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Risk of Postoperative Sensitivity and Pulpal Complications in Respect of: Amount of Reduction, Temporization, Cement Type

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Fixed partial dentures (FPDs) made of metal ceramic are a popular treatment option for missing teeth. Studies have shown that posterior abutments of FPDs had a higher pulp survival rate than anterior abutments. Postoperative sensitivity following the cementation of a fixed prosthesis is a frequent symptom, especially when the abutments include important pulp. Dentinal hypersensitivity affects between 4 and 74 percent of people. Females are found to have a somewhat greater DH incidence than males. While DH can affect individuals of any age, there have been several theories on what causes abutment sensitivity after tooth preparation and cementation. In this review we included some of it. Also, we discussed methods of management of postoperative sensitivity and Management of fractured abutment screw.

Keywords: Fixed partial dentures (FPDs); metal ceramic; DH; fractured abutment screw.

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1. INTRODUCTION

Fixed partial dentures (FPDs) made of metal ceramic are a popular treatment option for missing teeth. Studies have shown that posterior abutments of FPDs had a higher pulp survival rate than anterior abutments. This means that when premolars and molars are utilised as abutments for fixed partial dentures, their pulp life is preserved considerably better than when anterior teeth are used. The tooth preparation for metal Ceramic FPDs necessitates the removal of a substantial quantity of tooth structure.In most cases, however, abutment vitality may be preserved if prepared abutments are preserved following tooth preparation with provisional fixed partial dentures luted withtemporary luting cement, which is an important and critical step in effective fixed prosthodontic therapy. One of the most common problems in fixed prosthodontics is post-cementation discomfort, especially when the prosthesis is cemented on teeth with important pulps.Most doctors, however, underestimate the frequency of this post-cementation problem. The choice of permanent luting cement for fixed partial dentures is crucial since it affects post-cementation sensitivity and the final prosthesis' success [1].

Postoperative sensitivity following the cementation of a fixed prosthesis is a frequent symptom, especially when the abutments include important pulp. Unlike front teeth, it has been discovered that the vitality of most posterior teeth produced for permanent prosthesis may be retained without the need for elective endodontic therapy if adequate measures are followed during and after the tooth preparation operation. Despite following a normal procedure, some patients have hypersensitivity after dental restorations are cemented in place.Clinical investigations have found a wide range of post-cementation sensitivity rates, ranging from 3 percent to 34 percent. According to Rosenstiel and Rashid's survey, post-cementation hypersensitivity affects around 10% of the population. Most doctors, however, underestimate the occurrence of this post-cementation problem [2].

When the prosthesis is cemented on teeth with intact pulp vitality, glass ionomer luting cement, which is one of the most widely used permanent luting agents for cast restorations, has a relatively low initial setting pH at the time of placement, and this has been implicated as a cause of post cementation sensitivity. In comparison to Glass Ionomer cements, resin-based luting cements have a lower solubility and a higher pH at placement.However, because their major shortcoming is marginal flaws and gaps produced by polymer-ization shrinkage during insertion, resin-based luting cements have also been found to cause post-operative sensitivity. Since resin-based luting cements have only recently been developed, there are no thorough studies that evaluate the two luting cements' post-cementation sensitivity under similar settings. This investigation was conducted to determine which of these luting cements provides greater post-cementation sensitivity in abutments of fixed partial dentures with vital pulps and full coverage restorations [1].

"Short, acute pain occurring from exposed dentin in reaction to stimuli generally thermal, evaporative, tactile, osmotic, or chemical and which cannot be assigned to any other kind of dental defect or pathology," according to the ADA. The first half of the definition gives a clinical description of dentin hypersensitivity, while the second part helps with differential diagnosis [2].

Post and core systems for single-tooth crowns do not strengthen devitalized teeth and should only be used to secure the crown if the tooth has severe coronary loss. It is critical to establish a "ferrule design" during preparation to support single-crown teeth. However, it's uncertain if this generalisation also applies to the anchoring of devitalized teeth with double crowns. When there is strain in the area of the free-end saddle, it is possible that the strong physical frame present in double crowns causes significant tension in the tooth, especially in situations of severely reduced dentitions. As a result, posts may assist in the stability of these teeth [3-10]. Double-crown systems are produced with precious or non-precious alloys via the lost wax technique. [11] Various materials, such as zirconia, can be used in double-crown systems.

