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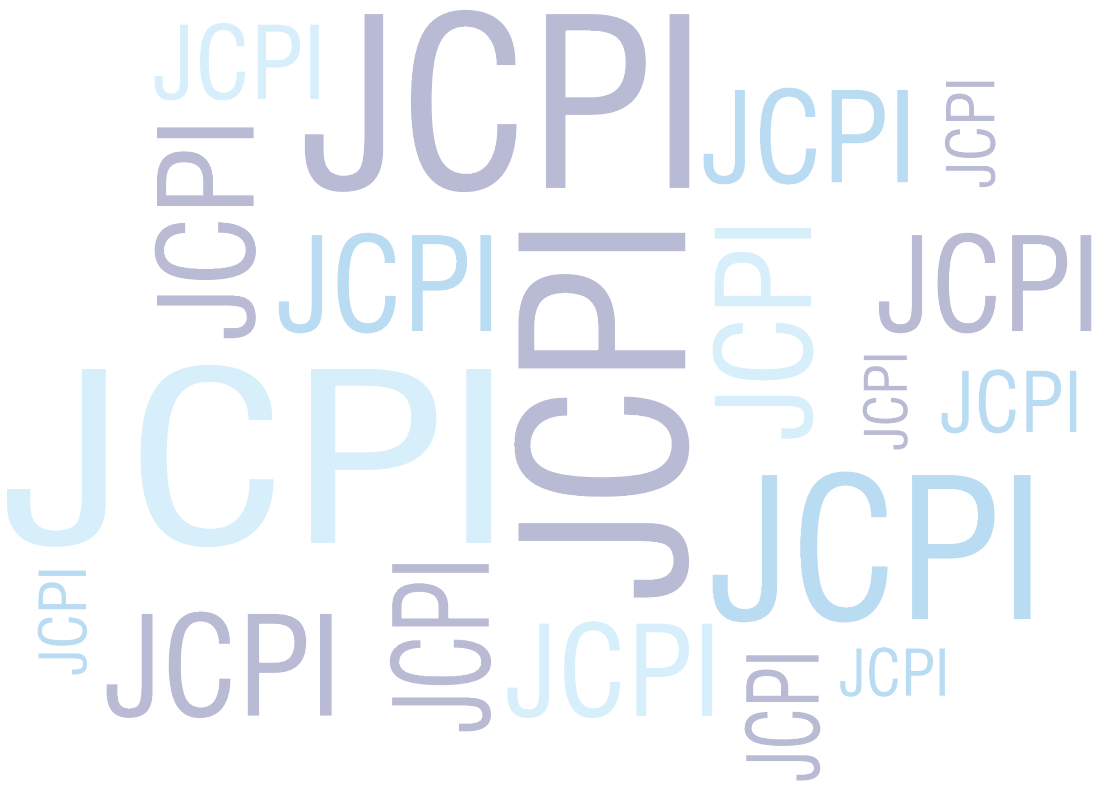

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C O N T E N T S

EDITORIAL

'If you can't explain it simply,
you don't understand it well enough'
- Albert Einstein

Scientific writing is an artistic skill analogous to a novelist or script-writer that requires utmost commitment in presenting it provocative and in such a way that it effortlessly influences the reader. With a decline in opportunities to graduates from entering academic arena, the entry into clinical pathway pose the specialist to forfeit ones' interest towards research. It is to etch in mind that even as a clinician, absolute ethical documentation of patient's data can significantly contribute to transformation in medical research. In the present time, it is stereotypically believed that only doctors associated with medical/dental institutions bestow with research process and scientific writing. In reality, any qualified potential graduate has the ability to take scientific research to the next level. At this moment let us take a pledge that none of quality time spend in research goes waste or lie as grey research. Rendition of scientific data in appropriate platform and presentation in simple understandable language help to dissipate the knowledge to wider audience across the globe for improvement of healthcare services.

To quote Prof. Robert M Pirsig , "the real purpose of scientific methods is to make sure, nature hasn't mislead you into thinking you know something you don't actually know." Ergo, I'm pleased to present the next issue of our Journal of Clinical Prosthodontics and Implantology. My whole hearted thanks to all the contributors, reviewers and the editorial board for their constant support.

Dr. Ponsekar Abraham A
Editor

ORIGINAL RESEARCH

Comparative evaluation of the pushout bond strength of fibre reinforced composite resin post and PEEK (polyetheretherketone) post following surface treatments

Badimela A,[a] Hariharan R,[b] Jayakrishnakumar,[c] Azhagarasan N S.[d]

ABSTRACT

Background: There is a lack of literature in the scientific domain on the use of PEEK material as a radicular post for both anterior and posterior teeth.

Aim: To comparatively evaluate the push out bond strength of prefabricated glass fiber reinforced composite resin post and customized modified Polyetheretherketone (PEEK) post following surface treatments.

Materials and methods: Total of thirty mandibular first single rooted premolars were divided into two groups of fifteen each (n=15) named as fibre reinforced resin post and modified PEEK post. All the specimens were subjected to endodontic therapy, followed by post space preparation. The posts from both the groups were subjected to dual surface treatments (Al2O3 50µm air abrasion followed by silane coating) and were subsequently cemented with dual cure resin cement (Maxcem elite, Kerr). All the samples were sectioned into three regions of each 2mm thickness and were subjected to push out bond strength analysis, followed by the assessment of mode of failure. Bond strength was compared using oneway ANOVA and Independent T test.

Results: There were significant differences ($P < 0.05$) in the push out bond strength in the three regions of modified PEEK post. There were no significant differences ($P > 0.05$) in the three regions of prefabricated glass fiber reinforced composite resin post. There were highly significant differences in push out bond strength ($P < 0.05$) between glass fiber post and modified PEEK post in coronal and middle regions but not in the apical region.

Conclusions: Within the limitations of this study it was concluded that surface treated modified PEEK material can be used as an intra radicular post because there were significant differences in the mean push out bond strength in all the three regions and there was absolutely no cohesive failure (within the post).

Keywords: Glass fiber reinforced composite resin post, Modified PEEK post, Push-out bond strength, Mode of failure, Alumina air abrasion, Silane coating.

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1. Introduction

Root canal treatment is broadly performed on teeth evidently affected by deep caries, multiple repeat restorations and/or fracture. It involves the removal of necrotic and infected pulp tissue followed by a well condensed obturation to prevent further microbial proliferation within the canal system.[1]

However, the long term clinical success of root canal treatment relays on efficient post endodontic restoration which prevent bacterial recontamination of the root canal system from the oral fluids.[2]

Several researches had proposed that the dentin in root canal treated teeth is appreciably different than dentin in teeth with vital pulps, where a protective feedback mechanism is lost when the pulp is removed and roots are more prone to fracture.[3, 4]

A variety of materials have been used for posts ranging from wooden posts of the 18th-century to metallic posts made of precious or nonprecious casting alloys and, more recently, carbon fiber, glass fiber, poly ethylene fiber, ceramic and zirconia posts. Endodontic posts are available as active or passive posts, parallel or tapered, custom made or prefabricated.[5]

Generally active posts are threaded and are anticipated to engage the walls of the canal, whereas passive posts are retained firmly by the luting agent. Active posts are more retentive than passive posts, but they bring in more stress into the root dentin.[3, 6]

Customised cast posts were used which were extremely rigid, promote stress concentration in isolated points which increases the risk of root fracture and highly unesthetic.[7]In 1990, Duret et al introduced fiber post with modulus of elasticity approaching that of the root dentin that effectively transmit and distribute the stress uniformly throughout the dentinal walls.[1]

These fibre posts can be adhesively luted to the root canal dentine using polymerizable resin cements. The inherent chemical homogeneity between the fibre post and the resin cement enables them to function together as a homogenous biomechanical unit, known as tertiary monoblock that mechanically replaces the lost dentin.8 Bonding strategies are usually employed to achieve micromechanical retention between the resin cement and root dentin.[9]

An important aspect of adhesive procedure for fibre post cementation is that two interfaces are involved namely, resin cement/root dentin interface and resin cement/fibre post interface. The adhesion in both interfaces is crucial for the long term success of post endodontic restoration.[10]

With regard to dentin and resin cement interface wide range of investigation was done using surface treatment of root canal dentin to remove smear layer and increase surface energy followed by cementation with conventional and self-adhesive cements. In order to improve the adhesion between fibre post and resin cement interface, pre-treatment of the fibre post surface had been proposed.[11]

Glass fibre posts are composed of various types of glass fibres such as SiO2, CaO, B2O3, Al2O3, with inorganic fillers and a polymer matrix, commonly an epoxy resin or other resin polymers.[12]Different surface treatments have been applied for conditioning of the post surface namely silanization, hydrofluoric acid etching, hydrogen peroxide, airborne-particle abrasion, methylene chloride, and laser irradiation.[13]

