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Original Research Paper

Endodontics

SIGNIFICANCE OF PRE –ENDODONTIC BUILD UP IN ROOT CANAL THERAPY- A REVIEW

Dr. Mansi Vandekar	BDS, MDS, Head Of Department, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.
Dr. Rashmi Misra	BDS, MDS, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.
Dr. Gayatri Pendse	BDS, MDS, Associate Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India
Dr. Nikita Shitole*	BDS, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India. *Corresponding Author
Dr. Rajni Khatri	BDS, Post Graduate Student, Department of Conservative Dentistry and Endodontics D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.
Dr. Heervita Maniar	BDS, Post Graduate Student, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.

ABSTRACT This review paper explores different techniques used in restorative dentistry for pre-endodontic buildup with particular emphasis on the Doughnut Technique, Canal Projection Technique, Open Sandwich Technique, the modifications of the Doughnut Technique, and alternative techniques for tooth isolation. These techniques are explained in detail, alongside their respective procedures, advantages, and possible modifications to adjust to different dental situations. The paper emphasizes that the choice of technique and restorative material should be carefully considered depending on the specific needs and conditions of the tooth to be restored. The success of these techniques is highly dependent on proficient skills and a deep understanding of restorative dentistry principles and endodontic procedures. Equally important is a thorough evaluation of each clinical situation to design a suitable treatment plan. The paper concludes with a reflection on the importance of these techniques for the success and longevity of the treatment. It underscores the need for further studies to evaluate the performance of these techniques in restorative dentistry and endodontic procedures.

KEYWORDS : Pre-endodontic buildup, Doughnut technique, Canal projection technique, Open sandwich technique

INTRODUCTION

Teeth that require endodontic treatment are often structurally compromised, which poses challenges for performing successful endodontic procedures. Pre-endodontic restorations play a crucial role in optimizing the outcomes of endodontic treatment in these teeth.

In recent years, there has been a growing interest in pre-endodontic restoration as a means to enhance the success and longevity of endodontic treatment and improve the overall structural integrity of teeth. In the field of dentistry, pre-endodontic restoration refers to the process of restoring the structural integrity and aesthetics of a tooth before performing endodontic treatment. The goal of pre-endodontic restoration is to provide a stable and durable foundation for the subsequent endodontic treatment, which can help improve the prognosis and success of the overall treatment. One of the main advantages of pre-endodontic restoration is that it addresses the structural compromises present in teeth requiring endodontic treatment.

Advantages

There are several advantages associated with pre-endodontic restoration techniques. Firstly, pre-endodontic restoration helps to strengthen the weakened structure of the tooth. This is particularly important for teeth that are structurally compromised, as it provides a stable foundation for the subsequent endodontic treatment.

By reinforcing the tooth structure, pre-endodontic restoration techniques can improve the overall durability and longevity of the tooth. Furthermore, pre-endodontic restoration can help to seal and protect the tooth from further damage or contamination during the endodontic procedure. Secondly, pre-endodontic restoration can aid in achieving optimal isolation during the endodontic procedure. [1] This is important for maintaining a clean and dry working environment, which is essential for the success of endodontic treatment. It also helps in better stabilization of rubber dam clamps, thus aiding isolation. Achieving optimal isolation can be challenging in teeth that are structurally compromised, as they may have poor marginal adaptation and impaired oral hygiene. Therefore, pre-endodontic restoration plays a crucial role in creating an ideal environment for performing endodontic procedures by improving isolation and facilitating better control over the treatment area.

In addition, pre-endodontic restoration techniques can also contribute to the aesthetic outcome of the final restoration. By addressing any aesthetic concerns prior to endodontic treatment, pre-endodontic restoration can enhance the overall aesthetic result of the final restoration. Furthermore, pre-endodontic restoration can aid in the preservation of tooth structure and minimize the need for extensive post-endodontic restorative procedures. [2]

Pre-Endodontic Restoration Techniques: Current Concepts and Decision-Making Flowchart [Figure 1]

The decision to perform pre-endodontic restoration is multifactorial and should be individualized based on the specific needs of each patient. The factors include the extent of structural compromise, aesthetic requirements, the presence of periapical pathology, root damage, complexities in the root canal system, and proximity to adjacent anatomical structures, the patient's oral hygiene habits, and the overall stability of the tooth.

