Natural Tooth Pontic and FRC splint Using Special Rigid Tray Technique (A Case Report)

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Abstract

Making a conservative bridge using a natural tooth pontic with mobile teeth is complicated, time-consuming and sometimes impossible with the current techniques and materials. The aim of this paper is` to describe a new method using Special Rigid Tray Technique (SRTT) to deal with such difficult clinical cases.

Key words: Natural Tooth Pontic, Splint, Rigid Special Tray

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Introduction

Today, there has been a trend toward changing demographics of dental practices with an increase in the number of older adults seeking care. For these patients, success in periodontal and endodontic therapy has allowed them to keep their natural teeth longer. Also, these patients want to live their lifetime with intact dentition. One problem facing the clinician in fulfilling these patient's expectations is the increasing mobility of anterior teeth that results from periodontal attachment loss. This is especially true for mandibular incisors. For these circumstances, treatment to reduce mobility by splinting periodontally involved teeth is accepted. (1)

Tooth mobility is one of the unwanted results of periodontal diseases. It is the movement of a tooth in a horizontal or vertical plane. According to the degree of attachment loss, all teeth have some degree of mobility. Increased tooth mobility may be caused by a variety of factors, which may be intrinsic or extrinsic. Orientation of the long axis of the teeth, morphological characteristics of the roots also morphology of the alveolar process, can be divided as intrinsic factors. The extrinsic factors are local ones such as plaque which predisposes to the alveolar bone loss, fabrication of long span bridges on few teeth, injurious bone resection during surgical periodontal therapy, par functional habits, and other factors such as food impaction, overhanging fillings, poorly contoured crowns and ill fitting partial dentures. The greatest challenge that mobile teeth present to the diagnostician is to make a decision as to their retention or extraction. (2)

In addition to the treatment modalities for mobility (scaling and root planning, sub gingival curettage,

occlusal correction, pocket elimination procedures, etc.), splinting is one of the treatments. While tooth splinting continues to be a topic of controversy, it remains one of the most poorly understood areas of dental therapy. (2)

Several techniques and materials, including wires, pins, nylon mesh, bonded reinforcing materials, and metal mesh, have been proposed for the direct splinting of mobile teeth with compromised periodontal support. Cast-metal, resin-bonded splints are used for indirect splinting of mobile teeth.(3).

In 1995, Miller and others reported a case that involved the placement of an immediate and indirect periodontal, prosthetic splint. They described the use of gas-plasma-treated, woven polyethylene fabric to reinforce composite resins used for periodontic splinting. The initiative to place a thin but strong composite resin based splint was met with the introduction of a high strength, bondable, bio-compatible, esthetic, easily manipulated, neutral color fiber that could be embedded into a resin structure. This led to the development of fiber reinforcement systems. Fiber reinforcement systems are chemically consisting of two groups: a) Ultra high molecular weight poly ethylene fibers and b) Long and short glass fiber reinforcement. (4, 5).

Advantages of fiber reinforced composite material periodontal splinting are a) ease of application with minimal tooth preparation, b) low to moderate cost as compared to crown and bridge stabilization, c) Reversibility, that is, it can easily be removed when splinting is no longer considered necessary, d) ease of repair in case of failure through re-bonding and reapplication of new material, e) facilitating more aggressive treatment modalities on teeth with questionable prognosis prior to long term stabilization, f) high esthetic value and g) ease of accommodation of daily home oral hygiene practices.(6, 7).

Various therapeutic solutions can be used to replace a single missing tooth. The development of implant-supported restorations led to a more conservative and ideal approach to a single-tooth replacement. However, in some patients this therapeutic option is rejected, which is a cause of the lower age, lack of time, higher cost, systemic problems and other contraindications. Other treatment approach such as conservative bridge, removable and fixed partial dentures is recommended. (8).

For a patient who requires removal of an anterior tooth, the primary concern is generally the restoration of an esthetic appearance immediately. Whether the tooth is removed surgically or lost due to trauma, the dentist should consider an immediate means to satisfy the patient's cosmetic requirements. Using the natural tooth as pontic offers the benefits of using the right size, shape and color. (9).