Double-crown systems consist of a primary crown (patrix, male), which is cemented to the teeth or the implant abutment, and a secondary crown, which is attached to the prosthesis [12,13,14] In cylindrical double crowns, all surfaces are prepared in parallel so that a piston-cylinder effect occurs. In conus crowns, parallelism is constructed only between the contact surfaces of the primary and secondary crowns.

Fig. 1. Conus crowns construction

2. PREVALENCE

Dentinal hypersensitivity affects between 4 and 74 percent of people. Females are found to have a somewhat greater DH incidence than males. While DH can affect individuals of any age, the majority of those afflicted are between the ages of 20 and 50, with a peak between the ages of 30 and 40. The canines and premolars of both arches are the most impacted teeth when it comes to the kind of teeth concerned. The buccal aspect of the cervical region is the most often damaged location [2].

For decades, partial dentures anchored with double crowns have been a well-known treatment option. Dentures of this type have an average lifespan of 6–10 years. The fracturing of the abutment teeth is a typical cause of partial dentures secured with double crowns eventually failing. Fracture rates have been recorded ranging from 0.4 percent to 14.8 percent, depending according to various studies. Endodontically treated devital teeth provided with double crowns have a worse prognosis than vital abutment teeth because to their propensity to fracture [3,15-24].

2.1 Post- cementation Hypersensitivity

There have been several theories on what causes abutment sensitivity after tooth preparation and cementation.

1- Excessive tooth preparation
2- Substandard provisional restorations
3- Bacterial leakage and contamination
4- Desiccation of the preparation before to cementation
5- Removal of the protective smear layer
6- In-vivo luting agent dissolving at the restoration margins
7- During cementation, hydraulic pressure in the dentinal tubules may allow cement to penetrate, particularly in preparations with little residual dentin thickness and high dentine thickness.

The activation of the low threshold myelinated nerve fibres (A fibres) that are responsible for dentinal sensitivity caused pain when compressed air was applied to the dentin. A brief air blast can remove enough fluid from the dentinal tubules to stimulate capillary forces, causing dentinal fluid to flow outward quickly. Intradental A fibres are reported to be activated by a fast outward movement of only 2m.The minor sensitivity to cold six weeks after final crown cementation might be indicative of a fluid gap near the dentin someplace beneath the crown, or at the very least tubules opening to the pulp in a gap [2].

2.2 Effect of Luting Cements on Post Cementation Hypersensitivity

The luting cement for crucial abutments should be chosen carefully since it affects post-cementation hypersensitivity and the ultimate prosthesis' success. The two most widely utilised luting agents are Type I glass ionomer cements

and resin-based luting cements. Glass ionomer cement can displace a small quantity of dentinal fluid, resulting in an increase in hydrostatic pressure and subsequent post-cementation discomfort. When the prosthesis is cemented on teeth, glass ionomer luting cement has a somewhat low initial setting pH at the time of implantation, which has been implicated as a cause of post-cementation sensitivity. In their in vitro investigation, Johnson et al discovered that using a resin sealer with glass ionomer cement resulted in a 55 percent improvement in retention. They came to the conclusion that a dentin bonding agent may be successfully utilised with type I glass ionomer cement [2,25,26].

Resin-based luting cements have a lesser solubility than glass Ionomer cements, and their pH at placement is likewise higher than glass Ionomer cements. Rohitmohanshetty et al. compared the postoperative sensitivity of abutment teeth restored with full coverage restorations retained with either conventional glass ionomer cement (GIC) or resin cement, and concluded that if postoperative sensitivity is a primary concern, self-adhesive resin cement can be the material of choice for luting.In a research, Hassan s et al determined that there was no significant difference between resin-based luting cement and glass ionomer luting cement in terms of post-cementation sensitivity in essential teeth with permanent restorations. However, because its major weakness is marginal flaws and gaps induced by polymerization shrinkage during installation, resin-based luting cements have also been found to cause postoperative sensitivity [2,27,28].

2.3 Abutment-related Complications

In a study that observed abutment teeth. With a high of 103.5 months, the average observation period was 39.5 months. A total of 84 abutment teeth were cracked, with 46 of them being removed immediately (34 vital, 6 root-filled, and 6 root-filled with posts). A total of 38 fractures were repaired. Five of the restored abutment teeth were removed due to a second fracture (4 formerly important, 1 root-filled tooth with post). 10.9 percent of all teeth broke during the whole test. Caries (17 teeth), periodontal damage (15 teeth), and endodontic issues were among the abutment tooth's additional concerns, in addition to fractures (15 teeth).