The use of adhesive restorative methods and surgical/ orthodontic techniques are two main approaches to pre-endodontic restoration that will be explored in this article. Adhesive restorative methods, such as direct composite resin restorations and indirect ceramic restorations, involve the use of materials that bond to tooth structure, providing strength and stability to the tooth. These methods not only restore the structural integrity of the tooth but also contribute to the aesthetic outcome of the final restoration.

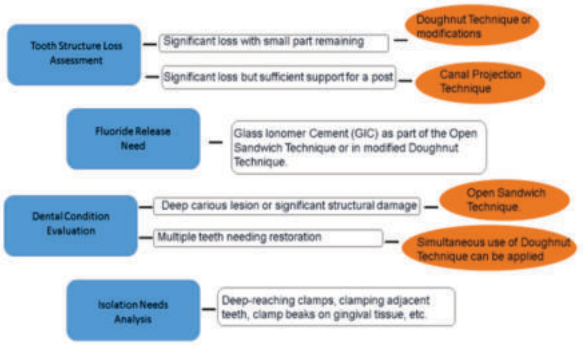


Figure -1 Current Concepts Of Preendodontic Restorations

Adhesive restorative methods play a key role in pre-endodontic restoration. These methods involve the use of adhesive materials, such as composite resin or ceramic, to restore the structural integrity of the tooth. By bonding these materials to the remaining tooth structure, dentists can reinforce weakened areas and prevent further damage or fracture. [3] Surgical and orthodontic techniques are also valuable tools in pre-endodontic restoration.

Surgical techniques may involve procedures such as crown lengthening or soft tissue grafting to enhance the overall structure and aesthetics of the tooth. Orthodontic techniques, on the other hand, focus on repositioning teeth or correcting alignment issues to create a more favourable environment for subsequent endodontic treatment. These techniques can help optimize the success of endodontic procedures and minimize complications. [4]

Restorative Techniques

Pre-endodontic restorative techniques are designed to restore the structural integrity of teeth prior to endodontic treatment. Here's an overview of some common methods:

1. Direct Restoration: This involves the direct application of a restorative material to the tooth. This could include composite resin or glass ionomer cement. These materials are applied in layers and light-cured, ensuring that they bond well with the tooth structure. This method is typically less costly and time-consuming than indirect restoration approaches. [2]

2. Indirect Restoration: This type of restoration involves the use of fabricated components such as inlays or onlays that are placed onto the tooth. Materials used for indirect restorations include composites, ceramics, or even gold. It is important to note that this method requires a two-stage process: the preparation stage and the fitting stage.

3. Partial Crown Restoration: This is a specific type of indirect restoration that involves the use of a partial crown when the damage to the tooth is extensive but doesn't warrant a full crown. This is especially useful in preserving more of the tooth's natural structure. [5]

4. Cusp Protection/Coverage: This technique involves covering or capping the cusp of the tooth with a restorative material to provide added strength and protect it from fracture.

5. Coronal Prefabrication: This technique involves the fabrication of a coronal substitute before the start of endodontic therapy. It has been used to manage severely damaged teeth.

Procedure: In coronal prefabrication, after cleaning and shaping of the tooth and the root canal, a prefabricated crown (made of a suitable material) is placed on the tooth temporarily. This is then used as a guide to shape the buildup material within the prefabricated crown, conforming to the predetermined shape of the future restoration.

Choosing the right restorative technique depends on the specific damage, the patient's oral health, and the dentist's evaluation. In many situations, a combination of these methods may be needed to ensure the best possible restoration. [6]

Surgical And Orthodontic Approches

Surgical and orthodontic techniques play an indispensable role in pre-endodontic restoration as they can prepare the oral environment for further endodontic procedures.