In recent times PEEK had evolved as a material of choice in various medical and dental applications. PEEK is a linear polyaromatic and semi-crystalline thermoplastic polymer with a suitable combination of high strength, stiffness, fatigue, and wear resistance. In addition, it is easy to process, non-toxic while possessing natural radiolucency as well as excellent thermal and chemical stability.[14]

PEEK based implants were used in (1).In the form of maxilla, facial and cranial implants. (2) For spine surgery – spinal cages. (3) For orthopedic surgery: In bone and hip- replacement surgeries, fixation plates, screws. (4) In cardiac surgery as intracardiac pump; heart valves. In dental applications for tooth replacement – dental implants from CFR-PEEK, dental prosthesis, intra-radicular posts.[15]

It has a melting point around 335.80C. PEEK can be modified either by the addition of functionalized monomers (pre-polymerization) or post polymerization modifications by chemical processes such as sulphonation, amination and nitration. The major beneficial property is its lower Young's elastic modulus (3–4GPa) being close to human bone, enamel, and dentin.[16]

To obtain better adhesion, PEEK surface requires treatment since it has low surface energy. Sand blasting is an efficient method for modifying surface morphology and to increase the surface area other methods are tribochemical silica coating and chemical attack.[17]

BioHPP (High Performance polymer) is a PEEK variant that has been specially optimized for dental field. It has been strengthened with special ceramic

filler, and optimized mechanical properties have been created for dental technical and/or dental medical use. This ceramic filler has a grain size of 0.3 to 0.5µm. Due to this very small grain size, constant homogeneity can be produced. The Elastic modulus of BioHPP lies in the range of 4000MPa, which is resemblance of human bone, makes it a more natural material. The aesthetic white shade supports its use in field of prosthetic and post and cores. Its insolubility in water makes it a biocompatible material, which is ideal for patients with metal allergies.[18]

Extensive search on the use of PEEK material as a post in medline/pubmed/cochrane databases didn't yield positive results. Therefore there was a need to explore the use of PEEK as a post material from a research point of view and then to identify its clinical feasibility. Glass fiber reinforced composite resin post had been widely used clinically and therefore it was chosen for comparative evaluation of push-out bond strength against modified PEEK in the current study

The null hypothesis for this study was that there would be no significant differences in the push-out bond strength between customized modified polyetheretherketone (PEEK) post and prefabricated glass fiber reinforced composite resin post.

Materials and Methods

Thirty single rooted human mandibular first premolars extracted as part of orthodontic therapeutic extractions and following severe periodontal problems were selected. After extraction, the teeth were cleaned and stored in 0.9% saline (Paradental drugs, India) at room temperature.[19] Each tooth was examined radiographically for presence of single root canal, a closed apex and with no evidence of a caries lesion or restoration. Each tooth was sectioned 15mm coronally from the root apex at CEJ using diamond disc (Mani Inc, Japan). All the teeth were embedded in a tooth colored self-curing acrylic resin (Dental products of India,Ltd, India), using a putty index made out of addition silicone impression material (Aquasil – putty index, Dentsply Sirona, Germany).

Access cavities were prepared and the working length was established by placing a size 20 K-file (Mani Inc, Japan) into the canal with 1mm short of apex. The root canals were prepared by Crown down technique using 6% rotary protaper file system (S1, S2, F1, F2, and F3) (Diadent, Korea). The root canals were irrigated with 3% NaOCl solution (Prime Dental Products PVT, India) at 37ºC and finally irrigated with normal saline (0.9%). The canals were dried with multiple sterile paper points (Diadent, Korea). Master cone size 30 of 6% taper was selected. All teeth were obturated by Warm vertical compaction method using 6% taper gutta percha cones of size 30 (Diadent, Korea) with Root canal sealer (Rc-seal, Prime dental, India). The decoronated and filled roots were stored for 24 hours in distilled water at 37ºC.[20]

Fig. 1 Pre fabricated glass fiber post and drill

The gutta percha was removed with the help of micromotor and handpiece (Marathon-3,Saeyang microtech, Korea) by using peeso reamers size1, 2, 3, 4 and 5 (Mani Inc, Japan), and Reforpost space drill (Angelus,Brazil) leaving a minimum 5mm apical seal and creating a standard post space of 9mm from the coronal surface corresponding to the tapered glass fiber post size #3 (1.5mm diameter, Reforpost, Angelus, Brazil) Following the preparation, the post spaces were rinsed with 3% sodium hypochlorite. A final irrigation was accomplished with distilled water (Emplura ®, Mumbai), and then the post spaces were dried with paper points. 30 mandibular first premolar root samples were divided into 2 groups according to the type of post material used, Group I: Prefabricated glass fiber reinforced composite resin post (REFORPOST- Size #3,Angelus,Brazil) (15 Nos,1.1mm apicaldiameter,1.5mm coronals) (Figure. 1), Group II: Customized modified Polyetheretherketone (PEEK) post (BioHPP, Bredent , Germany) (15 Nos) (Figure. 2).

Fig. 2 Customized modified peek post

Fig. 3 BioHPP peek granules

After post space dried with paper points and air dry, Canal space was applied with Isolating Liquid (Yeti Lube, Yetti Dental, Germany). Dental Inlay casting wax (GC Corporation, Tokyo, Japan) was used to obtain the intra canal wax patterns by using direct technique. The post patterns which were fabricated by using direct technique were sprued and invested in size 9 casting ring, according to manufacturer's instructions. 210 gms of powder with 35 ml of liquid (75% Deguvest liquid, 25% water) (Degudent GmbH, Germany) was used. After the investment set, burn out procedure was carried out in furnace (VULCAN 3-130, Dentsply, JAPAN) along with plunger for pressing. The procedure duration was 3hours and temperature was raised from 0oc to 840oc. After two and half hours the investment was taken out and BioHPP PEEK granules (BioHPP ds2 , Bredent , Germany) (Figure. 3) were inserted and then it was put back in the furnace for not more than half an hour at 400oc. After the burn out procedure was complete, the investments along with its plunger were subjected to pressing in its respective pressing unit (for 2 press, Bredent) (Figure. 4) at 60 psi for half an hour.[21] All the sprues were trimmed with diamond disks .All the posts were then fitted into their respective root samples.

Fig. 4 Bio HPP vaccum press

Surface of the post specimens were sandblasted with 50µm Al2O3 particles (Alminox 50µm ,Delta labs, India)for 10s. The air pressure for sandblasting was maintained at 2.8 bars at a distance of approximately 10mm between the surface of the specimen and the blasting tip in the sand blasting unit.22Then, the specimens were rinsed under running water and then dried with oil-free compressed air to remove the remnants for 10s. Silane coupling agent (Silano, Angelus, Brazil) was applied on the surface of each specimen and very gently air dried before cementation of the post into the post space of the each tooth sample.[23, 24, 25, 26] All the posts from both the groups were luted with dual-cure resin (Maxcem elite, kerr, New south wales, Australia) cement according to manufacturer's instructions. The cement was applied into the root canal with intra-canal tips and small amount was applied on the fiber post, to ensure adequate cementation.[27] The post was fixed under finger pressure, the excess cement was removed carefully and light cured for 20secs with LED curing light device (3M ESPE, Germany)

Thirty samples were luted with glass fiber post and modified PEEK post were transversely sectioned perpendicular to the post starting at 6mm from the apex of the specimen using a hard tissue microtome (LEICA SP 1600,Germany), along with continuous water irrigation to prevent overheating . In this manner, 3 slices of 2.0mm thickness were obtained in coronal, middle and apical region of each root specimen resulting in 45 slices/ group.[28] The push-out bond strength (MPa) was determined using Universal testing machine (Instron3369, Massachusett, USA). A custom made stainless steel platform (Figure. 5) was fabricated with a punch hole in the center of the platform. The diameter of this punch hole is made 0.2mm greater than the greatest diameter of post.

Fig. 5 Custom made platform for PBS

The specimens were positioned on the jig in an apico-coronal direction to avoid interferences due to root canal taper. The post segments were loaded with a cylindrical plunger of 1 mm in diameter

centered on the post segment; without contacting the surrounding dentin surface. Loading (Figure. 6) was performed at a cross head speed of 1.0mm/min until the post was completely extruded from the specimen.[25,27] The peak force of post extrusion was considered as bond failure and recorded in Newton (N), and this was divided by the bonded area (A) which was calculated by the formula:

$$A= \pi (R1+R2)*\sqrt{(R1-R2)2+h2}$$

Where R1 and R2 were the largest and the smallest radius, respectively of the cross sectioned tapered post, and h is the thickness of the root section.[20, 29]

Fig. 6 Load application in UTM

After the assessment of push out bond strength all the thirty test samples from both the groups were observed under optical microscope (OIAL/MET/01-A Dewinter Technologies, Maharastra, INDIA) with a magnification of 50X to assess the five modes of failures (Figure. 7), (Figure. 8).

