REVIEW ARTICLE

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Endocrown - An Overlooked Alternative

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ABSTRACT:

Endocrowns are a viable option for the often problematic and difficult restoration of extensively damaged endodontically treated molars. This is especially true when the inter arch distance is compromised. It's easier technique, less clinical time and better acceptance makes it a superior option among the various alternatives. The endocrown fits perfectly with the concept of biointegration and can be the preferred choice for restoring posterior endodontically treated and badly damaged molars. In this article the important properties and method of preparation of endocrowns are reviewed based on the existing literature.

Keywords: CAD -CAM, Endocrown, Ferrule, Post and core.

INTRODUCTION

Restoration of extensively damaged endodontically treated molars are often problematic and difficult, more so when the inter arch distance is compromised. Traditionally such cases were treated by the use of post and core followed by crown. Even though post and cores were used widely, studies have shown that these intracanal retainers only promoted the retention of the crown and in fact weakened the remaining tooth. Hence other alternatives were introduced over the years, but none were successful enough to replace post and cores. Endocrown is one such overlooked alternative. The recent advances in adhesive dentistry and the introduction of high mechanical strength ceramics which were capable of being etched, made endocrowns possible.[1]

Pissis was the forerunner of the endocrown technique. He described it as mono-block porcelain technique.[2] The term endocrown was introduced by Bindl and Mormann in 1999 as adhesive endodontic crowns.[3] These crowns are anchored to the internal portion of the pulp chamber and on the cavity margins, thus providing macromechanical retention. Several studies have been done to show the superior strength and mechanical properties of endocrown compared to conventional crown.

WHY ENDOCROWN?

One of the biggest problem in the rehabilitation of endodontically treated tooth is the insufficient inter - arch distance. Often the distance is not enough for a viable restoration. Endocrowns can be used in such cases as it does not require much inter arch distance and can have good strength even with limited space. Endocrowns can also serve as an alternative to intracanal retainers as unlike posts, they not only provide retention but also reinforces the tooth . Other advantages of endocrown include, it's easier technique, less clinical time and better acceptance. It maintains the biomechanical integrity of the tooth and reduces the number of adhesive bond interfaces as compared to posts.[4]

One of the limitations of endocrowns is its high failure rate in premolars. This is because of the smaller adhesion area of premolars and its greater crown height which compromises

its mechanical properties. But these limitations are not a concern for molar endocrowns.

BIOMECHANICAL ASPECT

Extra coronal support

The clinical longevity of root canal treated posteriors improve significantly with coronal coverage[5]. Various studies have clearly shown that the placement of a crown increased the fracture resistance of the endodontically treated tooth whereas no cuspal coverage led to high failure rate. Aqualina et al found that endodontically treated teeth without crowns failed at about 6 times greater rate than that of crowned teeth[6]. In a retrospective study of uncrowned endodontically treated tooth , the overall survival rate was 96%, 88% and 36% after 1, 2 and 5 years respectively. The presence of cusp coverage was more important than the type of foundation restoration[7].

Remaining Tooth Structure - Ferrule

One of the major causes of failure of endodontically treated teeth is fracture, which is related to the amount of healthy dentin remaining. So one of the major objective of endodontic therapy and subsequent restorative procedures is the maximum conservation of internal dentine. The presence of adequate circuitous tooth structure (ferrule) at the crown- root interface is essential for the success of the crowned endodontically treated tooth.[8]

The ferrule is the circumferential ring of sound tooth structure that is enveloped by the cervical portion of the crown restoration. A minimum sound dentine height of 1.5 - 2mm is required and when present, crown and root function as a single unit, transmitting the forces to the periodontium mimicking the normal physiology[9].

THE CONCEPT OF ENDOCROWNS

The endocrowns maintains the biomechanical integrity of the tooth. It avoids the excessive root canal preparation needed for a post. The presence of pulp chamber not only adds to the retention of the restoration but its anatomy also adds to the stability of the restoration. The restoration allows close adaptation at the bonded joints thereby increasing the resistance to fracture. The following are some of the concepts of endocrown which make it unique and diffeent from endocrown.

1. To engage the large pulpal chamber of root canal treated molar teeth.
2. To bond to a circumferential enamel margin and internal dentine of the pulpal chamber.
3. To preserve sound enamel on all four sides.
4. To avoid intra-radicular preparation and further compromise of the root structure.
5. To allow re-entry to the canals if required without post removal.
6. To reduce patient cost and chair side time.

TOOTH PREPARATION FOR ENDOCROWN

Occlusal

The primary goal of occlusal preparation is to achieve the occlusal reduction needed in endocrown, atleast 2mm in the axial direction. It can be done with the help of depth orientation grooves with a depth of 2mm. Diamond wheel bur is the bur of choice because of its shape, which allows for the control of the orientation of the reduction. This also gives a flat surface which is responsible for determining the position of the cervical margin or "cervical sidewalk". The orientation of the bur is along the major axis of the tooth and it is held parallel to the occlusal plane as shown in the figure 1.

Cervical margin should be supragingival. Care shoud be taken to avoid the staircase effect by linking the different levels between the various parts of the cervical margin by a slope of no more than 60°.

