ANNALS OF CLINICAL PROSTHODONTICS

OFFICIAL E PUBLICATION OF IPS KARNATAKA STATE BRANCH

EDITOR:

DR.UMESH Y PAI

Volume 3 Issue 2

Karnataka Prosthodontic Journal

www.kpjonline.com

MAY 2019

VOLUME 3

ISSUE 2

CONTENTS

INDIRECT SINUS LIFT OF ATROPHIC POSTERIOR MAXILLA USING OSSEODENSIFICATION: A CASE REPORT

Umesh Y Pai*, Nikita Agarwal, Shubham Agarwala[+]**

Department of Prosthodontics, Manipal College of Dental Sciences, Mangalore, Manipal Academy of Higher Education.

Abstract

Primary stability in implant placement is one of the most critical factors determining the outcome of implant therapy. The factors mainly involved in enhancing implant primary stability are bone density surgical protocol**,** and implant thread type, and geometry. The mechanical friction between implant surface and bone walls of the osteotomy site provides primary implant stability. The insertion torque peak was demonstrated to be directly related to implant primary stability and host bone density[5]; high insertion torque could significantly increase the initial bone-to-implant contact percentage (%BIC) with respect to implant inserted with low insertion torque values. Osseodensification is a novel biomechanical bone preparation performed for dental implant placement. It causes low plastic deformation of bone created by rolling and sliding contact with a densifying bur that is fluted to densify the bone as it drills with minimal heat elevation. **Osseodensification (OD),** a bone non-extraction technique, was developed by Huwais in 2013[8] and made possible with specially designed burs (Densah™ burs) to increase bone density as they expand an osteotomy. The new burs allow bone preservation and condensation through compaction autografting during osteotomy preparation, increasing the periimplant bone density.

This paper describes a case of indirect sinus lift with compaction autografting done in posterior maxilla along with simultaneous implant placement.

Keywords: osseodensification, indirect sinus lift, posterior maxilla

Introduction

Primary stability in implant placement is one of the most critical factors determining the outcome of implant therapy. The factors mainly involved in enhancing implant primary stability are bone density, [1, 2] surgical protocol**,** [3] and implant thread type, and geometry.[4] the mechanical friction between implant surface and bone walls of the osteotomy site provides primary implant stability. The insertion torque peak was demonstrated to be directly related to implant primary stability and host bone density[5]; high insertion torque could significantly increase the initial bone-to-implant contact percentage (%BIC) with respect to implant inserted with low insertion torque values.[6] Ottoni et al [7] demonstrated a failure reduction rate of 20% in single tooth implant restoration for every 9.8 N cm of torque added.

Osseodensification is a novel biomechanical bone preparation performed for dental implant placement. It causes low plastic deformation of bone created by rolling and sliding contact with a densifying bur that is fluted to densify the bone as it drills with minimal heat elevation. **Osseodensification (OD),** a bone non-extraction technique, was developed by Huwais in 2013[8] and made possible with specially designed burs (Densah™ burs) to increase bone density as they expand an osteotomy [9]**.** These burs combine advantages of osteotomes with the speed and tactile control of the drilling procedures. Standard drills remove and excavate bone during implant site preparation; while osteotomes preserve bone, they tend to induce fractures of the trabeculae that require long remodelling time and delayed secondary implant stability. The new burs allow bone preservation and condensation through compaction autografting during osteotomy preparation, increasing the periimplant bone density (%BV), and the implant mechanical stability was reported by in vitro testing.[10] When standard drills extract enough bone to let strains in the remaining bone to reach or exceed the bone micro-damage (MDX) threshold, the bone-remodelling unit (BMU) needs more than 3 months to repair the damaged area, so maintaining bone bulk will enhance healing and shorten the healing period.[11]

Unlike traditional bone drilling technologies, osseodensification does not excavate bone tissue. Rather, it preserves bone bulk, so bone tissue is simultaneously compacted and autografted in an outwardly expanding direction to form the osteotomy. It is accomplished by using proprietary densifying burs. When the densifying bur is rotated at high speed in a reversed, non-cutting direction with steady external irrigation (Densifying Mode), a dense compacted layer of bone tissue is formed along the walls and base of the osteotomy.[12] The bouncing motion (in and out movement) is helpful to create a rate-dependent stress to produce a rate dependent strain, and allows saline solution pumping to gently pressurize the bone walls. This combination facilitates an increased bone plasticity and bone expansion. Huwais in a case demonstrated that osseodensification utilizing the Densah™ Bur technology had facilitated ridge expansion while maintaining alveolar ridge integrity, allowing for total implant length placement in autogenous bone with adequate primary stability. Despite compromised bone anatomy, osseodensification preserved bone bulk and promoted a shorter waiting period to restorative phase.[13]

Undersized implant site preparation and the use of osteotomes to condense bone are surgical techniques proposed to increase primary implant stability and %BIC in poor density bone. Different healing patterns and periimplant bone remodelling models were also bserved .The alternative to implant drilling procedures in the posterior maxilla is the osteotome technique that aims to compact the bone with the mechanical action of cylindrical instruments along the osteotomic walls. This procedure created trabecular fractures with debris, which caused an obstruction to the process of osseointegration.

Osseodensification osteotomy diameters were found to be smaller than conventional osteotomies prepared with the same burs due to the spring-back nature of bone and elastic strain. This increased the percentage of available bone at the implant site by about three times. Histomorphological analysis has demonstrated autologous bone chips in the osseodensified osteotomy sites especially in bone of low mineral density relative to regular drills. These acted as nucleating surfaces promoting new bone formation around the implants, providing superior stability and greater bone density. Gil et al on the other hand found no significant difference in bone-area-fraction occupancy (BAFO) as a function of drilling technique (p=0.22)

CASE REPORT:

A 47 year old patient reported to the clinic with missing maxillary posteriors in the 1st quadrant with 15, 16 missing. Radiographic examination revealed that the available bone to be 5mm from the crest to the sinus floor necessitating an indirect sinus lift

Fig.1 preoperative OPG of the posterior maxilla

(fig.1). After a thorough history was recorded and necessary investigations were done, the patient was scheduled for surgery. The patient was asked to take prophylactic antibiotic coverage of amoxicillin 2g 1 hour prior to surgery.