Fig. 7 Optical image of resin post

Fig. 8 Optical image of PEEK post

1. Results

Oneway Anova test revealed that there was statistically insignificant difference in the both strengths of glass fiber posts in three regions. Whereas there was statistically significant difference in bond strengths of modified PEEK post in three regions (Table 1). Independent T test revealed there was statistically significant difference in bond strengths between glass fiber post and modified PEEK post at coronal and middle region. There was no statistically significant difference at the apical region.

Chi square test (Table 4) revealed that there was a statistically significant difference between glass fiber post and modified PEEK post at coronal region with regard to mode of failure.

Discussion:

Since teeth are always in contact with saliva in oral conditions, it is generally recommended that they are stored in a solution and kept wet. 30 In the present study, the extracted teeth were stored in saline solution (0.9%) at room temperature, according to the method described by Goracci et al.[25,31] Subsequently teeth were subjected for ultrasonic scaling and cleaned with water to remove calculus and soft tissue Teeth were sectioned with the cemento-enamel junction as reference point with root length of 15 mm to standardize the working length.

In the present study, 3% sodium hypochlorite was used as an irrigating solution because it is an effective antimicrobial agent, serves as a lubricant and also, it has effective tissue dissolving properties.[32] Warm vertical compaction method was performed for obturation of all the thirty samples. Abramovitz suggested that 3-6mm of gutta percha to be left to maintain apical seal.33 but in many other later studies, authors recommend 4-5mm of remaining gutta percha after post space preparation. It allows for proper apical seal. So the level of 4-5mm was chosen for this study.[34]

Surface of the post specimens were sandblasted with 50µm Al2O3 particles for 10s. The air pressure for sandblasting was maintained at 2.8 bars at a distance of 10mm between the surface of the specimen and the blasting tip in the sand blasting unit .Then, the specimens were rinsed under running water and then dried with oil-free compressed air to remove the remnants for 10s. Silane coupling agent was applied on the surface of each specimen and dried before cementation of the post into the post space of each tooth sample. In this study dual cure resin cement Maxcem Elite (Kerr) along with intra-canal tips was used because it reduces the clinical steps of etching, bonding and application of conventional resin luting cement.

Table 1: Materials used in the present study

S No	Material name	Manufacture name	Chemical composition	Commercial Name	Lot Number
1	Glass fiber reinforced composite resin post	ANGELUS	Glass fiber(80%),pigmented resin(19%),stainless steel filament(1%)	Reforpost	42430
2	PEEK post (BioHPP)	BREDENT	BioHPP ds 2 granules	BioHPP granules	458616
3	Silane coupling agent	ANGELUS	Silane and ethanol	Silano	44626
4	Alumina particles	DELTA	Al_{2O3} particles - 50µm size	Alminox	10104
5	Dual cure resin cement	KERR	1,6-hexanediyl bismethacrylate (5-10%) 2-hydroxy-1,3-propanediyl bismethacrylate-(5-10%) 7,7,9(or 7,9,9)-trimethyl-4, 13-dioxo-3,14-dioxa-5, 12-diazahexadecane-1, 16-diyl bismethacrylate-(1-5%) 3-trimethoxysilylpropyl Methacrylate-(1-5%) 1,1,3,3-tetramethylbutyl Hydroperoxide-(0.1-1%)	Maxcem Elite	6785838

TABLE 2: Overall comparison of mean push out bond strength (MPA) of prefabricated glass fiber reinforced composite resin post and customized modified peek post

		CORONAL	MIDDLE	APICAL	P – VALUE
FIBER POST	MEAN	10.173	8.404	8.846	.061
	S.D	±2.127	±1.803	±2.231	
PEEK POST	MEAN	6.178	6.279	7.593	**.003****
	S.D	±1.048	±1.088	±1.422	
P - VALUE		**.000***	**.001***	.077	

Table 3: Mode of failure for prefabricated glass fiber reinforced composite resin post

REGIONS	1 Adhesive (b/w post & cement)	2 Adhesive (b/w cement& dentin)	3 Cohesive (with in post)	4 Cohesive (with in cement)	5 Mixed
CORONAL	5 (33.3%)	4 (26.7%)	5 (33.3%)	-	1 (6.7%)
MIDDLE	5 (33.3%)	8 (53.3%)	2 (13.3%)	-	-
APICAL	1 (6.7%)	5 (33.3%)	2 (13.3%)	-	7 (46.7%)

Table 4 : **Mode of failure for customized modified peek post**

REGIONS	1 Adhesive (b/w post & cement)	2 Adhesive (b/w cement & dentin)	3 Cohesive (with in post)	4 Cohesive (with in cement)	5 Mixed
CORONAL	2 (13.3%)	13 (86.7%)	-	-	-
MIDDLE	6 (40%)	4 (26.7%)	-	4 (26.7%)	1 (6.7%)
APICAL	1 (6.7%0	8 (53.3%)	-	1 (6.7%)	5 (33.3%)

Table 5: Overall comparsion of mode of failure for prefabricated glass fiber reinforced composite resin post and customized modified peek post

REGION	P- VALUE
CORONAL	**.007***
MIDDLE	.077
APICAL	.403

The push out bond strength was employed to measure the bond strength in MPa between the root dentin, the resin luting cement and fibre post at three different levels categorized as coronal, middle and apical third. Goracci et al have highlighted the parameters that influence the bond strength tests and they include the geometry of the specimen, the size of the bonded surface area, the loading configuration and the type of the resin luting cement to be tested.[35] The push out tests proved to be more effective as it provided measurements with limited data variability. These push out tests had the ability to record low levels of the bond strength which was inherent in all the post- cement-root dentin bonds. The premature failure rates of the specimens were also less when push out bond strength was employed. Monticelli F et al demonstrated that push out bond strength were superior to micro tensile stresses using finite element analysis.[36, 37] Bitter et al stated that push out tests produces shear stresses comparable to the shear stress developed during the clinical conditions at the post-cement-dentin interface.[38]

However the limitations of push out tests include the following: Push out test when performed on thick root sections or on whole post causes non uniform shear stress distribution. The specimen position, the angle at which the load is applied influences the push out bond strength results.[39]To overcome these limitations the specimens were modified in our study to obtain 2mm thick dentin slices. The mean push out bond strength of customized modified PEEK post (Group –II) showed significant differences in all the three regions, with the highest bond strength observed at the apical region followed by middle and least in the coronal region. This could be due to the dentin depth and tubule density in the apical region. This results was consistent with the previous study on glass fiber post.[40, 41] The push out bond strength results in all the three regions of our present study for customized modified peek post were comparatively higher than those of previous studies on glass fiber reinforced composite resin post.[30,42,43] This could be attributed due to the silanization of the post surface following air abrasion with alumina particles.

The mean push out bond strength of prefabricated glass fiber reinforced composite resin post (Group – I) in comparison with customized modified PEEK post (Group –II) showed high significant differences at coronal and middle regions. There was no significant difference in the apical region. The push out bond strength for prefabricated glass fiber reinforced composite resin post was highest in the coronal region.

LIMITATIONS

The use of one type of diameter of the posts for the both the groups. mode of fabrication of modified PEEK post was done by Hot pressing technique, whereas CAD-CAM method can also be applied in future studies. Other modes of surface treatments for modified PEEK post should be explored. Future studies should include the use one piece customized modified PEEK post & core. Only one type of self-adhesive dual cure resin cement was used. It is unclear from the scientific literature with regard to the choice of cement to be used for luting of modified PEEK post. Therefore on an experimental basis self-adhesive dual cure resin cement was used. Future studies should include on GIC and resin modified GICs.

Relationship between radicular dentin surface conditioning and modified PEEK post should also be explored. In the current study specimens were not subjected to thermal and cycling loading before evaluation of push out bond strength. The relationship between these loading factors and post adhesion should be carried out in future studies for modified PEEK post. Future studies on modified PEEK post could include single rooted anterior teeth. Studies on flexural and fracture strength of modified PEEK post should also be explored.

Conclusions

Based on the findings of the present study it was concluded that surface treated modified PEEK material can be used as an intra radicular post because there was significant differences in the mean push out bond strength in all the three regions and there was absolutely no cohesive failure (with in the post)seen. However glass fiber post provided superior mean push out bond strength than the modified PEEK post and this was significant in coronal and middle regions only.

Clinical significance

Surface treated modied PEEK material can be used as an intraradicular post in clinical situations.But this material should not be considered as a replacement material for customized metal posts or prefabricated fiber reinforced resin posts. More future studies are required to enhance the results of this study.hese results are in accordance with previous glass fiber post studies.[20,25,26,29,44]

The most frequent type of failure in modified PEEK post (Table 3) was adhesive (between cement and dentin). This could be attributed due to

the remaining dentin debris on the canal walls after instrumentation and the absence of intra canal dentin surface treatment. Upon comparison these results were in line with the previous studies on mode of failure of glass fiber post.[29,43] The most frequent mode of failure in prefabricated glass fiber reinforced composite resin post (Table 2)was adhesive (between cement and dentine). This could be due to lack of intra radicular dentin surface treatment. These results were in line with previous studies.[44, 45] Based on the results of the present study, the null hypothesis was rejected because there was significant difference ($P < 0.05$) in the push out bond strength between customized modified PEEK post and prefabricated glass fiber reinforced composite resin post in the coronal and middle regions.