1. Surgical Techniques: These are often employed when non-surgical restorative measures do not suffice or are not feasible due to the complex nature of structural damage. Examples of surgical techniques include crown lengthening, apicoectomy, hemisection, or root amputation. Crown lengthening, for instance, involves reducing the gum line and re-contouring bone level to expose more tooth structure necessary for restoration. Procedures such as apicoectomy, hemisection, and root amputation are more advanced surgical options planned for restorations when conventional endodontic therapy could not resolve periapical pathosis.[7]

2. Orthodontic Techniques: These can be used in cases where malocclusion or poor tooth alignment may interfere with endodontic therapy or restorative procedures. Orthodontic movement can help to reposition teeth in a more favorable alignment for further treatment, correcting overeruptions, intrusions, or tipping beforehand. This also assists in managing complex anatomical cases, such as impacted or malpositioned teeth, aiding in effective isolation during the endodontic procedure.

In sum, surgical and orthodontic techniques are essential in creating the appropriate environment for endodontic procedures, thus, increasing the success rate and prognosis of the overall treatment plan.

Techniques:

Amalgam For Pre-endodontic Build Up

Amalgam has been traditionally used in dental restorations due to its strength, durability, and longevity, and is also sometimes used in pre-endodontic buildup. The pre-endodontic buildup phase aims to provide a solid platform for the tooth that is about to undergo root canal therapy. Here's how amalgam can fit into this process: [8]

1. Placement: After the decayed or damaged part of the tooth is removed, an amalgam filling can be used to rebuild the tooth structure, providing a firm base for the tooth.

2. Amalgam Properties: Amalgam is a robust restorative

material due to its high compressive strength and wear resistance, qualities which make it suitable for posterior teeth that need to withstand heavy biting forces. It also has good longevity, with amalgam restorations often lasting for many years.

3. Disadvantages: Despite its strengths, amalgam does have a few limitations to consider. It does not bond to the tooth structure, which may weaken the remaining tooth, and it also lacks aesthetic appeal due to its silver color.

Cervical Margin Relocation

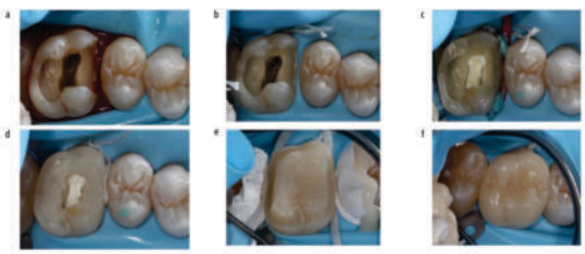
Cervical margin relocation (CMR) is a significant concept in pre-endodontic restoration, especially for teeth with deep subgingival defects that can compromise the success and longevity of both endodontic and restorative outcomes. Here's an overview of the procedure:

1. Concept: CMR is designed to shift the subgingival margins of a tooth to a more supragingival or equigingival location. This allows easier access to the subgingival lesion without impinging on the biological width and avoiding the need for crown lengthening procedures.

2. Procedure: In CMR, a temporary crown or an adhesive restoration is placed on the tooth before endodontic therapy, extending coronally to relocate the margin. Once the endodontic treatment is completed, the temporary restoration can be replaced by a permanent one. The CMR procedure creates a favorable environment that aids in better isolation and control of bleeding during the endodontic procedure. [Figure 2]

3. Advantages: This technique helps to maintain periodontal health, achieve better control of the operative field, and facilitate the placement of the final restoration. In addition, it prevents damage to periodontal tissues that can occur if traditional crown lengthening procedures are used.