Preparation of The Cavity Floor

The entrance to the pulpal canal is opened and gutta percha is removed to a depth not exceeding 2 mm to take advantage of the saddle-like anatomy of the cavity floor. A nonabrasive instrument is used in this step so that the integrity of the canals entrance is not compromised.

Axial Preparation

This step parimarily ensures that there are no undercuts in the access cavity. A cylindrical-conical diamond bur is used to make the coronal pulp chamber and endodontic access cavity continuous. It has a total occlusal convergence of 7°. The pulpal floor is left intact, care should be taken not to touch the pulpal floor while preparation. The width and thickness of the enamel strip should be maintained by preserving as much tissue as possible from the pulp chamber walls. The depth of the cavity should be at least 3 mm.

Polishing The Cervical Band

A cylindrical- conical diamond bur with a larger diameter, finer particle size and similar taper to the one used in axial preparation is used in this step. It is done around the entire surface of the cervical band. This removes the micro-irregularities and produce a flat, polished surface as shown in figure 2

Cleaning the Pulp Chamber

Ultrasound is recommended to clean the pulp chamber and its floor thoroughly. Abrasion is *not* indicated. Entrances and undercuts of mesial and distal were protected using an adhesive system and flowable resin.

The butt joint, or cervical sidewalk, is the base of the restoration , and it provides a stable surface that can withstand the compressive stresses that are most common on molars. The prepared surface is made parallel to the occlusal plane so that the stress resistance is ensured along the major axis of the tooth. The pulp chamber cavity ensures retention and stability. The saddle form of the pulpal floor enhances stability. The cervical butt joint and the walls of the pulp chamber act as pathways through which the compressive stresses are distributed, thereby increasing the fracture resistance of the tooth.. The prepared tooth should have at least a 3mm pulp chamber depth and 2 mm cervical band.[10]

Cementation

Adhesive resins are used for the cementation of endocrowns. Self- adhesive resins like Rely X Unicem (3M) became more popular because of the fewer steps involved in bonding and ease of use. Composites like Multilink (Ivoclar) are also for bonding the endocrown . However, there is no clear data at present regarding the advantage, if any of composites as the cementing material compared to adhesive resins.[11]

LABORATORY PHASE

There are various methods for the preparation of endocrowns depending upon the material and technique used. Generally two methods are used:

1) Conventional two visit technique.

2) Single visit CAD - CAM technique.

Empress II system developed by ivoclar is often used in conventional technique. It involves taking impression with addition silicone , preparing cast and eventually a mould into which the IPS Empress is pressed. This is a two visit technique and requires a provisional restoration while the endocrown is being prepared. With the advent of reinforced ceramics and single visit CAD-CAM technique, the conventional method has become less popular.[12]

The single visit CAD - CAM technique is now the method of choice for endocrowns. First, a digital impression is taken with an intra oral camera and fed to the CAD -CAM machine. The CAD - CAM then machines the endocrown from a ceramic block. The digital impression can also be sent to the lab, but this requires two visit. Even conventional siloxane impression can be used for the CAD - CAM technique. Here the cast made from the impression is scanned , rather than directly from the mouth.[13]

PROPERTIES OF ENDOCROWN

Strength

Various studies have been conducted to test the fracture resistance and strength of endocrowns . These studies show the superior strength of endocrowns compared to the conventional crowns. Higher fracture strength of endocrowns was determined from a study

by Biacchi and Basting comparing the fracture strength of endocrowns and post retained conventional crowns[14]. They concluded that endocrowns were superior to conventional crowns in terms of compressive strength, as they had higher resistance to compressive forces. These forces were distributed over the cervical butt joint (compression) and axial walls (shear force), thus moderating the load on the pulpal floor. It was theorised that the superior strength of endocrowns was due to the reduced number of bonded surfaces and high stress zones.

Longevity and Effectiveness

In an evaluation of adhesively placed endocrowns after 2 years, Bindl and Mörmann advocated that "the overall clinical quality of the endocrowns was very good." In another 2-year evaluation, Bernhart et al. concluded that endocrowns "represent a very promising treatment alternative for endodontically treated molars."[15]

Retention

The pulp chamber provided additional anchorage which improved the retention of the endocrowns. Macromechanical retention was provided by the pulpal walls and microretention by the use of adhesive cementation. This added retention provided for the increased longevity and effectiveness of endocrowns[16].

CONCLUSION

Endocrowns are a restoration of choice in endodontically treated tooth with reduced vertical dimension and insufficient tooth substance. They conform to all functional and aesthetic requirements. The preparation for endocrowns is rational and simple and can be performed quickly. Since root canals are not involved, the procedure is less traumatic than the alternatives. The endocrown perfectly embodies the concept of biointegration and can be the preferred choice for restoring posterior endodontically treated and badly damaged molars. Even with all these advantages , the lack of popularity and limited use of endocrown is puzzling, and it might be due to the age old resistance to change. With the advent of CAD -CAM and the demand for single visit procedure and less chair side time, endocrowns has become a viable alternative to conventional crowns.

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How to cite this article: Amal S, Nair MG, Sreeja J, Babu A, Ajas A. Endocrown - An Overlooked Alternative. Arch of Dent and Med Res 2016;2(1):34-38.