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LITERATURE REVIEW

Radiation stents – A road less travelled

Kiruthiga V.P,[a] Shakthi Abarna B,[b] Parameshwari G,[c] Neya S[d]

ABSTRACT

Radiotherapy has become one of the promising modalities in cancer treatment either as primary or in combination with other forms of therapy. But is also associated with a number of short and long term adverse effects such as pain, mucositis, erythema, ulceration, soft tissue necrosis, altered taste /olfaction, edema, radiation induced fibrosis, trismus, dysphagia, radiation caries, salivary gland dysfunction and Osteoradionecrosis. In almost every case, the adjacent normal tissue also gets irradiated because of its close proximity and worsens the scenario. Hence, their tissue tolerance exceeds, which leads to cell injury and a vicious cycle of adverse effects follows. Radiation stents can be a boon in sparing the adjacent tissues. This literature review summarizes the evidence which suggest actual reduction of adverse effects due to decline in levels of radiation in adjacent tissues.

Keywords: Backscatter radiation, Mucositis, Osteoradionecrosis, Quality of life, Radiation stents.

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INTRODUCTION

Head and neck cancers are the third most common cancers worldwide standing next only to lung and uterus cancers. Moreover the developing countries solely contribute to over 60% of this global cancer burden.[1] In United kingdom, it's the 8 most common cancers and in America it contributes to about 3% of all cancers and is seen to considerably wane in incidence.[2,3] But then, in India they contribute to a third of all cancers with a significant percentage of mortality rates.[4] Prevention being the core goal worldwide, treatment and palliative care take up equal significance. Radiotherapy has evolved into a more proficient therapy with computer aided hard and software tools. Despite advances, adverse toxic effects after radiation therapy prevails. In developing countries like ours, external beam radiotherapy prevails to be in use, while other modern techniques still remain a dream to a greater proportion. The use of radiation stents can at least minimize the toxic effects to adjacent tissues.

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Radiation Stents

Glossary of Prosthodontic terms, defines "Radiation shield" as an intra-oral device designed to shield adjacent tissues from radiation during Ortho voltage treatment of malignant lesions of head and neck region.

Types:

Amongst the various radiation stents described in literature. The protecting stents are elaborated in the following.

1. Protecting stents:
    a) Shielding stents
    b) Tongue depressing stents
    c) Displacing stents
    d) Custom mouth protectors
2. Materials used:
    a) Heat cure acrylic resin
    b) Cerrobend/ Lipowitz/ Woods metal/ Bend alloy/ Pewtalloy/ MCP 158
    c) Lead
    d) Aluminium

A radiation stent does not require complex techniques. They can be fabricated by commonly available lab armamentarium and materials and can be delivered with a few appointments. Primary impressions made with irreversible hydrocolloid material followed by interocclusal record at an open vertical dimension of occlusion (with a careful consideration of the patient's mouth opening as trismus could be a common association). With the records taken, the casts are mounted on an appropriate articulator. The stent waxed up according to specific dimensions, which is further flasked and processed in the usual way for most of the stents.

Heat cure acrylic resin:

This material becomes a vital requisite for the fabrication of radiation stent. It can be used solely in varying thickness or in combination with an array of metals with good shielding properties. Its protectiveact is due to the presence of large amount of hydrogen, which shows an exceptional shielding efficiency. Other materials with comparable properties are composites, water, saline etc.

Since the oral cavity is a compact environment with lot of interactions back scatter radiations from metal stent/crowns/restorations/implants can harm the normal tissues. Backscatter radiation can be reduced by increasing the thickness of acrylic material.[5]

Cerrobend/ Lipowitz/ Woods metal/ Bend alloy/ Pewtalloy/ MCP 158:

It's a eutectic fusible alloy with a melting point of 70°C (158 F). This low fusing alloy is composed of 50% Bismuth (Bi), 26.7% Lead (Pb), 13.3% Tin (Sn), and 10% Cadmium (Cd) by weight. It has a modulus of elasticity of 12.7 GPa, and an yield strength of 26.2 MPa. Cerrobend alloy should be 1 cm or greater in thickness to ensure sufficient protection. A 95% reduction in transmission risk of 18 MeV electron beam can be ensured by using cerrobend alloy with thickness of 1 cm or greater.[6]

Most of the shielding efficacy is attributed to the presence of lead. Whilst, other elements contribute to the mouldability and ease of processing, this alloy should be handled with caution as it contains lead and cadmium both of which are known to pose danger. Cadmium poisoning carries the risk of cancer, anosmia, and damage to liver, kidneys, nerves, bones and respiratory system

Lead:

It's a bluish gray metal with a molecular weight of 207.2, density of 11.34 g/cm3, melting point of 327.4°C. It has good malleability and corrosion resistance.

Its increased density and atomic number coupled with decreased size of its bond length and atomic radius contributes to its defensive property against radiation. The increased amount of electrons in the metal absorb and scatter energy whereby preventing deleterious ionizing radiation. This metal is more effective against shielding gamma rays and X-rays, both of which are used in radiation therapy whereas they do not show significant effect against neutrons.[7] Khan et al recommends a 1mm increase in thickness of lead for every 2 MeV energy of the electron beam.[8]

Handling Lead has been associated with occupational hazard for ages. Caution in terms of good ventilation and personal protection has to be exercised while handling this material. Some of the adverse effects are neuropathy, nephropathy, diminished hearing acuity etc.

Aluminium:

Its silvery white ductile metal with atomic number 13, density 2.70g/cm3 and Young's modulus 70 GPa. As a matter of fact when the atomic number decreases the shielding efficiency also decreases, hence it is a weak shielder compared to lead but can be an excellent material to prevent back scatter radiation when given along with a lead shield.[9]

Tongue displacing stents:

They are prosthetic devices that aid to deviate tongue in a repeatable position during radiotherapy.

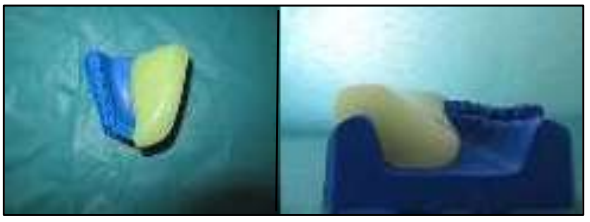

Figure 1(a) Tongue displacing stent – occlusal view; (b)Lingual view

A minimum distance of 10 -15 mm is mandatory for this type of stent. Johnson et al recommends a technique in which the material is molded to the level

of over the cusp tips over which three struts are designed, two in the posterior region and one over the anterior region for constructing a tear shaped paddle to displace the tongue.[10] The tongue is displaced to its maximum yet tolerable limit in order to prevent gagging, soreness and ulcerations. The position of the tongue should be optimized to a repeatable position and the patient be taught the same. In Fig. 1a, 1b the stent is designed such that it occupies one half of the floor of the mouth and extends onto the occlusal surface of posterior teeth from the incisors the thickness of the stent over the floor of the mouth is 8mm from all sides.

Tongue depressing stents:
These types of stent depress and protect the tongue from damage while the patient undergoes radiotherapy. [Fig. 2a,2b] depicts a tongue depressor with bite block intended to keep the mouth open during radiation dose delivery. An inter incisal distance of atleast 10- 20 mm is recommended for this stent.

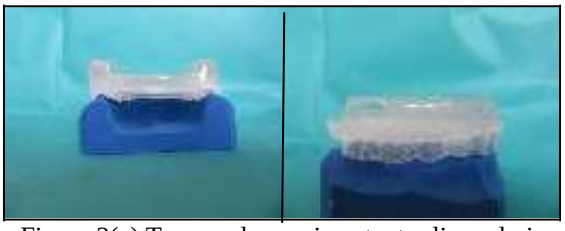

Figure 2(a) Tongue depressing stent – lingual view; (b) Lateral view

A quick chairside fabrication of this stent with light cure composite is also possible. Here the material is moulded so as to cover the tips of cusps only with two posterior struts to which an anterior triangular pad is attached. The pad is concave towards the tongue and convex above. And the groove (position) for tongue is optimized in the stent such that it is repeatable by the patient. The stent is polished to a satin finish and not a high luster.

Shielding stents:
Most of the requisites needed for other stents apply here also, except a shield metal or alloy (Lead, Lipowitz alloy, Rose metal, Newton's metal) is incorporated into the main framework to provide additional fortification.[11] And also in such stents an additional thickness of acrylic is needed to prevent backscatter radiation from the shield metals which could be even more dangerous than the primary beam itself. To further attenuate backscatter a tin or aluminum cover on top of the acrylic is being recommended by some authors.[12]

Custom mouth protectors:
These devices are effective means of preventing the effects of backscatter during radiation therapy. They are simple stents that extend the whole length of the tooth and prevent backscatter to the teeth.
The other usage is as topical fluoride applicators both pre and post irradiation in order to reduce the incidence of radiation caries.[13]

Figure 4(a)Custom mouth protectors – Occlusal view; (b) lingual view.

