An Innovative Rigid Tray Technique as a New Alternative Matrix System for Buildup of Severely Damaged Endodontically Treated Teeth (A Case Report)

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Abstract

Direct restoration of severely damaged endodontically treated teeth (ETT) using available and conventional and current matrix systems is sometimes impractical and in some clinical cases is impossible. The aim of this paper is to introduce and describe a new matrix system based on Rigid Tray Technique (RTT) for dealing with such difficult clinical cases.

Key words: Buildup, endodontically treated teeth, matrix.

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Introduction

A main factor that affects the success of root canal-filled teeth is the type and integrity of the final restoration.

Restorative treatment of endodontically treated teeth (ETT) may vary ranging from direct restorations using a post and a core build-up material to more complex indirect restorations involving the placement of an onlay or post-core and crown. Indirect build-up of ETT demands extensive preparation and laboratory needs which impose a higher cost and greater amount of time (1).

Some factors should be considered while designing a treatment plan for such ETT in order to choose direct or indirect restorations and/or a build-up. The factors include: the remaining tooth structure, position of the tooth, occlusion, function, aesthetic requirements, time, economy, the advantages and disadvantages of the materials and methods (2-6).

The indirect techniques have many disadvantages such as: enlargement of the canal, wedging effect, the possibility of oxidation and corrosion, providing aesthetics in anterior teeth receiving all ceramic crowns. Other disadvantages include the requirement of two or more appointments, longer chair time, and laboratorial procedures that increase the cost. In addition, it is necessary to place a temporary crown and post, which increases the possibility of root canal system contamination (1,7).

Most of the time, dentists are faced with many challenges in restoring endodontically treated teeth directly because of insufficiently supported matrix band due to lack of supragingival tooth structure. A matrix system such as a Tofflemier matrix is suggested in most cases. A customized matrix will rarely be necessary for a particular situation. In larger restorations with no axial walls, it is desirable to stabilize the matrix with rigid materials such as modeling compound or light cure composites. Compound or composite-supported copper ring is another option but it has its own shortcomings and limitations (8). In some cases, we may not be able to use any other matrices because of fitting and stabilizing problems which make the whole procedure untenable.

Amalgam, composite resin and glass ionomer cement are currently the most used direct materials for constructing cores (9).

Amalgam has been found as an inexpensive treatment option, less technique sensitive and less time-consuming as compared to a direct resin restoration, for instance (10,11). On the other hand it is not injectable. Long setting time makes the amalgam impossible to be prepared immediately right after its condensation and initial setting. Considering aesthetics, amalgam would not be a good core material for ceramic crowns.

The advantage of composite as a core material is its ability to adhere to tooth structure which strengthens the tooth. Polymerization shrinkage has been a serious drawback which may cause subsequent debonding, microleakage and recurrent caries (12,13).

Glass ionomer adheres to enamel and dentin and therefore gain direct retention. They also release fluoride and so they have an anti-cariogenic property, which increases their popularity as a core material (9).

There is also an injectable type of glass ionomer with acceptable mechanical properties for using as a core build-up material of choice. Direct restoration of some severely damaged ETT using currently available matrix systems is challenging and sometimes impossible. Moazzami et al. (14) 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.

The purpose of this paper is to introduce and describe a new matrix system based on Rigid Tray Technique (RTT) for restoring a badly damaged ETT.

Description of Technique

A 35-year-old woman was referred to the Operative clinic of Mashhad Dental School to have her heavily damaged tooth number 31 restored after a successful endodontic treatment. Oral examination, tooth position, remaining tooth structure, material and equipments as well as the question of time and economy lead us to innovate a new technique for building up the tooth for preparing a full metal crown. The following procedure has been adopted for the treatment of the case based essentially on making a special rigid tray.

1. Examination: Endodontic treatment and periodontal status of tooth were checked.
2. Cavity preparation: Temporary restoration and any friable and unsupported parts of tooth need to be removed (Diamond stones, Round end 18161 and Round 18163, SS White, New Jersey, USA) (Figs. 1 and 2).

Figure 1. Severely damaged endodontically treated tooth after cavity preparation

Figure 2. Centric occlusion “lateral view”

3. Taking impressions: Two half-arch alginate impressions (AROMA FINE DF III, GC Corporation, Tokyo, Japan) are taken from the treatment and opposing arches.

4. Bite registration: A wax bite of centric occlusion is taken.

5. Making study/ master casts: The alginate impressions are poured with dental stone (Moldano, Bayer, Leverkusen, Germany) to make the master and study casts (Figs. 3-5).

6. Mounting the casts: The casts are mounted in a simple hinge articulator (Fig. 5).

7. Forming the tooth: The broken tooth is formed with an acceptable contour on the master cast with light cured composite resin (Filtek P60, 3M ESPE, USA) (Figs. 4 and 5). To reduce the costs, an expired but curable composite can be used for such a purpose.