After administration of anesthetic (Lignox 2%, Warren Pharmaceuticals), a crestal incision was

Fig.2 full thickness flap raised.

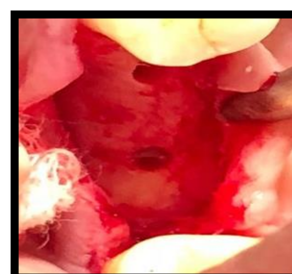

Fig.3 initial osteotomy completed with pilot drill

placed and a full thickness flap was reflected (fig.2).

Osteotomy was initiated with a pilot drill of 1.5mm diameter and was drilled to 1mm short of the sinus floor. This was done using the pilot drill in a clockwise direction (fig.3).

The position was confirmed by taking a radiograph. Once the initial osteotomy was determined, it was then sequentially expanded using the densah drills in densification mode, which involves using the drills in a pumping motion with copious saline irrigation in counterclockwise direction. The sinus membrane was simultaneously lifted along with bone densification and compaction autografting of the sinus floor (fig.4).

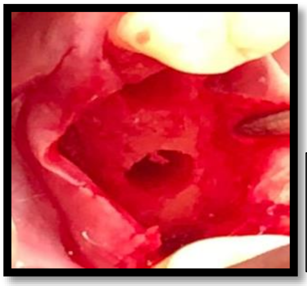

Fig.4: final osteotomy completed using osseodensification

Care has to be taken to see to it that not more than 3mm of the sinus is lifted indirectly at a given time according to manufacturer's instructions.

Two implants of 4mm and 4.5mm diameter and 8mm length were placed into the prepared osteotomies and cover screws were placed (fig.5).

Fig.5: Implant placement done

Primary closure was achieved using silk sutures and was submerged for healing. Post-operative x-rays were recorded to assess the final position of the implants.

Following 3 months, the second stage was initiated and healing abutments were placed. After 10 days the closed tray impressions were recorded and a screw retained prosthesis was delivered. Post-operative IOPA was recorded to check the final seating of the prosthesis.

Conclusion:

Osseodensification is a novel osteotomy preparation method that is inherently bone preserving. Unlike conventional osteotomy, osseodensification utilizes proprietary high-speed densifying burs to compact and autograft bone in its plastic deformation phase. The result is an expanded osteotomy with preserved and condensed bone tissue that maintains alveolar ridge integrity and allows for implant placement with enhanced stability along with no violation of the sinus membrane.

References:

1. Marquezan M, Osório A, Sant'Anna E, et al. Does bone mineral density influence the primary stability of dental implants? A systematic review. Clin Oral Implants Res. 2012; 23:767–774.

2. Trisi P, De Benedittis S, Perfetti G, et al. Primary stability, insertion torque and bone density of cylindric implant ad modum Brånemark: Is there a relationship? An in vitro study. Clin Oral Implants Res. 2011; 22:567–570.

3. Turkyilmaz I, Aksoy U, McGlumphy EA. Two alternative surgical techniques for enhancing primary implant stability in the posterior maxilla: A clinical study including bone density, insertion torque, and resonance frequency analysis data. Clin Implant Dent Relat Res. 2008; 10:231–237.

4. Dos Santos MV, Elias CN, Cavalcanti Lima JH. The effects of superficial roughness and design on the primary stability of dental implants. Clin Implant Dent Relat Res. 2011; 13:215–223.

5. Trisi P, Perfetti G, Baldoni E, et al. Implant micromotion is related to peak insertion torque and bone density. Clin Oral Implants Res. 2009; 20:467–471.

6. Capparé P, Vinci R, Di Stefano DA, et al. Correlation between initial BIC and the Insertion Torque/Depth Integral Recorded with an Instantaneous Torque-Measuring Implant Motor: An in vivo StudyClin implant Dent Relat Res. 2015;17 (suppl 2):e613–e620.

7. Ottoni JM, Oliveira ZF, Mansini R, et al. Correlation between placement torque and survival of single-tooth implants. Int J Oral Maxillofac Implants. 2005; 20:769–776.

8. Huwais S, inventor; Fluted osteotome and surgical method for use. US Patent Application US2013/0004918. January 3, 2013.

9. Huwais S. Autografting Osteotome. Geneva, Switzerland: World Intellectual Property Organization Publication; 2014. WO2014/077920.

10. Huwais S, Meyer E. Osseodensification: A novel approach in implant o preparation to increase primary stability, bone mineral density and bone to implant contact. Int J Oral Maxillofac Implants. 2015.

11.Frost HM. A brief review for orthopedic surgeons: fatigue damage (microdamage) in bone (its determinants and clinical implications). J Orthop Sci, 1998; 3(5):272-281.

12.EG, Huwais S. Osseodensification Is A Novel Implant Preparation Technique That Increases Implant Primary Stability By Compaction and Auto-Grafting Bone. American Academy of Periodontology. [abstract]. San Francisco, CA. 2014.

13.Huwais S. Enhancing implant stability with osseodensification. A two year follow up Implant Practice 2015, vol.8 (1), 28-34.

*ASSOCIATE PROFESSOR, DEPARTMENT OF PROSTHODONTICS

**PG STUDENT DEPARTMENT OF PROSTHODONTICS

+INTERN, DEPARTMENT OF PROSTHODONTICS

EXTRACTION AND IMMEDIATE RESTORATION OF THE MAXILLA USING INTRA ORAL WELDING CONCEPT- A CASE REPORT WITH ONE YEAR FOLLOW UP.

Dr. Nivya John*, Dr. Mridu Dubey*, Dr. Punit Jain, Dr. Rakshit Hegde*****

Department of Oral Implantology, A.B.Shetty Institute of Dental Sciences, Mangalore,NITTE University

Abstract:

Immediate rehabilitation of full arch ridges has always been challenging due to long time frame and tedious surgical procedures. With the dawn of the intra oral welding concept, clinicians have been able to deliver definitive restorations supported by a titanium bar. Here we have reported a case that presented with failing dentition which was extracted and rehabilitated with immediate provisional with a titanium welded substructure. The provisional was then restored with a screw retained prosthesis. The one year follow up of the case showed sustained crestal bone levels around the implants and dimensional stability of the prosthesis.