A critical step in splinting mobile teeth is the placement of the splint, which must be well adapted to the shape of the surfaces to be stabilized. Additionally, stabilizing mobile teeth in an altered position may result in occlusal interferences and subsequent occlusal adjustment needs. Several techniques have been suggested to adapt the splint to the desired position and avoid moving mobile teeth from their passive position during the direct splinting procedure. (3) Papazoglou and Anagnostou suggested maintaining a fiber strip passively in position by passing stabilizing strands of dental floss through the interproximal areas of the teeth to be splinted and lightly pulling the strands, using one hand and avoiding excessive force(10). Hughes and Strassler described the use of vinylpolysiloxane impression material instead of wooden wedges in the gingival embrasures to passively blackout the interproximal areas and avoid moving the mobile teeth (11). Additionally, bonding of cast-metal, resin-bonded splints may be problematic for teeth with compromised periodontal support because of the mobile teeth and loosening of the precise fit between the resin-bonded splint and the teeth to be splinted. The use of a vacuum formed plastic sheet is described to aid in transferring and bonding metal or fiber reinforced splints from the cast to the desired position intraorally. This technique can be used for direct and indirect splinting procedures. (3)Also Moazzami et al. has described a method for reattachment of an anterior composite tooth pontic using rigid tray. In this technique, the prepared pontic was placed exactly in its place within the rigid splint so there would be no occlusal interferences.

FRC placement and curing procedure is very sensitive even for an expert clinician. Using a natural tooth pontic simultaneously even makes it more complicated. The availability of vacuum press machine and rigid tray sheets and also the low cost of the technique led us to the use of SRTT. Translucency, thickness, and rigidity of the rigid tray help the practitioner to decrease technique sensitivity while achieving an unbelievable outcome in less clinical time for FRC splint.

The aim of this report is to describe a new method using RSTT for accurate replacement of a natural tooth pontic in mobile anterior teeth which would simultaneously fulfill the esthetic and splinting needs of the patient.

Description of the Technique

A 65-year-old patient was referred to the clinic for periodontal splinting of teeth number 22 to 27 (12) and making a temporary restoration for tooth number 23 , which was periodontally hopeless and candidate for

extraction(fig.1). The following procedure has been adopted for the treatment of the case based essentially on making a special rigid tray:

1. Examination: The periodontal status of the anterior lower teeth specially in regard to plaque and calculus accumulation, packet depth, grade of mobility and the occlusal condition either in static or lateral movements was carefully checked. This would be an imperative step, helping the operator to wisely eliminate the contributing factors with teeth mobility before the splinting procedure. Radiographically, the mandibular incisors have over 50% bone loss with a mobility of grade 2 according to the Miller's Index(13).

2. Temporary fixation: The mobile teeth were provisionally stabilized, while they were in their unstressed position by means of flowable resin composite (GRADIA® Direct Flo, GC Corporation, Tokyo, Japan) injected interdentally and cured (Astralis 10, Ivoclar Vivadent AG, Bendererstrasse 2,9494 Schaan, Principality of Liechtenstein, 500mW/cm^2 power) for 5 seconds per increment(fig.2).

3.Taking impressions: Two full-arch alginate impressions (GCAroma Fine DF III, GC Corporation, Tokyo, Japan) were taken from the upper and lower arches.

4. Extraction: The hopeless tooth was extracted.

5. Fabricating the Study/ Master Casts: The alginate impressions were poured with dental stone (Moldano, Bayer, Leverkusen, Germany) to make the study/master casts.

6. Determining the FRC location on the lower cast with a fine point (0.5 mm) pencil just above the teeth cingulume (fig.3).

7. Preparing the space needed for FRC and composites on the Cast: A flowable resin composite (GRADIA® Direct Flo, GC Corporation, Tokyo, Japan) was used to create the required space for the splinting material then exposed to curing light beam (Astralis 10, IvoclarVivadentAG, Bendererstrasse 2, 9494 Schaan, Principality of Liechtenstein) for 10 seconds (fig.4).