MODERN RADIATION THERAPY MODALITIES:

1. External beam radiation therapy:
   a) 3D Conformal radiation therapy
   b) 4D Radiation therapy
   c) Intensity modulated radiation therapy
   d) Stereotactic radiation therapy (gamma knife)
   e) Stereotactic body radiation therapy (cyber knife)
2. Internal radiation therapy:
   a) Temporary brachytherapy implantation
   b) Permanent brachytherapy implantation
   c) Systemic radiation therapy.[14]

AUTHOR (YEAR)	TYPE OF STUDY	RESULTS
Priyanka mall (2016)	Randomized control trial *Treatment*-Positioning Stents	Mean QOL scores in study group was less (p<0.001)
Goel A Tripathi (2010)	Randomized control trial *Treatment*-Positioning Stents	Mucositis (p<0.001) xerostomia (p=0.002,0.006,0.006)were lower in trial group
Qin W J (2007)	Randomized control trial *Treatment*-Tongue displacing stents	Taste dysfunction in study group was lower (p<0.001) Grade 3-4 mucositis was lower in trial group (p=0.4)
Miura (1998)	Retrospective analysis (1979-1994) *Treatment*-Acrylic stent	Incidence of osteoradionecrosis was lower in study group p=0.0004 Spacer (p=0.02)&combined Chemotherapy (p=0.02) combined External (p=0.02) are significant independent factors associated with Osteoradionecrosis
Karma Yangchen (2016)	Pilot study *Treatment*-Shielding Stents	Pain on swallowing, salivary changes, zerostomia, mucositis, and dysphagia were lower in study group(p<0.05) Caries incidence lower in study group (p<0.05)
Kenichi Obinata (2003)	Retrospective analysis (78 months) *Treatment*-Acrylic Stent	When spacer distance was >5mm incidence of Osteoradionecrosis was less (p<0.01).[15,16,17, 1 8,19,20.]

DISCUSSION:

Radiation stents as prosthetic devices is a path less trodden. The following is the evidence from the literature based on some of the clinical trials that shows reduction in dose &adverse effects with the use of radiation stents.

Some of the oldest literature regarding radiation stents dates back to 1978, obtained from the unpublished works of Schare L in M.D Anderson hospital, Texas. According to his research, backscatter produced directly adjacent to a metal stent is approximately 35% for 18 MV electrons, 73% for 8 MV x - rays and 74% for Co 60. He suggests that the effect can actually be reduced by increasing the distance from the alloy. A 6mm thickness of polymethyl methacrylate essentially reduces the backscatter radiation by 10% in 18 MV electrons and 18 MV X-rays whereas by 1% in Cobalt 60.5

Some of the invitro research which throws light on dose reduction are those that are conducted by Verrone which utilizes dose volume histogram to describe mean reduction rates and the ones done by Russel wang regarding the correlation between thickness of hydroplastic acrylic material and the reduction of adverse effects and Peter C Levendag dealing with thickness of lead shielding stent and reduction in incidence of osteoradionecrosis.[21,22,23]

A recent systematic search conducted in 2018 by Quiyang tang summarizes a wide array of materials used as radiation spacers ranging from acrylic resin, blood patch balloon filled with saline, human collagen, HLA (Glycosaminoglycans polymer), polyethylene glycol, hydrogel acellular human debris for different types of cancers and their utility in sparing normal tissues from radiation.[24]

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CLINICAL REPORT

Denture Phonetics Enhanced By Rugae Duplication

Lokesh S [a], Brintha Jei J [b], Murugesan K [c], Muthukumar B [d]

ABSTRACT

In edentulous patients, dentures should not only provide better function and aesthetics, but also should permit good phonetics. Phonetics is a significant factor to be taken into consideration for the denture patients. Palatal rugae contours have a very important role in phonetics, by production of linguo-palatal sounds that involves the contact between tongue and palate. By customizing palatal contours of a maxillary denture to the tongue, the patient may easily adapt to the definitive denture contour, which in turn shortens or eliminates the adjustment period for the achievement of proper speech phonetics must be considered , along with mechanics and esthetics as the integral factors in contributing to the success of a dental prosthesis. , the replication of soft tissue contours favors the formation and pronunciation of Sibilants as clearly as a normal dentate individual Proper contact between the tongue and the palate is always involved in the production of linguopalatal group of sounds This article describes a novel technique for palatal rugae transfer to a complete denture.

Keywords: Palatal rugae, Phonetics.

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INTRODUCTION

The denture should adequately provide esthetics, comfort and efficiency to the patient. Phonetics is produced by turbulence of stream of outgoing air and the tongue contacts the landmark in the palatal area[1,2]. Palatine rugae are associated with phonetics, taste, proprioception and adaptation. Palatal rugae is also called plica palatinae transversae which is the ridges on the anterior part of the palatal mucosa which is present on each side of the median palatal raphae and just behind the incisive papilla [3,4]. According to Thomas et al rugae pattern is classified based on length as primary, secondary and fragmentary rugae, based on shape as straight, curvy, circular and wavy[5]. This palatal rugae also help in forensic odontology for the identification of person person because the rugae pattern is unique distinct for each person[6,7]. So the fabrication of denture should be with the aim to promote phonetics. This can be provided by contouring palatal portion and by transferring the palatal rugae to the final denture. This case report describes a technique to transfer the palatal rugae to the removable denture

Case Report

A 73-year-old male patient reported to the Department of Prosthodontics, with a chief

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complaint of unsatisfactory retention and ill-fitting upper denture. Partially edentulous maxillary arch with the presence of 17 teeth alone in maxilla and presence of 33,34,43,44 and 45 teeth in the mandibular arch which were periodontally compromised (Figure 1). Treatment options explained to the patient but the patient was not willing for extraction and any other restoration and he wanted only a new removable denture. So, advised for removable denture in maxillary arch with reproduction and transfer of palatal rugae and removable partial denture in lower arch.

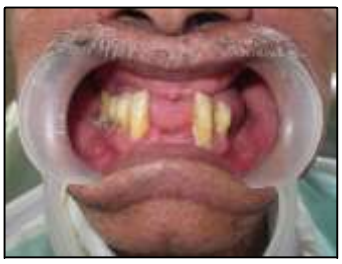

Figure.1: Pre-Operative view

TECHNIQUE

1. Maxillary and mandibular primary impressions were made using alginate impression material and master casts were prepared (figure 2 and 3).

Figure 2 & 3: Primary Impression and Primary Casts

2. Temporary denture bases were then made, followed by recording of jaw relations and teeth arrangement in a semi adjustable articulator.

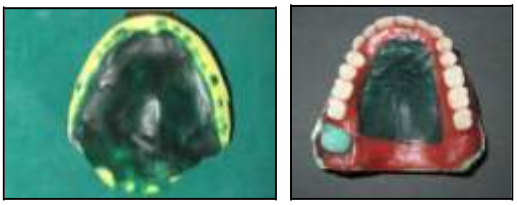

Figure 4 & 5 Rugae duplication with inlay wax. Transfer of wax duplicated Rugae

3. After try-in stage, pattern of rugae was recorded from the patient by making maxillary impression using mucostatic impression material (alginate). The impression recorded the rugae pattern on either side of the midline.
4. In that impression Type II Inlay wax (BEGO) were softened and poured over the palatal rugae area in layers to form a uniform adequate thickness of 2mm. (Figure 4)
5. Then the palatal portion of temporary denture base in trial denture was trimmed and removed.
6. The waxed portion of palatal rugae from the elastomeric impression was carefully removed and transferred to the trial denture by using incisive papilla and midline as guide. (figure 5)
7. Then the wax-up of trial denture was done with the transferred portion of rugae region
8. Flasking procedure was carried out by conventional method under long curing cycle.
9. After deflasking trimming and polishing were done and the details of palatal rugae were checked in the denture and was followed by insertion.

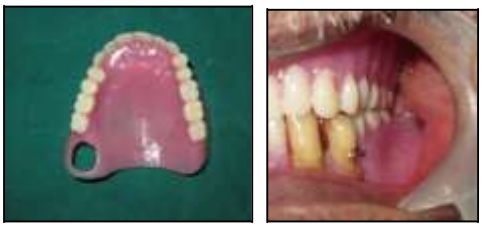

Figure 6&7 Processed Denture with rugae duplication and Post-Operative intra oral view

10. The patient was given a test paragraph to check the phonetics which contain the words with d, t, n, l, s and sh.
11. The patient was satisfied with the new denture and also showed improved phonetics.