Keywords: intra oral welding, immediate loading, maxillary extraction placement

Key Message : The immediate provisionalisation using the intraoral welding approach is a promising solution for those patients who deter from full arch implant treatment due to delayed rehabilitation ,extensive surgical procedures and who do not accept conventional complete dentures .

Introduction:

The field of Implantology is in a state of constant metamorphosis, be it surgical concepts ,prosthetic rehabilitation or material science . Although implant rehabilitation shows promising results, laborious two stage procedure and temporary edentulousness for full arch rehabilitations has been a dilemma to the patients as well as the clinicians. Immediate loading and provisionalisation of implants have been recorded as a successful treatment in various studies. [1-5]

Evolved from works of Mondani and Hruska, Intra oral welding concept (Degidi et al),enables the clinician to fabricate a provisional prosthesis for full arch rehabilitation ,strong enough, to be functionally loaded the same day of surgery . A provisional prosthesis reinforced with metal bar splinted with immediately loaded abutments would provide rigidity and stress distribution over larger area. This in turn would reduce micro movements and promote faster healing.[6-7]

Degidi et al recorded immediate loading of threaded implants with a metal reinforced acrylic resin provisional restoration on the day of surgery in 40 consecutive patients.

The results of this study indicated that adequate rigid splinting of multiple immediately loaded implants has reduction of treatment time and provided the patients with immediate temporaries.[8]

Rehabilitation of maxilla is challenging as the clinician is forced to place implants in sites where bone is more prevalent. This is due to the fact maxillary bone has sinuses that undergoes pnuematization and that extraction of the teeth would further compromise the topography of the bone due to fractures of the cortical plate.So careful preoperative analysis is imperative to plan a treatment .Here we have described a case of a 45 year old female patient who was rehabilitated immediately with welded prosthesis after the extraction of the failing dentition.

CASE REPORT:

Preoperative Stage:

A female patient aged 45 years, presented with failing FDP in the Maxillary and Mandibular ridges . Preoperative procedures such as facial

Fig 1a: Pre operative view-maxilla

Fig 1b: Pre operative view-mandible

Profile analysis ,intra oral examination(Fig 1a,1b) and radiographic analysis were performed(Fig 2) .The failing FDP was discarded

Fig 2: Pre operative OPG

and patient was advised oral prophylaxis to reduce soft tissue inflammation .Diagnostic impressions were made ,occlusion and vertical dimensions were established . A provisional restoration was fabricated with high strength composite and hollowed out (pro shell) to house the metal framework .(Fig 3)

Fig 3: Proshell for provisonalisation

Surgical phase: Antimicrobial prophylaxis was obtained with the use of 500 mg of Amoxicillin thrice daily for 5 days, starting 1 day and 1 hour before surgery. 0.2% Chlorhexidine Gluconate mouth rinse was also prescribed one week and one hour prior surgery. Perioral disinfection of the patient was done with 5% w/v Povidone Iodine solution.

The surgery began with the administration of local anaesthesia (2% lignocaine hydrochloride).Extraction of the teeth was done preserving the buccal and palatal walls . A full thickness flap was elevated and implants were placed(Ankylos C/X Sizes 3.5/ 9.5 -3.5/14) 0.5-1 mm sub- crestally without bone augmentation as the jumping distance was less than 1mm .The implants were immediately loaded with multi unit abutments and titanium welding sleeves were placed (ANKYLOS) in the maxillary

Fig 4a: Immediate Loading of the implants with multiunit abutment.

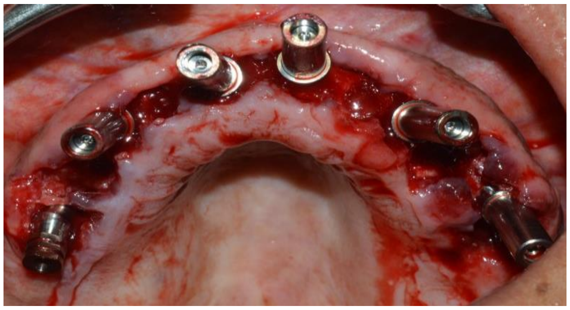

Fig 4b: Fixation of the temporary titanium sleeve

ridge(Fig 4a ,4b). However, it was decided that rehabilitation of the mandibular ridge would be done during the final rehabilitation of the maxilla.

Welding : The welding of the sleeves to the titanium wire was performed using the intra oral welding protocol.(Degidi et al). Protective eyewear was used for the entire process. A subtle click confirmed the completion of the weld. A 2.0-mm-diameter titanium (grade 2) bar was welded on to the temporary sleeves

Fig 5a: Intra oral welding of the titanium wire with the sleeves.

Fig 5b: Extra oral welding of the retention wires.

intraorally. (Fig 5a) Welding of 1.2 mm titanium wires to the framework was done extraorally for additional retention.(Fig 5b)

Prosthetic phase I :The adaptation of the pro shell was confirmed intraorally so that it could accomodate the metal framework and the relined material .The provisional restoration was trimmed ,polished and placed back into the mouth. The occlusion was adjusted intraorally keeping light contact in centric occlusion .Interferences when performing eccentric movements were eliminated. Immediate Post operative OPG was then taken.(Fig 6)

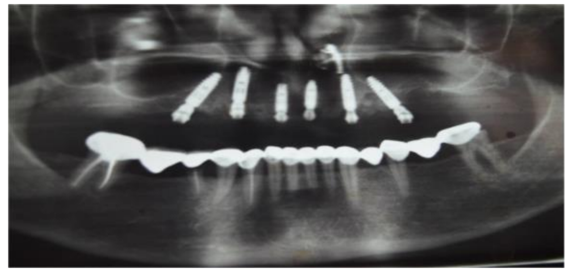

Fig 6: Immediate post operative OPG

Post operative care: Postsurgical analgesic treatment was performed using 100 mg of aceclofenac twice daily for five days along with the antibiotics and mouth rinse. Oral hygiene instructions were provided. Patient was advised to be on soft diet for 6 weeks.