8. Fabricating the Rigid Special Tray (RST): Firstly, a thermoplastic 0.9 mm thick rigid tray (Rigid-Tray®Sheets, UltradentProducts. Inc. South Jordan, UTAH 84095, USA) was fabricated over the study/master cast using a vacuum press machine (T&S Dental &Plastic Co. USA) (Figure 4). Secondly, the special tray was trimmed off using a #11 scalpel blade (Wuxi X.D. Medical Device Co. LTD, China) 3-5 mm apical to the gingival margin. A pair of small curved scissors can be used to remove the rough edges if necessary. Thereafter, the fit was checked by matching the tray with the study/master cast. Now the tray is ready to be checked in the patient's mouth (fig. 5 and 6).

9. Preparing the extracted tooth: After tooth extraction and passing the healing time (3 weeks), the patient came back to the office, bringing the extracted tooth which had been stored in salin solution and kept in the refrigerator during post operation healing time. So we reexamined the extraction zone and the gingival configuration, gauged the needed clinical crown height using a file(fig.7). Consequently, the tooth was cut, based on the measured height(fig. 8).Then we made an endodontic access ,the filing and cleansing steps were done(fig. 9).Tooth was etched(Ultra-Etch® Ultra dent Products. Inc., 505 West South, South Jordan, UTAH 84095, USA) from the endodontic access and also retrograde using a cannula for 15 seconds, rinsed with water for 15 seconds and air dried for 10 seconds using a air-water syringe. Then the adhesive (Adper Single Bond 2, 3M ESPE, US) was actively used with a micro brush and well cured for 20 seconds. Finally, we carefully filled the tooth with a flowable composite resin (14)(GRADIA® Direct Flo, GC Corporation, 76-1 Hasunduma-Cho, Itabashi-Ku, Tokyo, Japan) and cured it from buccal and lingual for 60 seconds per each site. An ovate shape was given to the cervical area to create an aesthetic emergence profile. Subsequently, the tooth was placed in the rigid tray and directed to its correct place to make sure of its position ,while paying attention that the tooth would slightly press the gingival tissue, reassuring that there is no unpleasant space between the tooth apex and the gingiva.

10. Measuring the required length of FRC strip: An aluminum foil strip was used to adapt to the cast on the FRC strip site to indirectly measure the actual length of the required FRC strip(fig.10) (Interlig Impregnated Glass Fiber, Angelus Industriade Produtos Odontolgicos S/A, CNPJ 00.257.992/0001-37, I.E. 60128439-15, RuaWaldirLandgraf, 101 – BairroLindoia, CEP 86031-218, Londrina, PR, Brazil). FRC Strip (flat pre-impregnated woven fiber ribbon) was measured and cut to the required length within the package.

11. Teeth Surfaces Preparation: The anterior lower teeth and also the natural tooth pontic were cleaned with Pumice powder. The middle third segment of lingual enamel surfaces on all targeted teeth for splinting and also mesial and distal sites of the natural pontic were roughened with a # 534 pre-grinding diamond bur (Meisinger, Meisinger USA. L.L.C, Easter Avenue, Centennial, Colorado 80112, USA), rinsed and dried with an oil-free syringe. Also the open interproximal spaces were roughed using a needle diamond bure (D&Z, Switzerland). The teeth were isolated with cotton rolls and the altered enamel surfaces were etched (Ultra-Etch® Ultra dent Products. Inc., 505 West South, South Jordan, UTAH 84095, USA) for 15 seconds, rinsed with water for another 15 seconds and then air-dried. In the next step, an unfilled resin (Margin Bond®, Coltène

AG, Feldwiesenstrasse 20, 9450Altstätten, Switzerland) was applied and cured with the curing light beam as instructed by the manufacturer. The etching, rinsing, and drying steps and adhesive application/curing were also done carefully for natural tooth pontic as stated before.

