophy paste, existing pit and fissure sealants and existing restorative materials.

Figure 3

Interpretation: Values

- 5 - 25 – Initial lesion in enamel
- 25 - 35 – Initial lesion in dentin
- > 35 – Advanced dentin carie

Alternating current impedance spectroscopy

Alternating current impedance spectroscopy uses multiple electrical frequencies to detect and diagnose occlusal and smooth surface caries. CarieScan® is an example of this technology.[6]

- ACIST scans multiple frequencies.
- It characterizes the electrical property of tooth and lesion.

Figure 4

Ultrasonography in caries detection

Ultrasound imaging has a promising future as a hard- and soft-tissue diagnostic tool in all dental specialties. A study published in OOOE (November 2008) stated that "all ultrasound measurements were accurate, reliable, and positively and significantly correlated between examiners,"

Figure 5

Polarization-sensitive optical coherent tomography (OCT)

OCT uses near infrared light to image teeth with confocal microscopy and low coherence interferometry resulting in very high resolution images at ~10—20 microns. The accuracy of OCT is so detailed that early mineral changes in teeth can be detected in vivo after exposure to low pH acidic solutions in as little as 24 hours by using differences in reflectivity of the near infrared light. In addition, tooth staining and the presence of dental plaque and calculus do not appear to affect the accuracy of OCT.[10] It is important to always keep in mind, the ultimate beneficiary of technology, the patient.

Dental OCT system consist of :

1. a computer,
2. compact diode light source,
3. photo detector
4. hand piece that scans a
5. .3Fiber-Optic Cable Over The Oral Tissues

Figure 6

Infrared Thermography

This technology relies on the absorption of infrared laser light by the tooth with measurement of the subsequent temperature change, which is in the 1° C or less range. This technology is utilized by the Canary System® (Quantum Dental Technologies). This optical to thermal energy conversion is able to transmit highly accurate information regarding tissue densities at greater depths than visual only techniques.(10) Early laboratory testing has shown better sensitivity for caries detection by this technology, than radiography, visual or laser fluorescence technology.(10-12)

Figure 7

Terahertz Pulse Imaging

This method of imaging uses waves with terahertz frequency (= 1012 Hz or a wavelength of approximately 30 m) for caries detection

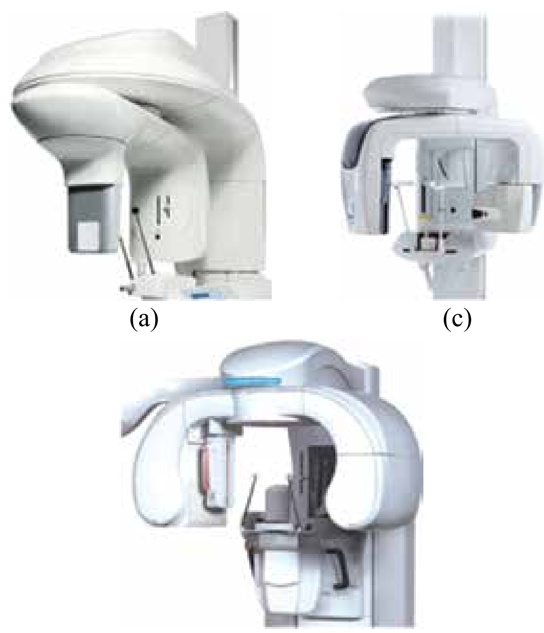
Magnetic Resonance Microimaging

Magnetic Resonance Micro Imaging (MRM) is a refinement of whole body MRI and a development of nuclear magnetic resonance (NMR) spectroscopy. There are two differences between MRI and MRM. MRI uses a magnetic field in the range of to1.5 to 3 Telsa, while MRM uses a greater field strength ≤ 7 Telsa. The micro imager has a small bore ≥ 2.5cm than a whole body imager.

Cone beam computer tomography

CBCT imaging appears to be the best prospect for improving the detection and depth assessment of caries in a proximal and occlusal lesions (9). CBCT uses a cone-shaped source of ionizing radiation and detector fixed on a rotating gantry to acquire multiple sequential projection images in one complete scan around area of interest.

CBCT imaging for caries should be limited to non-restored teeth. It has greater sensitivity & less specificity in detection of carious lesions. CBCT should not be considered a replacement for panoramic or conventional projection radiographic applications , but rather a complementary modality for specific applications.



(a) (c)

(c)

Figure 8: CBCT units. (a) KODAK Dental Imaging 9000 3D, (b) Veraviewepocs 3D, and (c) Picasso Trio.

Summary

Many oral healthcare professionals are quite surprised to learn that, as a group, they do not excel at diagnosing caries, especially interproximal caries using bitewing radiography. If dentists were able to diagnose teeth with 95+% accuracy with the basic tools of their eyes, probes and bitewing radiographs, there would be no market demand for any other caries detection technologies. Currently available technology and improvements in the future will enhance accuracy in detection of caries improving the oral health of the over health population at large.

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A LIGHT ON COMPARATIVE ANALYSIS OF DIFFERENT TECHNIQUES INVOLVED IN PERIAPICAL EXTRUSION OF DEBRIS:A REVIEW

Dr. Tanya, Dr. Rajasekhar, Dr. Saurabh Arora, Dr. Mayur Kahate, Dr. Shristee Priya

ABSTRACT

Several factors can influence the amount of periapically extruded debris. The purpose of root canal treatment is to clean and shape the canal and prevent reinfection. In order to meet the requirement various instruments, irrigants, intracanal medicaments are involved and to use them different methods of cleaning and shaping, irrigation is used. Hence wrong selection of any of these procedure lead to failure of the treatment. This article highlights various studies done on periapical extrusion of debris to know the factors involved in extrusion in order to prevent inter-appointment flare-up.