Prosthetic phase II :After 3 months, The implants along with the remaining teeth in the mandibular region was restored with metal ceramic crowns. The provisional restoration in the maxillary ridge that housed the temporay sleeves and the bar was replaced with a screw retained PFM substructure and cement retained crowns wrt 11,13,21 and 23 regions.(Fig 7a,7b)

Fig 7a: Final Prosthesis

Fig 7b: Smile view of the patient.

Follow up: X-rays were taken at the time of surgery and after 3 months(Fig 8a) and 1 year post op

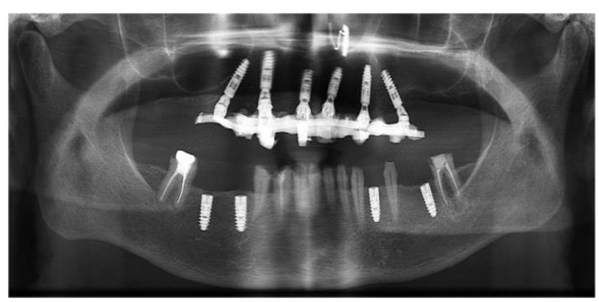

Fig 8a: Three month post operative OPG

(Fig 8b). Oral hygiene instructions were given and patient was recalled for oral prophylaxis every six months.

Fig 8b: One year post operative OPG.

Discussion:

In the past ,the loading of implants was delayed in order to avoid any unfavourable micro movements that were thought to cause fibrous encapsulation and hinder osseointegration. However, Cameron et al reported that osseointegration can be achieved even with micro movements and suggested that a movement of 30µm or less has no adverse effect on integration.[9]

Splinting multiple implants distributes the stress over a larger area thereby reducing the mechanical strain and micromotion in the implants . In 2006, Degidi et al ,published a protocol for the immediate loading of multiple implants by welding a titanium bar to implant abutments directly in the oral cavity, so as to create a customized metal-reinforced provisional restoration.[8] It is known that the peri-implant bone adjusts its architecture according to its capacity to withstand functional loading, Thus the provisional restoration provides bone training to the ridges during the healing period.[10]

The provisional restorations used in the intra oral concept are all free of cement, which would reduce the risk of peri-implantitis .A study by Fanali et al concluded that even though there was higher inflammatory and reparative responses in the welded areas, the plaque accumulation was low and there was no visible fractures or radiographically detectable alterations of the welded frameworks.[11]

In this case, after the extraction of the failed dentition in the maxilla, we immediately rehabilitated the patient with composite provisional, reinforced with welded titanium framework.

A case done by Fogli et al showed that rehabilitation of the maxillary ridge after extraction ,with the welding concept, allowed improved healing and stabilization of the prostheses in the ridge that otherwise could not be rehabilitated immediately.[12] Various studies showed same positive outcomes in the rehabilitation of the edentulous ridges on a long term basis.[13-14]

Unfortunately the patient returned with chipping of the provisionals three months later. Thus a screw retained prosthesis was planned. Although screw retained prosthesis provides better retrievebility and a lesser risk to peri-implantitits , ideal implant position is required to maintain aesthetics which is hard to achieve.[15] In order to restore the angulated abutments, we delivered a screw retained PFM substructure with cement retained crowns in 13,11,21,23 regions.

It is possible on the same day of surgery to successfully rehabilitate the edentulous atrophic maxilla with a fixed definitive restoration supported by an intraorally welded titanium framework attached to axial and tilted implants .[16] Studies also have recorded few drawbacks that are associated with the prosthesis such as superficial chipping of the resin and fractures of the cantilevered areas due to decreased tensile strength.The need for relining the intaglio surface of the prosthesis has also been recorded in a few studies.[17] Nevertheless, Immediate rehabilitation, time saving procedures, higher psychological comfort and high social acceptance make intra oral welding a promising alternative to a delayed loading protocols.

Conclusion:

The immediate rehabilitation of the edentulous patient using the intraoral welding approach is a promising solution for those patients who deter from implant treatment due to delayed rehabilitation or who do not accept conventional complete dentures.However, Further studies on the long term success rates of intra oral welding in xtraction cases would be of great interest and also substantiate this concept.

References

1. Misch CE, Degidi M. Five-year prospective study of immediate/early loading of fixed prostheses in completely edentulous jaws with a bone quality-based implant system. Clin Implant Dent Relat Res. 2003;5:17-28.
2. Fischer K, Stenberg T, Hedin M, Sennerby L. Five-year results from a randomized, controlled trial on early and delayed loading of implants supporting full-arch prosthesis in the edentulous maxilla. Clin Oral Implant Res. 2008;19:433-41.
3. Iban˜ez JC, Tahhan MJ, Zamar JA, et al. Immediate occlusal loading of double acid etched surface titanium implants in 41 consecutive full-arch cases in the mandible and maxilla: 6- to 74-month results. J Periodont .2005;76:1972-81.
4. Degidi M, Lezzi G, Perrotti V: Comparative analysis of immediate functional loading and immediate non-functional loading to traditional healing periods: a 5-year follow-up of 550 dental implants. Clin Implant Dent Relat Res. 2009;11:257-66
5. Strub, J. R., Jurdzik, B. A. and Tuna, T. Prognosis of immediately loaded implants and their restorations: a systematic literature review. J Oral Rehab.39: 704-17.
6. Mondani PL, Mondani PM. The Pierliugi Mondani intraoral electric solder. Principles of development and explanation of the solder using syncrystallization. Riv Odontostomatol Implantoprotesi. 1982;4:28-32.
7. Hruska AR. Intraoral welding of pure titanium. Quintessence Int. 1987;18:683-88.
8. Degidi M, Gehrke P, Spanel A, Piattelli A. Syncrystallization: A technique for temporization of immediately loaded implants with metal-reinforced acrylic resin restorations. Clin Implant Dent Relat Res2006;8:123-134.
9. Cameron HU,Macnab I,Pilliar R.Porous surfaced vitallium staples. S Afr J Surg .1972; 10(2):63–70.
10. Brunski JB. Biomechanical factors affecting the bone-dental implant interface. Clin Mater 1992;10:153-201.
11. Fanali S, Perrotti V, Riccardi L, Piattelli A, Piccirilli M, Ricci L, Artese L. Inflammatory Infiltrate, Microvessel Density, Vascular Endothelial Growth Factor, Nitric Oxide Synthase, and Proliferative Activity in Soft Tissues Below Intraorally Welded Titanium Bars. J Periodont. 2010; 81: 748-57.
12. Fogli V,Michele C,Lauritano D. Intraoraly welded titanium bar for immediate restoration in maxilla: Case report and review of the literature. Annals of Oral & Maxillofacial Surgery. 2014;2:6.
13. Degidi M, Nardi D, Piattelli A. Immediate loading of the edentulous maxilla with a final restoration supported by an intraoral welded titanium bar: A case series of 20 consecutive cases. J Periodontol. 2008; 79:2207–13.
14. Fischer K, Stenberg T. Prospective 10-year cohort study based on a randomized, controlled trial (RCT) on implant-supported full-arch maxillary prostheses. Part II: Prosthetic outcomes and maintenance. Clin Implant Dent Relat Res.2013; 15:498-508.
15. Lee A, Okayasu k,Wang H.L.Screw-Versus Cement-Retained Implant