12. Placing Flow able Resin Composite on the lingual Surface of the Teeth: A very thin layer of flowable resin composite A3 (GRADIA®Direct Flo, GC Corporation, Itabashi-Ku, Tokyo, Japan) was applied over the bonded areas on the lingual surfaces of the mandibular anterior teeth. Afterwards, a thin layer of composite A3 (GRADIA® Direct, GC Corporation, Itabashi-Ku, Tokyo, Japan) proportionate to the prepared space was placed over the flow able one in a way that little excess would remain after the rigid tray placement. The interproximal spaces were closed and interim light curing was done.

13. Placing the FRC Strip and Natural Tooth Pontic in the RST: Firstly, the FRC seat in the tray was covered with a thin layer of the flowable composite. Secondly, the FRC strip was well positioned, adapted to the tray, and coated with a thin layer of the flowable resin composite. In addition, the natural tooth ponticwas adapted in its correct position in tray using composite A3 (GRADIA® Direct, GC Corporation, Itabashi-Ku, Tokyo, Japan).

Lastly, the customized tray was as accurately as possible positioned over the teeth/arch.

14. Placing the SRT: The prepared special tray, including the FRC strip coated with flow able composite and the natural tooth pontic, was placed in its proper position applying an even pressure over the patient's arch. It was immediately exposed to the curing light beam in the scanned form for 80 seconds through the rigid tray (fig.11).

15. Removing the RST: After initial curing, the special tray was easily removed.(FRC strip and flowable resin composite do not bond to the plastic tray).

16. Gross Finishing: Before the final curing phase, a slight excess of material would need to be removed from facial, lingual and interproximal to provide the final contour, using coarse diamond instruments.

17. Post Light Curing: Following the special tray removal, post curing was done approximately for 40 seconds per tooth using line scan and HIP mode(Astralis 10, IvoclarVivadent AG, Bendererstrasse 2, 9494 Schaan, Principality of Liechtenstein).

18. Occlusal Adjustment: The occlusion was checked for probable premature centric and eccentric contacts with articulating paper. It should then be adjusted if needed.

19. Final Finishing and polishing: Finishing was conducted using an extra fine# 504 prefinishing diamond bur(Meisinger, Meisinger USA. L.L.C., 10200 E., Easter Avenue, Centennial, Colorado 80112, USA)and a #12 scalpel blade (Meheco, ChinaMeheco Co. LTD, No 18 Guangmingzhongjie, Dongcheng Beijing 100061, China). Polishing was performed with polishing cup and points (Astropol, IvoclarVivadent AG, Bendererstrasse 2, 9494 Schaan, Principality of Liechtenstein). The splint was examined to ensure that the interproximal spaces could be cleaned .At the end, the patient was instructed how to clean the embrasure spaces with interproximal brushes (GUM® Proxabrush®, Sun star Americas, Inc., 4635 W Foster Ave. Chicago, IL 60630-1709)(fig.12).

Figure 1. Patient with mobile lower anterior teeth

Figure 2. Temporary fixation

Figure 3. Determining the FRC location on the lower cast

Figure 4. Preparing the space needed for FRC and composites on the Cast

Figure 5.Fabricating the Rigid Special Tray (RST)

Figure 6.The RST is fabricated

Figure 7.Determinig the clinical crown height using a file

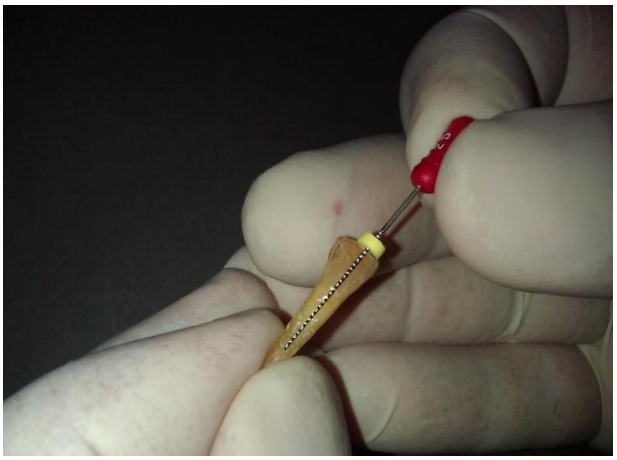

Figure 8. Cutting the natural tooth pontic according to the measured height

Figure 9. Preparing a classic access hole

Figure 10.Measuring the required length of FRC strip

Figure 11. Placement of the SRT containing FRC & the natural tooth pontic

Figure 12. Final finishing & polishing.