INTRODUCTION

Root canal treatment is a procedure in which whatever technique is being employed there is periapical extrusion of debris in more or less amount .Various irrigation techniques, chemomechanical preparation techniques,instrumentation techniques are used in order to clean and shape the canal.The most favourable features of irrigants are their flushing action, tissue dissolving ability,antibacterial effect and low toxicity. Many irrigants are used in dentistry but the most commonly used ones are various concentration of sodium hypochlor ite,chlorhexidine,EDTA,MTAD,.It is likely that irrigants do not predictably reach all aspects of the canal especially the apical third therefore a media is required to make the irrigant reach all through the canal such as safety end single vent needle,safety end double vent needle,Endovac.Irrigants along with instruments and instrumentation technique such as rotary or hand instruments used in a step back or crown down fashion also contribute to the periapical extrusion of debris. This study reports comparative analysis between different irrigants to know which technique does less extrusion of debris periapically to help clinician decide better treatment plan as extrusion leads to periapical inflammation,posttreatment pain and possible delayed healing.

COLLECTION OF DATA

A comprehensive literature search for longitudinal studies on the outcome of the use of various irrigation techniques, chemomechanical preparation technique, irrigation techniques,instrumentation techniques was conducted. Three electronic databases (PubMed,Medline,Embase) were used to identify studies from 1987-2016 in English language. Review and reference articles were searched for cross references. In addition different journals (JOE,International Endodontic journal,Brazilian Dental Research,Journal of Conservative dentistry,Indian Journal of Dental Research) were hand searched and relevant data was collected.

OVERVIEW ON PAST COMPARATIVE STUDIES

Eduardo E.Ruiz-Hubard in 1987[1] did a comparative analysis between step back and step down technique and it was seen that step down technique causes less extrusion of debris periapically . Dennis R. Fairbourn in 1987[2] used conventional filing technique,cervical flaring technique,ultrasonic ,sonic technique and he found that conventional filing technique has highest extrusion of debris periapically . Douglas in 1990 [3]compared balanced force,endosonic and step back filling instrumentation technique and evaluated that balanced force technique comparatively extrude less debris than endosonic and step back . GARRY L MEYERS in 1991[4] did a comparative study on weight of debris extruded apically by Conventional Filing and Canal Master technique and it was seen that canal master technique leads to less extrusion . Sarina A Reddy in 1998[5] used step back instrumentation with K files,balanced force with Flex R file,lightspeed Ni-Ti and .04 taper Profile 29 series and she observed that step back technique does highest extrusion of debris . Masoud Pairokh in 2012[6] compared 2% chlorhexidine,2.5% sodium hypochlorite and 5.25% sodium hypochlorite.he found that 5.25%sodium hypochlorite had the highest extrusion of debris . Zoi Psimma in 2013[7] inserted needle at 1,3 and 5 mm short of the working length and observed that extrusion was less as the needle is placed far from apex . Paula Barcellos Silva in 2016[8] evaluated apical extrusion of debris using a flat open ended needle,a side vented needle and a double side vented needle and he found that a flat open ended needle extrude greater amount of debris compared to side and a double side vented needle.

EXPERIMENTAL SET UP

Above procedure used more or less same procedure for collection of debris .Each tooth was secured for instrumentation and debris collection by the root being forced through a precut hole in a rubber stopper. A glass shell vial was used as the collecting container for any debris or irrigant extruded during instrumentation. This vial was placed into a glass flask with the rubber stopper fitted securely into the mouth of the flask. The apex of the root was suspended below the upper rim of the collection vial . The use of the collection vial was a modification of the technique used by Fairbourn et al. for debris collection. A 25-gauge needle was placed alongside

Fig. 1: Experimental set up done for the studies

the stopper during insertion to equalize the air pressure inside and outside the flask. After canal instrumentation, any debris visually adherent to the root end was scraped off with the inner edge of the collection vial and the root apex was flushed with 0.1 ml of distilled water to wash any remaining debris into the vial. Unexpectedly, a significant amount of irrigant was frequently present in the collection vials. The vials were then immediately placed into a dessicator (with $CaCl_2$ crystals) to drive off all moisture before a dry weight was obtained. The dessicator was kept in a warm room until the vials were dry and was then kept at room temperature for 24 hours before the final weighing[9].

FACTORS AFFECTING PERIAPICAL EXTRUSION OF DEBRIS

- The time of contact between file and tooth affects the amount of extrusion as rotary has limited torque and movement so less extrusion occur compared to hand filing[10]
- As close as the needle is placed to the apex more apical pressure is developed so more chances of extrusion
- Open ended needle let the flow of irrigant inadvertently apically whereas irrigant from side vented needle hits the wall of tooth and than go apically so less extrusion
- Needle tip design clearly influences the flow pattern,solution speed and apical wall pressure are all important parameters determining irrigation effectiveness and safety
- A faster aggressive system removes more debris in a shorter period of time thus all debris does not move coronally compared to gradual dentin cutting files
- It was seen that when preparation is done 1 mm short of the working length less extrusion is seen compared to full length preparation
- The more tissue dissolving the irrigant is the more extrusion is periapically

CONCLUSION

From 1968 the topic is under consideration and still the work is under progress. The idea behind the topic was to make clinician opt a suitable treatment plan in order to prevent the mishaps caused by improper knowledge of the instrument ,irrigant and instrumentation technique as well.

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