Restorations: Current Concepts.Imp. Dent.2010 ;19:8-13

16. Degidi M,Diego N,Piattelli A. Immediate Loading of the Edentulous Maxilla with a Definitive Restoration Supported by an Intraorally Welded Titanium Bar and Tilted Implants. Int J Oral Maxillofac Implant.2010;25:1175-82
17. Degidi M,Diego N,Piattelli A. Immediate definitive rehabilitation of the edentulous patient using an intraorally welded titanium framework: A 3-year prospective study.quintessance int.2010.41;651-59

*** PROFESSOR

*ASSISTANT PROFESSOR

** PG, DEPARTMENT OF PROSTHODONTICS

A.B. SHETTY MEMORIAL INSTITUTE OF DENTAL SCIENCES, MANGALORE

FABRICATION OF PEEK CROWNS WITH IMPROVED ESTHETICS – A TECHNIQUE

Vaishnavi K **, Vidyashree Nandini V*, Russia M^, Surya R ^MDS

Abstract:

Objective: This article aims at demonstrating a simple technique for layering milled PEEK (Polyetheretherketone) crown with veneering composite following sandblasting the surface with 50μm aluminium oxide particles.

Technique: A die stone model was scanned and used for milling PEEK crown. Sequential composite layering was done in the crown after treating it with grit blasting using 50μm alumina particles. The crown was finished and polished to match contours of adjacent teeth.

Conclusion: An easy technique to layer CAD CAM Milled PEEK crowns was carried out . Results obtained proved to be a promising aesthetic alternative to conventional crowns.

INTRODUCTION

With advancement in dental materials and dental techniques, new materials are being incorporated for fabrication of dental appliances and prostheses on an alarmingly large scale in the recent times. Requirements like biocompatibility, close resemblance to properties of dental structures, good esthetics, good manipulative properties and biostability are shown by many materials which are increasingly used in various forms in dental practice. One such material, that has been put to use in different forms and situations is Polyetheretherketone (PEEK). PEEK is a polymeric, ash coloured biomaterial which has been in use in the field of orthopaedics for several years now.(1-3) Its use has been extended to all the branches of dentistry because of its versatility and its ability to show good strength with relatively less bulk and good rigidity.

PEEK is an aromatic, linear and semi crystalline polymer, which is white in colour. The thermal stability enables it to be used as a high performance plastic material that can effectively replace metal structures. This material is radiolucent with elastic modulus closer to that of human bone and dentin which implies that it will be well tolerated by these structures in function(4). It is also stable in lytic chemical environment and shows good thermal stability which means it can be autoclaved under high temperatures.

In addition to these properties, it has been found that PEEK blanks can be milled using CAD CAM units to produce various framework designs for fixed and removable partial dentures.(5) It has also been shown that fracture resistance of milled peek crowns are much higher than the fracture resistance of alumina , lithium disilicate or even zirconia crowns. PEEK materials show comparable abrasive resistance to that of metals. However because of their opaque nature and unesthethic colour it cannot be used as a milled monolithic restoration. It can however be used as a core material on which layering can be done with suitable veneering composite after treating the surface in some ways. A number of procedures have been recommended to treat and condition the surface of PEEK materials to make it conducive to resin composite layering like grit blasting with 50 micron or 150 micron alumina particles with or without silica coating and treating the surface with sulphuric acid, that helps to alter the chemical stability of the surface allowing it to bond with the hydrophobic luting composites[6-8]. These studies have emphasised predominantly on conditioning the surface of PEEK to improve bonding with resin cement, resin composites and to dentin. In one study , it was shown that using adhesive primers improved bonding of PEEK to resin [6], while in another study it was discussed that creating micro irregularities on the surface, using grit blasting, helped to enhance the bond between PEEK and the priming adhesive used by increasing contact surface between the functional groups[7]. Authors also have found that using only multifunctional methacrylate containing primers achieved durable adhesion between PEEK and resin[8,9]. Nevertheless, layering PEEK crowns with micro-filled composite resin has been widely accepted as an alternate option in lieu of crowns of alloys, crystalline and glass ceramics in light of their improved properties. In an in-vitro study for fabricating three unit FDP, authors have utilised PEEK substructure for fabricating the FDPs and utilised different conditioning methods to layer the crown with two different types of veneering composites and evaluated bond strength and fracture resistance [9]. The purpose of the current study was to demonstrate one such technique of layering on one milled peek crown using resin light curable composites (ADORO) after grit blasting the surface of the crown with 50 micron alumina particles.

TECHNIQUE

A Die stone model of prepared tooth number 21was made from polyvinyl siloxane impression using putty wash technique. The maxillary cast was scanned using a high precision, fully automated optical structured light scanner that permitted full jaw scanning (Fig.1) (Ceramill Map 400+ , Amann Girrbach AG, Austria).