DISCUSSION

Generally, while making complete dentures great importance is given to esthetics, comfort and function but phonetics is commonly neglected. Some patients cannot get adapted to the changes in palatal contours of maxillary denture and can have difficulty in pronouncing linguopalatal sounds[8]. So, while transferring the contour of palatal rugae to the final denture, the patients can easily adapt to it and can definitively improve the phonetics within a short duration. Different techniques are there to transfer the palatal rugae to the final denture like arbitrary carving the rugae, plastic palatal forms, electroplated metal dentures, customized acrylic pattern, tinfoil duplication, transferring the rugae contour by using putty impression material from patient etc[9]. But these techniques are technique sensitive, expensive and time consuming. So, in this article most accurate and a simple technique was used to transfer the rugae contour to the final denture using elastomeric impression material and inlay wax.

When the palatal contour of maxillary denture is accurately approximated with the tongue it can improve the phonetics and provides rigidity to the

maxillary denture. This in turn is associated with the position of artificial tooth, plane of occlusion and accurate vertical dimension[10]. It was also stated that they can improve the biological adaptation of the tongue to the denture enhance the taste perception[11]. The denture in the palatal rugae region provides an irregular surface in which the tongue can be locked and creates a negative pressure and the flavor from the food is sucked. It also enhances the perception by opening up the microvilli by stretching them each other by the elevations and depressions on the denture contacting the palatal rugae. This helps to form the hydrogen ion from the food in contact with the taste receptors which are oriented perpendicular to the surface in a parallel arrangement[12,13].

CONCLUSION

So, by obtaining proper vertical dimension, positioning of anterior and posterior teeth in correct position, proper occlusal plane and a good contouring of palatal region will provide an optimal phonetics to the patients. So, prosthodontists should customize the rugae and palatal contour in removable acrylic dentures which enhance the phonetics and also reduce the period of waiting and training of phonetics after insertion of denture. So, it can be concluded that palatal rugae when transferred to acrylic dentures will improve phonetics.

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CLINICAL REPORT

REHABILITATION OF PARTIALLY RESECTED MAXILLECTOMY PATIENT

Shilpa P,[a] Narendra R.[b]

ABSTRACT:
"Face is the mirror of the soul." Rehabilitation of the patient with congenital or acquired defect of the hard palate and soft palate is a new era in prosthodontics. Acquired maxillofacial defects due to tumors, surgical intervention, and trauma impair the stomatognathic system and aesthetics. Cancers of the head and neck have the potential for producing obvious disfigurement and dysfunction, which may be only partially compensated for by prosthesis and rehabilitation. Intraoral defects Like maxillectomy, mandibulectomy can be rehabilitated with a conventional removable dental prosthesis (cast partial denture) or newer advancements like implants retained prosthesis. This case report describes the fabrication of definitive prosthesis for an individual who underwent partial maxillectomy.

Keywords: Maxillofacial Prosthetics, Rehabilitation, Obturator

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INTRODUCTION

Maxillofacial prosthetics is the art and science of anatomic, functional, or cosmetic reconstruction. Prosthetics utilizes nonliving substitutes of those regions in the maxilla, mandible, and face that are missing or defective because of surgical intervention, trauma, pathology, or developmental or congenital malformation. [1]. The most important objectives of rehabilitation include the restoration of esthetics or the cosmetic appearance of the patient, restoration of function, protection of tissues, therapeutic or healing effect, psychologic therapy. The maxillofacial defect rehabilitation involves teamwork of surgeon, prosthodontist,

speech therapist, psychiatrist, physical therapist. Surgical repair of palatal defects extends from the suture of minor lacerations to reconstruction, using major regional flaps and free tissue transfers. Split thickness skin grafts are used to cover raw surfaces and to reduce scarring and contracture, but do not provide bulk or structural support. Tongue flaps and buccal mucosal flaps are useful to repair small medial defects and to reconstruct the free margin of the soft palate and the tonsillar pillars. Nasolabial flaps are well suited for anterolateral defects.

Hinged nasal septum flaps provide tissues for closure and support for abnormalities of the hard palate. [2].

Even though surgical reconstructive procedures are performed, maxillofacial prosthetic treatment is also

indicated for the restoration of normal oral function in most maxillectomy patients. [3,4,5,]. A successful prosthetic design for functional reconstruction of the maxillectomy defect utilizes the remaining palate and dentition to maximize the support, stability, and retention of the prosthesis [6]
This case report describes the rehabilitation of a partial maxillectomy patient with a definitive prosthesis like cast partial denture.

Case Report

A 54 yrs. Old female patient resident of Kadapa came to the Department of Prosthodontics with a chief complaint to replace her missing teeth concerning the left front and back regions of the upper jaw. Her past dental history reveals tooth extraction followed by partial maxillectomy in the remaining anterior area because of carcinoma of

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the nasal cavity, surgical closure was done and underwent radiotherapy one year back. On extraoral examination, facial asymmetry in the middle third of the left side of the face with depression in the infraorbital region [figure 1],

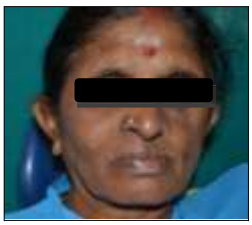

Figure.1 Extraoral

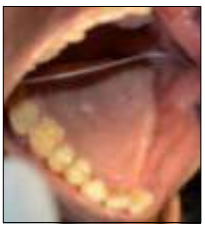

Figure.2 Intraoral

No deviation of the mandible, no palpable or tender lymph nodes, and no abnormality with the TMJ are detected. Intra orally deficient ridge and sulcus depth concerning the left maxillary arch is present. The patient underwent surgical removal of the left-sided maxillary alveolar, palatine process, and the entire ipsilateral dentition from the midline, spanning from central incisor to 2nd molar [figure 2].

Prosthetic rehabilitation proceeded after adequate healing has taken place. Clinical and radiographic examinations were done accurately to evaluate the condition of the remaining natural dentition of the uninvolved contralateral side. The primary objective of the presenting clinical scenario was to distribute the occlusal forces among the remaining teeth synchronously. Hence a cast partial design was decided since it preserves and maintains harmony among the existing hard and soft tissues. The patient was explained about the procedure, and consent is taken.

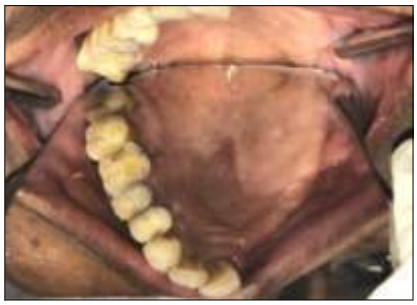

Figure.3. Rest seat preparation on 15,16,17

Preliminary impressions of upper and lower arches were made with irreversible hydrocolloid (Algitex R Dpi.Mumbai) and poured with type IIIdental stone[Labstone, Kalabhai]. The maxillary cast was surveyed and designed to determine the position of occlusal rest, guiding plane, and necessary teeth alterations. Rest seat preparation done to 15, 16, 17[figure 3].

A final impression was made with elastomeric impression material [GC Flexceed Putty And Light Body] and poured with type IV stone [Asian Chemicals Pearlstone Die stone Type IV]. The master cast was surveyed, and designing of the metal framework was done [Figure 4, 5]

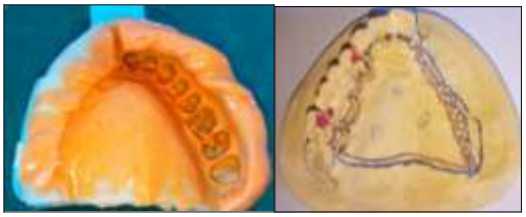

Figure.4 Impression with putty and light body
Figure.5 Master cast

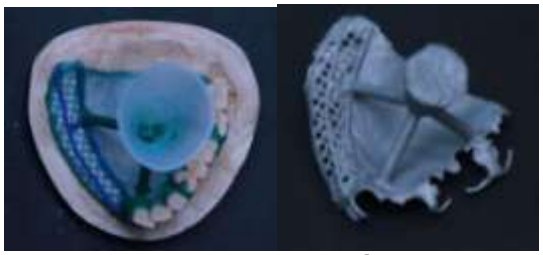

Figure 6.Wax pattern with spruing.
Figure.7 Metal framework

The wax pattern with spruing is made on the refractory cast, and casting was done [Figure 6, 7]. After casting, the metal framework was verified in the patient's mouth for proper seating.

Figure .8.Metal framework with occlusal rim
Figure .9 Bite registration

Figure10. Trial denture
Figure.11 Finished prosthesis

The maxillo-mandibular relationship was recorded using a bite block and bite registration material [Figure 8, 9]. Try in was verified [Figure 10], and the denture was processed, finished, and polished. [Figure 11].Denture insertion is done [Figure 14, 15].