However, it's important to note that CMR is a technique-sensitive procedure and requires meticulous planning and execution. It is not suitable for all cases and should only be considered when other non-surgical restorative measures are not sufficient. [9]



Cervical margin relocation (CMR): from pre-endodontic to post-endodontic restoration. a) Non-vital upper right first molar after removal of caries and previous restorations. b) Isolation and c) mesial CMR with sectional matrix. d) Pre-endodontic restoration (including cusp reduction) completed. e) Preparation for adhesive restoration after completion of endodontic treatment. f) Ceramic onlay after adhesive cementation

Figure -2 [7]

Doughnut Technique

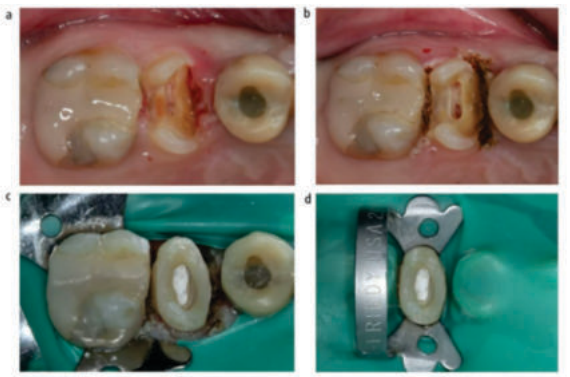
The Doughnut Technique is a well-known method used in pre-endodontic buildup, specifically when large parts of the tooth crown are missing and there is only a small part of the tooth left. Here are the main features of this technique:

1. Concept: The Doughnut Technique aims to provide a solid, box-shaped foundation for the tooth that is going through root canal treatment. An artificial wall is created, representing the missing part of the tooth, which will encapsulate the filling material, resembling a "doughnut".

2. Procedure: The first step is to clean and shape the remaining tooth structure. Subsequently, a ring-shaped matrix band is placed around the remaining tooth structure. Cotton pellet is used to avoid blockage of canal. Finally, a suitable restorative material like composite resin or amalgam is inserted and light-cured (for composite resin) within the created space, resulting in a restored tooth ready for subsequent endodontic treatment.

3. Advantages: The Doughnut technique creates a stable, conducive environment for endodontic procedures. It enhances the tooth structure ensuring better grip and isolation during root canal treatment. The reinforced tooth structure also aids in accurate location of canal orifices and consequently an efficient biomechanical preparation of the root canals.

Remember, the successful implementation of the Doughnut Technique requires proficient skills and understanding of both restorative dentistry principles and endodontic procedures. [4]



Combined pre-endodontic restoration of an upper right second premolar. a) Pre-operative condition with subgingival mesial and distal margins. b) Following laser gingivectomy. c) 'Doughnut' composite build-up using polytetrafluoroethylene in pulp chamber. d) Final rubber dam isolation before initiating endodontic treatment

Figure -3 [7]

Canal Projection Technique

Canal projection in pre-endodontic buildup refers to the process of creating an artificial extension, or "projection", of the root canal during the restorative procedure. This technique is particularly helpful in situations where there is significant loss of tooth structure due to decay, fracture or wear.

In the canal projection technique, after thorough cleaning and shaping of the root canal system, a post is placed into the root canal that extends above the tooth structure, mimicking the natural tooth's anatomy. This provides a framework for the buildup material and the subsequent crown or restoration. [Figure 4]

The material for the post can vary, but popular options include prefabricated posts (metal or fibre posts) or custom cast posts. The choice largely depends on the tooth's condition, the dentist's preference, and the specific requirements of the case. With the canal projection in place, dentists can move forward with the reconstruction of the tooth, using suitable restorative materials (like composite resin) to create a new, functional crown structure.

One of the primary advantages of canal projection is the increased retention and stability it offers for the restorative materials. However, it's important to remember that this technique also requires careful planning and execution, as incorrect application can lead to complications, including root fracture.

Keep in mind that each clinical situation is unique and the dentist should assess the case thoroughly before opting for canal projection or any other restorative technique.