Fig. 1

The scanned image of the cast was extracted to the CAD design software . The CAD design software used in this study was EOCAD Valletta (Fig.2)

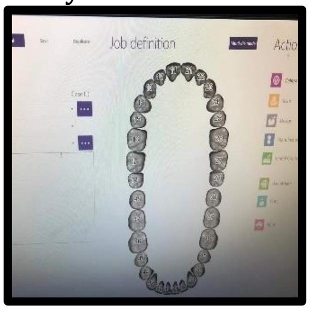

Fig. 2 – EXOCAD Valletta

(EXOCAD Gmbh, Germany). The software was used to design the coping dimensions and generate a standard tessellation language (STL) file. Ideal path of insertion determination and undercut blocking out was carried out using this software. The file was then extracted to a milling user interface software CIM3d millbox (Fig. 3a, 3b) (CIM systems, Cinisello Balsamo).

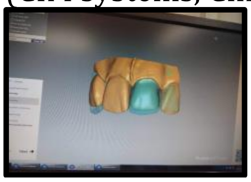

Fig. 3(a)

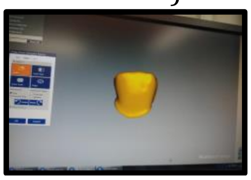

Fig. 3(b)

PEEK crown was then milled from Juvora Block(JUVORA Ltd, UK)with the help of CAD CAM milling unit imes icore 350i (Fig. 4) (imes-icore GmbH , Eiterfeld). The milled PEEK crown was then treated with grit blasting using 50μm alumina particles for 15 seconds.

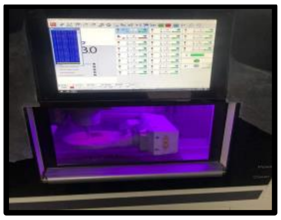
Fig. 4

The conditioned crown was then subjected to a layering process using microfilled veneering composite resin (Fig. 5a, 5b), (SR ADORO, Ivoclar Vivadent AG, liechtenstein).


Fig. 5(a)


Fig. 5(b)

An opaque of shade A2 was first applied on the coping and then light cured for 10 minutes using Lumamat 100 (Fig. 6) (Ivoclar Vivadent AG, Liechtenstein).


Fig. 6 - Lumamat 100 curing unit

The curing unit was exclusively designed for integrated light and heat curing of SR Adoro material from Ivoclar with infrared curing device. This was followed by layering with deep dentin shade and subsequently with dentin body and incisal shades with periodic curing after each application. The final texture to the restoration was provided using micro and macro grade diamond discs (Sof-Lex, 3M, light and dark orange) to bring about the vestibular contour to emphasise the transitions from cervical to incisal third maintaining symmetry with adjacent tooth. Once the macro details of the restoration was obtained, fine polishing was accomplished using rubber discs of different grades, starting from coarse to fine. The final enamel sheen was given by using fine grit aluminium oxide paste using felt brush in low speed circular rotations. (Fig.7)



Fig. 7(a) – Finished PEEK crown
Fig. 7(b)

DISCUSSION

PEEK (Polyetheretherketone) is growing into a very popular material substitute to the more conventionally used materials like ceramics and metals. It has been in use in industrial engineering [12] and for medical implant device fabrication [1-3] long before it was adopted for dental application. Although their use now is gaining popularity among dental clinicians, little has been studied about its bonding properties with more fervently used dental materials and with tooth structure. However it has been proved that bond strength of treated PEEK surfaces with composites is definitely better than untreated surface[7,11,13] .

Many in vitro studies have been conducted to evaluate the bond strength of PEEK crowns with resin luting cement and to dentin. Studies regarding the bond strength and fracture resistance of PEEK with veneering composites are scarce. However it has been established that surface treatment by both sandblasting and acid etching , improve the bond strength of PEEK to veneering composites exponentially by creating surface roughness and reducing contact angles (improving wettability)[9]. This technique highlights the ease of fabrication of PEEK crowns and the resultant esthetics that is comparable with conventional crown restorations.

Athough in this technique, surface treatment with grit blasting was the only conditioning procedure done to improve bond strength of composite to PEEK, there are studies that show that acid etching with concentrated 98% Sulphuric acid with different time exposure can create similar irregularities [6,9,11] . However, unlike sand blasting acid etching produced higher contact angles and lower irregularities or roughness. Nevertheless, although the roughness produced was not as evident as for sand blasting, this method of conditioning showed the highest shear bond strength values[9] . A mixture of sulphuric acid and hydrogen peroxide (pirannha solution) has also been used to etch the surfaces of PEEK [6,7,13] . Acids of such high corrosive nature are required for etching the surface of PEEK because of it high thermal and chemical stability and apolar nature. In some studies multifunctional methacrylate containing priming agents were used to etch the surface of PEEK[8]. In other studies the use of multifunctional primers has been recommended after sand blasting[10].In all these studies , the bonding ability and fracture strength of the material has been studied.

PEEK can be reinforced by incorporating substances like carbon fibre and glass. This ability to produce PEEK of different rigidity provides windows to the versatile applications in dentistry. For example, while crystalline PEEK can be used to produce single crowns and FDPs, amorphous PEEK is used in the fabrication of removable partial denture frameworks. In addition to this, they can also be subjected to methods of sterilisation like gamma sterilisation, heat sterilisation and steam sterilisation[15]. In conclusion however, despite all the promising mechanical properties, without a leakproof bond with layering composite, failure is an inescapable eventuality.

Studies evaluating the mechanical properties of PEEK are limited in literature. Effect of thermal aging and degradation under cyclic loading have also not been extensively studied. In this article, a simple technique to fabricate PEEK crowns has been demonstrated. It can be observed that the results obtained by using PEEK as substructure for crown fabrication are as promising as conventional PFM crowns or ceramic crowns (Fig.8) because of the ability of composites to be finished and polished to tooth like resemblance.

Fig.8 (a) – PEEk crown

Fig. 8 (b) - Zirconia Bridge

PEEK has also gained popularity as a framework material in place of cast partial dentures because of their esthetics. They are also being used to fabricate implants and their components. PEEK temporary abutments are easy to process chair side and their whitish colour avoids the use of an opaquer that is usually necessary to mask the show of grey titanium abutments [16]. Studies have been conducted to evaluate and compare the fracture resistance of PEEK and Zirconia under cyclic loading [17] . It was seen that both Zirconia and PEEK showed higher fracture resistance to physiologic biting forces. In comparison with Zirconia, PEEK showed less fracture resistance and deformed plastically under loading because of its lower elastic modulus. In terms of elastic modulus, PEEK is closer to the dental tissues therefore it is better suited as a restorative material over zirconia.