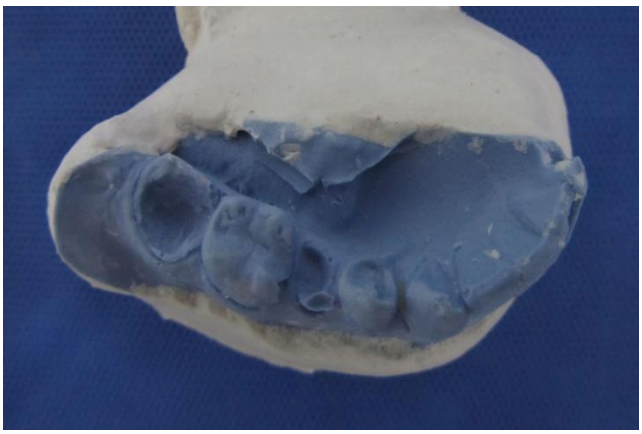

Figure 3. Master cast.

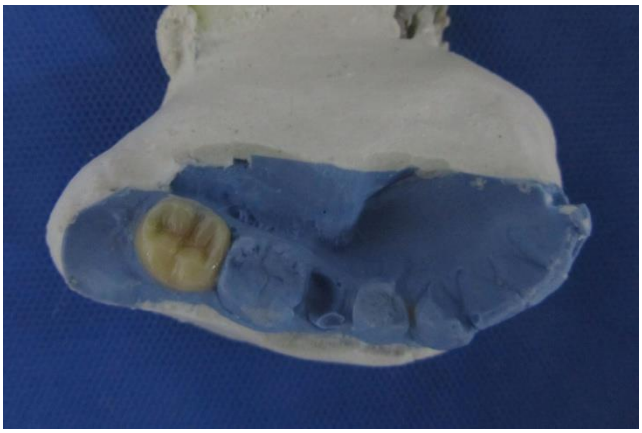

Figure 4. Final composite mock-up "occlusal view".

Figure 5. Final composite mock-up "lateral view".

Making a rigid tray: A thermoplastic 0.9 mm thick rigid tray (Rigid-Tray® Sheets, ULTRADENT INC, USA) is fabricated over the lower master cast using a vacuum press machine (T&S Dental & Plastic Co. USA). The tray is trimmed off using a scalpel blade 3-5 mm apical to the gingival margin. A pair of small curved scissors can be used to remove the rough edges if necessary. Fitness is checked by matching the tray with the master cast and rechecked in the patient's arch. An occlusal window needs to be made by cutting the tray with scalpel and scissors, or dental bur (Fig. 6).

8. Cementation of the post: A suitable prefabricated intracanal post (Gold plated screw post, SVENSKA DENTORAMA AB, Sweden) is cemented (Luting Glass ionomer, GC Corporation, Tokyo, Japan) (Fig. 7).

Figure 6. Final composite mock-up with perforated rigid tray

Figure 7. Cemented post "occlusal view"

Figure 9. Final build-up "occlusal view"

9. Placing the Rigid Tray: After isolation with cotton rolls, the tray is placed in the proper position.
10. Using the core build-up material: An injectable self-cured or bulk light-cured core build-up material can be used after dentinal treatment. We used A 3.5 bulk filled radiopaque posterior restorative in injectbale capsules (EQUIA™ FiL, GC Corporation, Tokyo, Japan) as described by the manufacture (Fig. 8).
11. Removing the Rigid Tray: After a five-minute waiting time for initial setting, the tray can be removed and occlusion can be checked if necessary. 2 layers of its sealing material need to be used as manufacture's instruction. After 24 hours, it is ready to prepare for making a crown (Figs. 9-11).

Figure 10. Prepared crown before making impression

Figure 8. Injecting glass- ionomer through the rigid tray occlusal window

Figure 11. Final indirect restoration

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

Purpose/step	Materials or device	Specification
Taking impressions	Alginate impression material	AROMA FINE DF III, GC C Corporation, Tokyo, Japan
Cavity preparation	Diamond stone	Round end 18161 Round 18163 SS White, New Jersey, USA
Making master casts	Hard Plaster for models	Moldano, Bayer, Leverkusen, Germany
Forming the tooth	Light cured composite resin	Filtek P60, 3M ESPE, USA
Making a rigid tray	Vacuum press unit	T&S Dental & Plastic Co, USA
Making a rigid tray	Rigid sheet	Rigid-Tray® Sheets, ULTRADENT INC, South Jordan, USA
Cementation of the post	Prefabricated posts	Svenska Dentorama AB, Sweden
Cementation of the post	Luting glass ionomer	GC Corporation, Tokyo, Japan
Using the core build up materials	Injectable glass ionomer	GC Corporation, Tokyo, Japan

Potential Problems

The only potential problem is availability of vacuum former and rigid sheet needed for making a rigid tray. A suitable core build-up material is also needed.

Advantages and Disadvantages

Being single visit, easy to do and patient satisfying makes RTT more practical. It is a cost effective and time saving method since RTT has minimal laboratory procedures. The RTT is an artistic technique for build-up or temporary restoration that can be used in restorative dentistry to bring satisfaction to the dentist concerned about their patients' welfare.

The disadvantages of RTT are the same addressed with direct build-up techniques. The lack of chance to use amalgam as the best material for a direct build-up can be considered as a disadvantage for RTT.

Conclusion

The novel matrix system "RTT" using a rigid tray matrix may sometimes be the only way to build-up the core as a foundation for an indirect restoration or even be used as an interim restoration.

Acknowledgment

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