Figure 1 (a) Preoperative photograph: severely broken down tooth 16 (mirror view). (b) Preoperative radiograph: deep occlusal caries and chronic periradicular periodontitis, tooth 16. (c) Access opening completed under rubber dam, four orifices detected. (d) Files are prepared with projectors. (e) Composite built up around projectors to occlusal surface. (f) Files removed leaving projectors in place. (g) Projectors are removed using H-file. (h) Final result: orifices projected to occlusal surface. (i) Postobturation radiograph.

Figure -4 [9]

Open Sandwich Technique

The Open Sandwich Technique is an integral part of restorative dentistry, often considered in pre-endodontic buildup, especially for teeth with significant structural damage or deep carious lesions. Here are its key elements:
1. Concept: The Open Sandwich Technique is designed to provide a stable restoration for teeth, combining the beneficial properties of two different materials: Glass Ionomer Cement (GIC) and composite resin. The GIC acts as a base layer offering fluoride release and good adherence to dentin, whilst the composite resin provides strength and aesthetic finish.

2. Procedure: In this technique, the decayed part of the tooth is removed, and a base layer of glass ionomer cement is applied to fill most of the tooth cavity, especially the portion nearest the pulp. The layer of GIC is then left exposed (hence the term 'open') around the gingival margin of the restoration. Thereafter, composite resin is placed over the GIC, filling the rest of the cavity and forming the crown's occlusal surface.

3. Advantages: This technique has several benefits. The GIC layer can release fluoride, which helps to prevent further caries formation. It also reduces microleakage around the restoration's margins, improving long-term outcomes. In addition, the composite layer provides strength, wear resistance, and good aesthetics.

Modification Of Doughnut Technique

The modification of the Doughnut Technique in pre-endodontic buildup may involve the implementation of additional restorative materials or slight changes in the procedure. However, the main goal remains the same: to provide a solid foundation for the tooth that is about to undergo root canal treatment.

One modification could involve the type of restorative material used. For example, in some cases, dental practitioners might prefer the use of glass ionomer cement (GIC) instead of composite resin due to its excellent adhesion properties and the ability to release fluoride.

Another variation could be in the placement of the filling material. Traditionally, the filling material should be within the doughnut shape, but in some instances, depending on the severity of the dental condition, portions of the filling material might be placed outside the doughnut shape for better structural support.

In cases where more than one tooth needs restorative work, another modification can be the simultaneous use of the doughnut technique on several teeth, improving efficiency. [4]

Alternative Techniques For Tooth Isolation

Alternative techniques for tooth isolation can be considered when the traditional methods may not be suitable or feasible. These alternative techniques include the use of deep-reaching clamps, clamping adjacent teeth for multiple tooth isolation, placing clamp beaks on gingival tissue, cementing a preformed copper band, temporary crown, or orthodontic band, and using pin-retained amalgam buildups, glass ionomer cements, or composites. The choice of which technique to use depends on factors such as the extent of tooth structure remaining, stability of the technique, complexity, and time requirements. Furthermore, the placement of gingival retraction cord can aid in achieving hemostasis and visualization of subgingival tooth margins during restorative procedures.

CONCLUSION

The importance of a pre-endodontic buildup in the overall prognosis of the endodontically treated tooth cannot be overemphasized. Various techniques can be utilized for restoring the tooth prior to start of endodontic treatment.

The use of the Doughnut Technique or its modified versions can provide advantages such as simple application and maintenance of access to the root canal system. However, it is important to note that these techniques require proficient skills and a deep understanding of restorative dentistry principles and endodontic procedures.

In addition, alternative techniques for tooth isolation can also be considered based on the specific case requirements. Upon analyzing the available literature on the subject of tooth isolation techniques in restorative dentistry and endodontic procedures, it is evident that several techniques have been used to overcome the challenge of tooth isolation.

All procedures demand a high level of proficiency and an understanding of restorative dental principles. The overall goal remains the same - to restore oral function while preserving the integrity of the patient's natural dentition as much as possible. By succeeding in this, dental professionals not only enhance oral health but also greatly improve their patients' well-being and self-esteem.

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