This article only presents a technique of layering milled PEEK crowns with veneering composite after treating the surface by sandblasting with 50µm aluminium oxide particles. More studies will have to be done to evaluate the effectiveness of different conditioning techniques and determine the bond strength of PEEK with veneering composites and to identify the failure types and interfaces in PEEK containing restorations in functioning oral environment.

CONCLUSION

The technique used for layering milled PEEK crowns with veneering composite showed promising esthetic results. More studies will have to be done to identify the reliability of PEEK material to be used in routine clinical practice as a permanent restoration.

ACKNOWLEDGEMENTS

This demonstration was supported by VIP DENTAL LAB PVT LTD and CURA DENTAL FOUNDATIONS. Authors thank them for their contribution.

REFERENCES

1. Toth. J M, Wang M, Ester B T, Scifert J L, Scim H B, Turner A S. Polyether etherketone as a bio material for spinal applications. Bio materials 2006; 27: 324-34
2. Kurtz S M, Devine J N. PEEK biomaterial in trauma orthopaedic and spinal implants. Biomaterials 2007; 28: 48, 45- 69.
3. Pokormy D, Fullin, Staf M, Jahoda D, Landor I, Sosna A. Polyether etherketone part II; Application in clinical practice. Acta Chir Orthop Traumatol Cech 2010; 77:470-8
4. Gonzalez GD, Rusinek A, Jankowiak T, Arias. A. Mechanical impact behaviour of polyether etherketone. Compo struct 2015; 124:88-99.
5. Waleed H M, Rekaby E. Impact of milled peak vs conventional metallic removable partial denture frameworks on the abutment teeth in distal extension basis. A randomised clinical trial. Int J Dent and Oral Heal 2019; 5:3, 20 – 26.
6. Schmidlin P R, Stawarczyk B, Wieland M, Attin T, Hammerle C H, Fischer J. Effect of different surface pre treatments and luting materials on sheer bond strength to PEEK. Dent Mater 2010; 26(6):553 -9.
7. Hallmann L, Mehl A, Sereno N, Hammerle C H F. The improvement of adhesive properties of PEEK through different pre-treatments. Applied surface science 2012; 258:7213-8.
8. Kern M, Lehmann F. Influene of surface conditioning on bonding two polyether etherketone. Dental Materials 2012; 28(12):1280-3
9. Ourahmoune R, Salvia M, Mathia T G, Mesrati N. Surface morphology and wettability of sand blasted PEEK and its composites. Scanning 2014; 36:64-75.
10. Fuhrmann G, Steiner M, Freitag W S, Kern M. Resin bonding to three of polyether ehterketones – durability and influence of surface conditioning. Dent Mater 2014; 300: 357-363.
11. Sproesser. O, Schidlin P R, Uhrenbacher J, Roos M. Effect of sulphuric acid etching of polyether etherketone on sheer bond strength

to resin cements. J Adhes Dent 2014; 16 (5): 465-472.
12. Hao Y, Wong H M, Wang W, Li P, Xu Z, Chong E Y W, Yan C H, Zyeung K W, Chu P K. Cytocompatability, osseo integration and bio ativity of three dimensional porous and nano structured network on polyether etherketone.. Bio materials 2013; 34(37); 9264-9277.
13. Zhou L, Qian Y, Zhu Y, Liu H, Gan K, Guo. The effect of different surface treatments on the bond strength of PEEK composite materials. Dent Mater 2004 Aug; 30(8): e209-15.
14. Rocha RFV, Anami L C, Campos TMB, de Melo RM, Bethino MA. Bonding of the polymer PEEK to human dentin: Effect of surface treatments. Braz Dent J 2016;27(6):693-699.
15. Domininghaus. H, Resin materials and its properties, Berlin, Springer-Verlog, 2005,pp. 203-22
16. Santing JH, Meijer J A H, Rhaghoebar G M,Ozcan M. Fracture Strength and Failure Mode of Maxillary Implant-Supported Provisional Single Crowns: A Comparison of Composite Resin Crowns Fabricated Directly Over PEEK Abutments and Solid Titanium Abutments. Clin Imp Dent Rel Res 2012:14(6);882-889
17. Tartuk B K, Ayna E, Basaran E G, Comparison of the Load-bearing Capacities of Monolithic PEEK, Zirconia and Hybrid Ceramic Molar Crowns. Meandros Med Dent J 2019;20:45-50.

**Post graduate student, Department of Prosthodontics and Implantology

*Head of the Department, Department of Prosthodontics and Implantology,

^ Senior Lecturer, Department of Prosthodontics and Implantology,

SRM Kattankulathur Dental College & Hospital, Kanchipuram District

Corresponding Author:
Dr. V. Vidyashree Nandini MDS, DNB.,
Head of the Department,
Department of Prosthodontics & Implantology,
SRM Kattankulathur Dental College & Hospital
SRM Institute of Science & Technology,
SRM Nagar, Kattankulathur,
Kanchipuram District – 603203
e-mail id: drvidyashreev@gmail.com

MODIFIED ANDREW'S BRIDGE -A CASE REPORT

Parvez Abubakkar*, Sharanbasappa C Nagral**

Department of Prosthodontics, Al Badar Rural Dental College, Kalaburagi, Karnataka

Introduction:

The art and science of Prosthodontics involves the replacement by artificial substitutes, the main goal is to restore the function, esthetics and comfort of the patient[1]. The prostheses which are fixed or removable given according to the clinical situation can provide an exceptional satisfaction to the patient. Having said this the choice of giving a prosthesis to the patient depends upon the correct diagnosis and proper treatment plan.[1] Decisions concerning the type of the restoration involve many factors - caries, existing restorations, tooth vitality, shape, angulation, oral hygiene, cost, and experience. The congenital absence of a tooth or the extraction of a tooth is associated with the progressive reduction of the surrounding volume of hard and soft tissues. Loss of such tissues is even more pronounced in situations of trauma, cleft lip & palate, and after the surgical excision of pathoses. [2]

The traditional management of such patients i.e. where radical surgical excision has been done requires the use of partial removable dental prostheses to replace the missing dentition and associated structures.[2]

This can be associated with problems of patient adaptability, retention, and stability. Esthetic replacement is difficult when there is radical surgical excision of the pathology. One choice to manage this situation is to give a fixed removable type of prosthesis i.e. is the "ANDREW'S BRIDGE".