Figure 13: After 12 Months

Table 1: List of materials and device used in this study.

Purpose/Step	Materials or Device	Specification
Taking impressions/ 3	Alginate Impression Material	GC Aroma Fine DF III, GC Corporation, Itabashi-Ku Tokyo, Japan
Making study/master casts/ 5	Hard Plaster For Models	Moldano, Bayer, Leverkusen, Germany
Preparing the space needed for FRC and composites on the cast/7	Flow able Composite (A3)	GRADIA® Direct Flo, GC Corporation, Itabashi-KU, Tokyo, Japan
Making a rigid special tray/ 8	Vacuum Press Unit	T&S Dental & Plastic Co. USA
Making a rigid special tray/ 8	Rigid Sheet	Rigid-Tray® Sheets, Ultra dent Products. INC., 505 West South, South Jordan, USA
Making a rigid special tray/ 8	Scalpel Blade #11	Wuxi X.D. Medical Device Co. LTD, China
Preparing the extracted tooth/9	Adper Single Bond 2	Adper Single Bond 2, 3M ESPE, US
Measuring the required FRC strip length/10	FRC Strip	Interlig Impregnated Glass Fiber, Angelus Industria De ProdutosOdontolgicos S/A, RUA RuaWaldirLandgraf, 101 – BairroLindoia, CEP, Londrina, PR, Brazil
Preparing the teeth surfaces/11	Phosphoric Acid 35%	Ultra-Etch®Ultradent Products. INC., 505 West South, South Jordan, , USA
Preparing the teeth surfaces/11	Bonding Agent	Margin Bond® Coltène/Whaledent AG, Feldwiesenstrasse Altstätten, Switzerland
Preparing the teeth surfaces/11	# 534 Pre-grinding Diamond Bur	Meisinger, Meisinger USA. L.L.C., 10200 E., Easter Avenue, Centennial, Colorado 80112, USA
Preparing the teeth surfaces/11	Needle Diomond Bur	*D&Z*, Switzerland
Placing composite on the palatal surface of the teeth/12	Flowable Composite (A3)	GRADIA Direct Flo, GC Corporation, ItabashiI-KuU, Tokyo, Japan
Gross finishing/16	Diomond Bur	*D&Z*, Switzerland
Finishing and polishing/19	# 504 Pre-finishing Diamond Bur	Meisinger, Meisinger USA. L.L.C., 10200 E., Easter Avenue, Centennial, Colorado 80112, USA
Finishing and polishing/19	Scalpel Blade #12	Wuxi X.D. Medical Device Co. LTD, China

Potential Problems

The only potential problem is availability of vacuum former and rigid sheets needed for making the RSTT

Summary of Advantages and Disadvantages.

This technique helps the patient get his/her esthetic back with a natural tooth pontic while splinting the mobile teeth in a conservative reversible way. Using the natural tooth as a pontic offers the benefits of using the right size shape and color which satisfies the patient's cosmetic requirements as well. It also helps the dentist to well adapt the FRC and the pontic to its correct position resulting in minimal occlusal interferences and subsequent occlusal adjustments. Since RSTT has minimal laboratory procedures, it is a time-saving method. Additional costs for laboratory procedures that can be considered as a disadvantage for the technique will be offset with decreased clinical time and increased accuracy of the FRC placement.

Conclusion

The novel RSTT may sometimes be considered the only accurate, time-saving, and practical way to splint the mobile anterior teeth in some patients.

Performing a part of procedure in the laboratory will reduce not only the chair side time for both patient and practitioner but also minimizes the clinician's physical stress to the half, while increasing the accuracy and quality of the service.

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