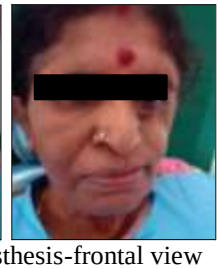

Figure. 14.Finished prosthesis-frontal view
Figure.15 Extra oral view with the finished prosthesis

DISCUSSION

Aramany's classification system addresses removable partial framework design and prosthetic rehabilitation of the partially edentulous maxillectomy patient in 6 categories. [6] According to Aramany's classification, the case report described comes under Aramany's classification I. Aramany's classification system for acquired maxillary defects illustrates the basic principles in designing a removable cast framework for partially edentulous patients. Usually, a quadrilateral or tripodal design is favored over a linear design because this allows a more favorable distribution of forces for enhancing the support, stabilization, and retention of the prosthesis.[7,8]

Primary support was placed on the teeth nearest to the defect and the most posterior molar on the opposite side. An indirect retainer was positioned as perpendicular to the fulcrum line possible, and guiding planes are located proximally on the molar and premolar tooth. The connection between all the rest areas gives a wide triangular area, which prevents the prosthesis from the rotational movements from all the directions around its all the axis of triangular arms. In dentulous patients, the number and distribution of remaining teeth determine the primary retention, support, and stability of the prosthesis. [9, 10] This case report discusses a simple method of fabricating a definitive prosthesis deriving support and retention from the remaining dentition by use of a cast partial metal framework for a partial maxillectomy following the design criteria from Aramany's class I defect.

CONCLUSION

The most challenging part of rehabilitating the patient with hemimaxillectomy is to obtain adequate retention and stability. Because of the presence of teeth rehabilitation with the cast, partial denture prosthesis in partial maxillectomy defects benefitted the patient Functionally Esthetically and Psychologically to lead a healthy life.

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CLINICAL REPORT

Fabrication of an Interim Closed Hollow Bulb Obturator Prosthesis with Frozen Saline: A Modified Technique

Naveen Raj.S, [a] Ananth Prathap, [b] Vidyashree Nandini.V,[c] David Charles. P, [d] Thamarai Selvan

ABSTRACT

Maxillary defects can be congenital or acquired in nature. Anatomical defects may be created between oral and the nasal cavity due to surgical resection and patients are usually faced with difficulties while performing normal functions such as speaking and swallowing, due to the communication formed between the cavities. Rehabilitation of the defect site with an obturator prosthesis assists in achieving these goals reducing the morbidity and thereby improving the psychological state of the patient. While rehabilitating these large defects, one of the main problems is with the weight of the prosthesis. The prosthesis may become bulky and non-retentive due to its weight. To overcome these difficulties hollow bulb obturators fabricated using different techniques. Also, a closed obturator design has been found to be advantageous over the open type as it prevented the seepage of oral and nasal secretions into the hollow space thereby helping in easy maintenance of the prosthesis. This case report deals with a simplified method for fabrication of an interim obturator with closed hollow bulb design for a 75-year-old male patient with a Class I Aramany's defect.

Keywords: Rehabilitation, Obturator, Hollow Bulb.

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INTRODUCTION

Defects of the orofacial region can be debilitating for an individual as it impairs the normal form and function of the stomatognathic system. These defects may be congenital or acquired in nature[1,2]. Frequently adopted technique is ablative surgical therapy for the control of abnormal growths in the oral cavity and other malignancies. The postsurgical effect can be serious as the stomatognathic system is disturbed by the loss of form and function and also the facial contour.

Postsurgical maxillary defects result in fluid leakage through the nose and hypernasal speech, including the possibility of aspiration[3]. Patients with maxillary defects often encounter problems with mastication and speech due to the presence of oroantral communication. Prosthodontic treatment mainly aims at closing the oro-nasal compartments thereby reducing the nasal regurgitation and hypernasal speech. An obturator prosthesis helps in rehabilitating such situations[1,2].

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An obturator according to the GPT - 9 is defined as " A maxillofacial prosthesis used to close a congenital or acquired tissue opening, primarily of the hard palate or contiguous alveolar or soft tissue structures"[4]. The obturator can be given during different phases of rehabilitation as surgical, interim or a definitive prosthesis. The hollow design of the obturator has significant advantages over the non- hollow variant as it considerably reduced the overall weight and thereby helped in better retention of the prosthesis. Also, the closed type hollow bulb was found to be better when compared to the open type as it prevented the entry of oral and nasal secretions into hollow space and helped in easy maintenance of the prosthesis by the patient[5,6]. The degree of extension of an obturator in the defect site depends on factors like the extent of the defect, resiliency of the lining tissue and the need for achieving basic functional requirements like support, retention and stability.[7].

Various techniques have been proposed for the fabrication of hollow bulb obturators [8]. Schneider used crushed ice to create a matrix inside the bulb to maintain the hollowness during processing[9]. Matalon and Parel used sugar whereas Srinivasan et al in their study fabricated the hollow bulb portion using the lost salt technique.[10,11] .Other materials were also incorporated to create the hollowness. Chalian used an acrylic resin shim in the defect area whereas Tanaka et al incorporated polyurethane foam[12,13].

In this case report, a modified technique has been described for fabrication of an interim closed hollow bulb obturator processed using a single base -double counter pour technique and custom frozen saline for the fabrication of the hollow bulb.

Case Report

A 75-year-old male patient reported to the Department of Prosthodontics for the rehabilitation of an extensive maxillary defect. The patient reported with the complaint of difficulty in breathing for the past 6 months. The patient was diagnosed with squamous cell carcinoma of the left maxillary sinus. The lesion was extending superiorly to the floor of the orbit, posteriorly till medial and lateral pterygoid plates, medially crossing the midline involving hard palate and laterally till the zygomatic arch. The patient had a Class I Aramany's maxillary defect. Primary and secondary impressions were made of the defect site and master cast was poured in type IV dental stone. Bite registration and the wax trial procedures were done and the retentive clasp was given on teeth 17 and 18 in the trial denture. The processing of the hollow bulb obturator was carried out using a single base-double counter pour technique and custom frozen saline was used for the fabrication of the bulb portion.

TECHNIQUE

Impression, Maxillomandibular Relation and Denture Trial:

• Primary impression was made of the defect site using impression compound and irreversible hydrocolloid (Zelgan plus, Dentsply India Pvt. Ltd, Gurgaon) (Figure 1). The custom tray was fabricated using self polymerized acrylic resin(DPI-RR Cold cure, Dental Products of India, Mumbai), green stick compound(DPI Pinnacle Tracing sticks, Dental Products of India) was used for border moulding and then 0.5 mm of material was scraped off on the surface of the green stick compound. Once the material was scraped off, the tray adhesive material was added onto the surface of acrylic resin and green stick compound. Then secondary impression was made using light body addition silicone material(Reprosil, Dentsply International, Milford). The master impression thus obtained was poured using Type IV gypsum product to obtain the master cast.

•The master cast was then duplicated using reversible hydrocolloid material agar-agar(Castogel, BEGO and Co, Germany) after blocking out the unfavourable undercuts.

•The occlusal rim was fabricated over a self polymerized acrylic denture base resin(DPI-RR Cold cure, Dental Products of India) by blocking out the defect region completely in the duplicated master cast using aluminium foil.

•Then jaw relation registration was made and teeth setting was done in the anterior region for the aesthetic purpose and a flat occlusal table was provided on the posterior surface with wax.

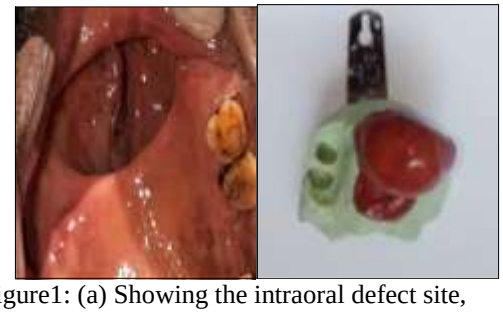


Figure1: (a) Showing the intraoral defect site, (b) Diagnostic impression of maxilla made using impression compound and alginate

Fabrication of the Hollow Bulb using the First Counter Pour

•Type II plaster was used to block out unfavourable undercuts in the defect site and at the tooth portion

of the master cast for the easy removal of the counter pour after flasking procedure.

•Putty consistency addition silicone was adapted along the walls of the defect and over the dentulous portion of the cast. The adaptation of putty within the defect space ensured a smooth even finish for the inner portion of the hollow bulb. It helped in maintaining a thin space for the heat polymerized resin and also facilitated the easy removal of the counter portion of the flask from the defect space during the flasking and processing stages. (Figure 2).

Figure 2: Adaptation of putty along the defect space and dentulous portion of the cast

•Flasking of the master cast (blocked in the dentulous region and over defect region to create a mould space for heat processed acrylic resin to flow) to the base of the flask was completed using Type II Dental Plaster. Separating medium (Cold mold seal, DPI, Mumbai) was applied and the first counter was poured. Once the plaster was set the counter portion of the flask was separated from the base pour. The putty silicone which was adapted over the defect site was then removed(Figure 3).