Case Report:

A 20 year old male patient reported to the Department of Prosthodontics Crown Bridge & Implantology at Al Badar Rural Dental College and Hospital who was treated for ameloblastoma in the left quadrant of mandible

The Patient's chief complaint was inability to chew from the treated site. Patient's medical history was good as he had no known allergies. Patient's clinical and radiographic findings showed loss of teeth in left quadrant from lateral incisor till 1st molar and 2nd molar was mesially tilted with a defect which extended almost to the floor


Fig. 1


Fig. 2

of the mouth (fig 1, 2). The radiographic finding also showed a Recon Bone plating in the area of the defect (fig 3).

Due to vertical loss of the bone and proximity to inferior alveolar nerve, dental implants were ruled out (fig 3).

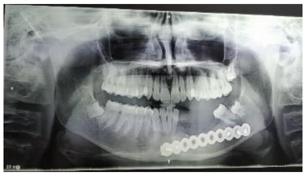

Fig. 3

A conventional FPD was also not planned for this patient as it would be resulting in a long span bridge. Discarding all the above options it was decided to give Andrews Bridge as it would provide good aesthetics, phonetics and access to the pontic area owing to the removable component thus providing a cleansable area to maintain a proper oral hygiene.

Diagnostic impressions were made of both the arches using irreversible hydrocolloid. As the lower left 2nd molar had shown mesial tilting an intentional RCT was performed. Mandibular Right central and lateral incisor and mandibular left central incisor and mandibular left 2nd molar were selected as abutments. A Porcelain fused to metal prosthesis was chosen for the abutment teeth.

Tooth preparation were done giving a shoulder margin on the buccal aspect and a

Fig. 4

chamfer margin on the lingual aspect. Before making a final impression the gingiva was retracted using MAGIC FOAM (fig 4) (as magic foam is easy to use, patient comfort and retraction is better than conventional method) and the final impression was made using Polyvinyl Siloxane impression material

Fig. 5

(fig 5) and bite registration was recorded. The metal frame work was fabricated in cobalt chromium alloy with custom ball and socket attachment.

The framework was evaluated for the fit intraorally and the occlusal registration was

Fig 6

made (fig 6). After the evaluation of fit, a pick up impression was made using Polyvinyl Siloxane (fig 7) and a PFM prosthesis was

Fig. 7

Fig. 8

made (fig 8) followed by denture processing with the Nylon Cap housing to engage the Ball attachments which were made on the framework (fig 9, 10).

Fig. 9

Fig. 10

The metal framework was luted with Glass

Fig. 11

Ionomer type 1 cement following manufacturer's instructions (fig 11). The

Denture was evaluated and occlusal adjustments were made.

Oral hygiene instruction were given to the patient and demonstration was also provided including the use of Mouth wash and interproximal brush.

Upon review the oral hygiene was satisfactory and the patient no longer had problem to masticate food at the affected site.

Discussion:

Ameloblastoma is a rare benign tumour of odontogenic epithelium and is invasive in nature, most commonly occurring in the posterior ramus area of mandible and rarely occurs in maxilla. Due to its slow invasive nature it is asymptomatic in nature unless the swelling attains considerable size.

As mentioned earlier an implant retained FPD was not possible due to the vertical loss of bone height and close proximity to inferior alveolar nerve, Andrews Bridge was selected as it is inexpensive and is designed to meet this particular situation easily. Due to its removable component maintaining oral hygiene in the affected area is possible and there are less chances of food entrapment.

Conclusion:

The treatment was completed with a modified Andrew's bridge (here instead of a simple bar with removable component we gave a ball and socket attachment). Considering the clinical situation a minimally invasive prosthesis was given which was easy to maintain and acceptable to the patient. Andrew's bridge is a simple economically viable and patient friendly option when other treatment modalities like FPD's and surgical procedure are not suitable.

References:

1. Sajjad, Arbaz. (2017). Andrews bridge revisited: A new custom cast ribbed bar and sleeve design fixed removable partial denture. Journal of Dental and Allied Sciences. 6. 44. 10.4103/jdas.jdas_51_16.

2. Taylor CL Sattertwaithe JD. An alternative solution for a complex prosthodontic problem: A modified Andrews fixed dental prosthesis. J Prosthet Dent. 2014 Aug;112(2):112-6

3. Pietrokovski J, Massler M. Alveolar ridge resorption following tooth extraction. J Prosthet Dent 1967;17:21-7.

4. Johnson K. A study of the dimensional changes occurring in the maxilla following tooth extraction. Aust Dent J 1969;14:241-4.

3. Everhart RJ, Cavazos E. Evaluation of a fixed removable partial denture: Andrews bridge system. J Prosthet Dent 1983;50:180-4.

4. Gardner MF, Stankewitz CG. Using removable gingival facades with fixed partial dentures. J Prosthet Dent 1982;47:262-4.

5. Mueninghoff LA, Johnson MH. Fixedremovable partial denture. J Prosthet Dent 1982;48:547-50.

6. Morgano SM, Lima Verde MAR, Haddad MJ. A fixed-detachable implant-supported prosthesis retained with precision attachments. J Prosthet Dent 1993;70:438-42.

7. Djemal S, Setchell D, King P, Wickens J.

Long-term survival characteristics of 832 resin-retained bridges and splints provided in a post-graduate teaching hospital between 1978 and 1993. J Oral Rehabil 1993;26: 302-20.
8. Pjetursson BE, Tan WC, Tan K, Brägger U, Zwahlen M, Lang NP. A systematic review of the survival and complication rates of resin bonded bridges after an observation period of at least 5 years. Clin Oral Implants Res 2008;19:131-41.