The results showed That cumulative fracture rate for devital abutment teeth (47.5 percent) was clinically significantly greater than that of vital abutment teeth (13.4 percent) [3].

2.4 Clinical Treatment of Post-Cementation Hypersensitivity:

- Tooth reduction, high-volume spray preparation, and the quality of provisional restorations were all thought to have a substantial influence on the occurrence of post-cementation sensitivity. Several attempts have been made to minimise postoperative sensitivity, particularly in the selection of operational method and the liberal application of water cooling during tooth reduction.

- Dentin exposed to the surface for 1 or 2 weeks will have bacterial invasion at least halfway to the pulp.As a result, the crown must completely cover the cervical dentin while avoiding disrupting the periodontal tissues, which is a crucial step.

- A more solid provisional crown or, at the at least, a firm cement, such as zinc phosphate or polycarboxylate cement, will be more favourable to the pulp. This might be useful, for example, in a molar tooth with one diseased root canal and the rest of the root canals being more or less healthy, as shown by a positive vitality test. Because the outward flow of fluid is prevented, a perfect seal might produce discomfort and even toothache.It is preferable for this to happen when a provisional crown is being placed rather than after permanent cementation.

- Prior to permanent cementation, the occlusion should be verified. A crown that is slightly too high in one area may cause damage to the tooth's blood and nerve supply, resulting in poor cellular response, insufficient blood flow, and hypersensitivity.

- Before final cementation and interlocking, all lining must be removed from the dentin, and the dentin should be cleaned with a brush or rubber cup using low speed and pumice in an appropriate solution to provide a good mechanical bonding. The dentin should be maintained moist until it is time to cement. In his research, Brannstorm discovered that typical dentin evaporation is enough to activate capillary

forces and generate a fast outward flow of fluid, resulting in discomfort that lasts several minutes and the loss of primary odontoblasts.However, this will not cause any difficulties for the pulp; in fact, new cells may generate irregular, reparative dentin that plugs the pulpal ends of the tubules, which may have a beneficial impact.

- Having the patient bite on a cotton roll or pellet while the cement is curing should not result in an inward migration of tubule contents, which might cause discomfort and other pulpal issues.

- Even when put extremely close to the pulp, luting cements are not annoying. To prevent the creation of voids and air or fluid gaps around the dentin, the cement should be brushed on the dentin rather than only the inside of the crown. Furthermore, connection with the oral cavity is not required to cause microbial problems or hypersensitivity. Living bacteria may be present under the dentin's surface, and any fluid gap might cause heat sensitivity. The effects of fluid gaps around the dentin are well understood [2].

3. DISCUSSION

Unlike front teeth, the vitality of most posterior teeth produced for permanent prosthesis can be retained without the need for elective endodontic treatment if adequate measures are followed during and after tooth preparation. Pulp hyperemia is the most common cause of postoperative sensitivity. The choice of luting agent for fixed prostheses with essential abutments is significant because it affects post-cementation sensitivity and the final prosthesis' success. Several studies have been conducted [1].

- On cold sensitivity tests, the majority of the patients showed mild to moderate sensitivity, with only a small percentage showing extreme sensitivity.

- With both luting cements, the sensitivity responses mellowed with time.

- In terms of post-cementation sensitivity in essential teeth with fixed restorations, there was no significant difference between the resin-based luting cement and the glass ionomer luting cement.

Prior research has indicated that when adjacent teeth are present medially and distally, i.e., when proximal connections are formed through neighbouring teeth, endodontically treated teeth have the best prognosis. This causes the teeth to become more stable under the strain of chewing forces. When loading the free-end saddle for double-crown anchored dentures, however, significant stresses in terminal abutment teeth are predicted, according to Sahin et al. and Saito et al. As a result, it's worth noting that SRD was home to more than 40% of the abutment teeth. High vertical and horizontal stresses on the remaining abutment teeth are predicted in circumstances where there are no proximal connections. SRD abutment teeth had considerably poorer survival rates than NSRD abutment teeth, according to Cox regression. This is consistent with prior research findings. Future research should look into this further to see if post and core reconstructions, particularly in SRD, are recommended to enhance abutment tooth survival [3].

4. CONCLUSION

Devital abutment teeth has a greater risk of complications. The use of a post and core system on abutment teeth is linked to a decreased risk of problems than teeth that were only root-filled and built up with composite. This difference, however, is not statistically significant.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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