Figure 3: (a) Counter portion of the flask, (b) Master cast in the base pour with the putty removed from the defect space

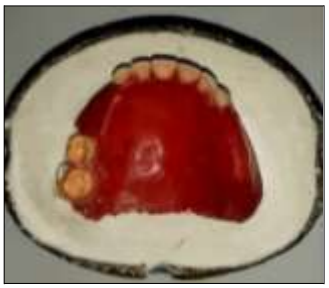
•On both the halves of the flask, separating medium was reapplied and allowed to dry. Heat polymerized acrylic resin (Heat cure acrylic, Dental Products of India, India) was placed over the defect area and a trial closure was performed to remove the excess material extending beyond the defect border(Figure 4). The counter portion of the flask(first counter) was repositioned over the base of the flask and clamps were tightened. Processing of the bulb portion was done by subjecting it to a short curing cycle(74˚ C for 2 hours and 100 ˚C for an additional one hour).

•After processing was complete, the flask was removed from the water bath and bench cooled for 30 mins. Subsequently, the flask should be immersed in cool tap water for 15 mins. The counter portion of the flask was carefully retrieved from the master cast.

Figure 4: Packing of heat cure acrylic resin

Fabrication of the Interim Obturator using Second Counter Pour

•The trial base containing the denture teeth was transferred to the master cast in the base of the flask and were waxed up. The waxed up trial base and the clasps were sealed onto the master cast which contained the previously cured hollow bulb (Figure.5). After applying separating medium to the base pour, the second counter pour was carried out and flasking was completed using Type II dental plaster.



•The dewaxing procedure was completed by placing the flask in boiling water for 4 minutes and the counter and base portion of the flask were separated. The bulb portion was filled with saline and kept for freezing in a refrigerator. The use of custom frozen saline reduced the freezing point of ice making it colder and reduced the rate at which the ice melted . This helped in prolonging the working time for maintaining the hollowness of the obturator(Figure.6). Separating medium was applied to both parts of the flask and allowed to dry. Heat polymerized acrylic resin was placed on the second counter containing the denture teeth and the base of the flask was placed over it and tightly secured with help of a clamp. Processing of the heat polymerized resin was carried out by

following a short curing cycle as mentioned previously. After the bench curing the final prosthesis was carefully retrieved from the master cast, finished and polished (Figure.7).

Figure 6: (a)Hollow bulb filled with frozen saline after the dewaxing procedure, (b) second counter lid with acrylic teeth and clasps after dewaxing

•Saline incorporated within the bulb was drained after perforating the bulb portion using 701 carbide bur and the outlet was sealed with light polymerized acrylic resin.

Figure 7:Final interim obturator prosthesis

•The finished and polished interim obturator was inserted in the patient's mouth. The patient is on a regular follow up and has been reviewed for the last 6 months (Figure.8 a,b)

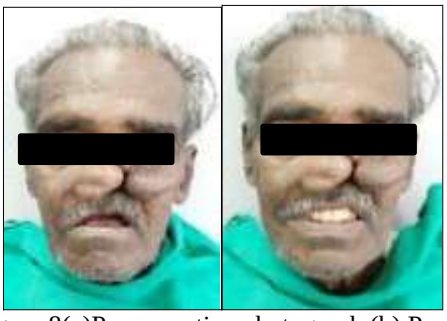


Figure.8(a)Pre-operative photograph (b) Post – operative photograph

DISCUSSION

Cysts or tumors can be managed by surgery, It is the Prosthodontist's role to restore the function and aesthetics for maxillofacial patients who suffer from functional as well as facial deformity. In patients with a maxillectomy defect, the primary goal is to give prosthetic obturation which will close the defect and separate the oral cavity from sinonasal cavities. Degree of impairment and difficulty in prosthetic rehabilitation is influenced by defect size and location. Most commonly followed treatment modality is the use of maxillary obturator prosthesis than surgical reconstruction as it is less invasive, easily accepted by the patient and easy to fabricate and maintain[14]. The bulb extension of the obturator helps in facilitating speech by providing resonance to the voice. Bulb extension can be open hollow, closed hollow or solid type. The most preferred is the hollow bulb obturator due to its reduced weight and the better speech by adding resonance to the voice. There will be an increase in retention, better patient acceptance and comfort due to the significant decrease in the weight of the obturator[15]. Closed hollow bulb obturator is better compared to the open type as it prevents the seepage of oral and nasal fluids into the hollow space thereby helping in better maintenance by the patient[16].

Wu et al in their study found that there is a reduction in the prosthesis weight from 6.55% to 33.06% by using hollow bulb obturators [17].

The processing of the bulb portion can be done with the oral portion of the prosthesis or can be separately fabricated and joined later with light or chemically polymerizing acrylic resin[18,19]. There are various techniques which have been used in the fabrication of obturator in one piece or two pieces [20]. The advantages of one-piece obturator are: it is hygienic and there are no lines of demarcation between the bulb portion and the denture base portion.

In this case, the bulb portion was fabricated initially and used as a receiver for the custom frozen saline which was used for maintaining the hollowness and joined with the oral portion using heat polymerized resin. The obturator which was completely fabricated of heat polymerised acrylic resin minimized the staining, reduced leakage and also increased the longevity and durability of the prosthesis. The custom made frozen saline space created here allowed for uniform space to be maintained in the bulb portion, unlike the crushed ice which may collapse and get merged with the resin in previous techniques [9]. Charles et al in their study used frozen water for creating the hollowness of the bulb [21]. But in tropical weather conditions, it is difficult to maintain the hollowness of the bulb as frozen freshwater melts at a relatively faster rate. The use of frozen saline helped in achieving suitable working time as it reduced the freezing point of ice by making it colder and melt at a lower rate. However, the reduction in the freezing point of ice meant a longer time duration for the freezing process to complete.

CONCLUSION

This modified technique can be employed for the fabrication of a lightweight closed hollow bulb obturator prosthesis using heat polymerized acrylic resin. The custom frozen saline used in this study helped in maintaining the hollow space of the bulb during the final processing.

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SHORT COMMUNICATION

A technique to stabilize the upper member of articulator, during balanced occlusion teeth setting.

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INTRODUCTION

One of the important procedures during Post graduation is fabrication of Complete Denture with Balanced Occlusion. The Hanau Wide Vu articulator[1] (Figure 1) is widely used, being robust with an easy learning curve. The articulator is of the Arcon, Closed track Condylar element type. To fix the position of the occlusion in varying stages of protrusion or latero-trusion and help arrange the teeth for Complete dentures or to analyze natural dentition, a centric holding nuts is given to lock the condyle in place (Figure 2).

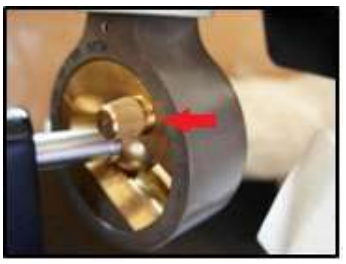

Figure 1 & 2

Before proceeding with teeth arrangement, the articulator has to programmed as per the patient`s centric and protrusive records. To programme the semi-adjustable articulator, the movable parts like lateral condylar guidance, horizontal condylar guidance and incisal guidance are adjusted accordingly. Now when you commence to set the teeth in Centric occlusion position the articulator is just perfect[2]. When you want to check the occlusion / modify the occlusion in certain positions other than Centric occlusion, you use the centric holding nuts to lock the condyle in the particular position.

The most common problem at this point, since the centric holding nuts is a friction grip type of screw,

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it slips and it is difficult to lock the condyle. To overcome this problem articulators like Dentatus have a screw to hold the condyle at predetermined length (Figure 3). To overcome this difficulty the following procedure is recommended.

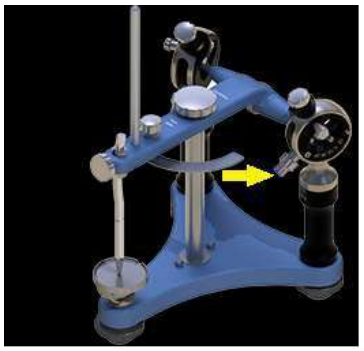

Figure 3

PROCEDURE:

Initially the upper member is held in the required protrusive and the centric holding nuts are tightened to hold them in place. The Incisal rod is raised from the incisal table. Next some lab putty is mixed and placed on the incisal table. The incisal rod is replaced and held firmly touching the incisal table. It is held fast till the lab putty sets. By doing this an index is made in protrusive.

Figure 4

Now even with the holding screws loosened, the incisal rod can be replaced in the required position repeatedly without any change. This procedure can be used as an additional aid to centric lock system to place the incisal pin in position during teeth arrangement procedure. (Fig. 4)

The same procedure can be repeated for left lateral and right lateral to make an index for respective positions of the articulator. These indexes should be placed in articulator during teeth arrangement procedure.

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