Review Article

Overview on Restoration with Endocrown

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ABSTRACT

Endocrown restorations are single prostheses that are made of reinforced ceramics and may be acid etched; they are recommended for endodontically treated molar teeth that have suffered a considerable loss of coronal structure. In order to provide a strong foundation for the restoration and strengthen the restored tooth structurally, the quality and integrity of the residual tooth structure should be carefully preserved. For this reason, Endocrown is used as a minimally invasive technique. Endocrowns are particularly recommended for molars with short, destroyed, dilacerated, or unstable roots. They may also be utilized when it is unable to achieve an acceptable thickness of the ceramic coating on the metal or ceramic substructures due to significant coronal dental tissue loss and constrained interocclusal space. Endocrowns provide a more beneficial choice than conventional and post- and core-retained restorations because of the little and simple preparation required. This favorable outcome can be attributable to a number of variables, including the preparation method, occlusal thickness, and elastic moduli. When it comes to material selection it is impossible to create what is called the material of choice since new material is constantly being introduced.

Keyword: endocrown, tooth restoration, prostheses, restorative materials.

Introduction

Single prosthesis known as "endocrown-type restorations" are made of reinforced ceramics and may be acid etched; they are recommended for endodontically treated molar teeth that have suffered a considerable loss of coronal structure. Endocrowns are made of a monoblock with the coronal section incorporated into the apical projection, which also may contain the root canal entrances and fills the pulp chamber space [1]. Instead of dehydration or structural changes in the dentin, the loss of structural integrity brought on by caries, stress, and prolonged cavity

Preparation accounts for the majority of the decline in stiffness and fracture resistance of ETT. The lifespan of endodontic therapy is influenced by the type of restorative materials utilized and a proper restoration that preserves tooth structure. In order to provide a strong foundation for the restoration and strengthen the restored tooth structurally, the quality and integrity of the residual tooth structure should be carefully preserved. According to biomechanical principles, the number, inherent strength, and anatomical shape of hard tissues all affect the structural strength of a tooth [2-7]. Studies revealed that using intraradicular posts

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By themselves did not improve the preservation of the restoration and that a filling core had to be created to provide the restoration more stability. This was especially true for posterior teeth, where the predominant masticatory pressures are directed in a direction parallel to the tooth's long axis. Even in situations of more involved restorations, such entire crowns, and the filling core in this instance encourages preservation of the restoration. Additionally, the structure of the roots, such as dilations or smaller root sections, may restrict the insertion of posts in root canals (short roots) [1, 8-10]. Variations in tissue quality after endodontic therapy turned shown to have a very small impact on the way teeth behave biomechanically. A conservative endodontic access cavity has been proven to have a negligible mechanical impact on a tooth's ability to resist fracture. Another problem is the reduction of neurosensory input brought on by pulpal tissue loss, which may lessen the ETT's protection during mastication. There are studies that demonstrate that the disappearance of marginal ridges is the primary cause of the decline in durability. According to some researchers, tooth brittleness is not increased by changes in dentine but rather by endodontic access cavities and root canal preparation that cause tooth tissue to be lost. Endodontic operations, occlusal cavity preparations, and MOD cavity preparations all weaken cusps by 5%, 20%, and 63%, respectively, according to research comparing the impact of these procedures on healthy human teeth [2, 11-14]. Using varied extensions of endocrowns inside the pulp chamber, Dartora et al. investigated the biomechanical behaviour of endodontically treated teeth in 2018. He concluded that the longer extensions of endocrowns offered higher mechanical performance. Compared to a 1 mm extension, which had low fracture resistance and a significant likelihood of the component rotating while in use, a 5 mm extension had lower intensity and a better stress distribution pattern [15-17]. The chosen restoration in postendodontic therapy must consider a number of factors. One of the primary alternatives among the different tooth restoration techniques performed by endodontics is the post, core, and crown. The major options are post, core, and crown because of their exceptional aesthetic and practical qualities. When used properly and in accordance with instructions, composite post and cores produce long-term contentment. Root anatomical differences, dilatation or short roots, tiny diameter root morphologies, and expensive expenses are some restrictions on the usage of postcore. Adhesive endodontic crowns, commonly known as endocrowns, are a replacement for post and crown [18]. Endocrowns are particularly recommended for molars with short, destroyed, dilacerated, or unstable roots. They may also be utilized when it is unable to achieve an acceptable thickness of the ceramic coating on the metal or ceramic substructures due to significant coronal dental tissue loss and constrained interocclusal space. Because they ensure the mechanical strength required to withstand the occlusal stresses placed on the tooth as well as the bond strength of the restoration to the cavity walls, reinforced, acid etchable dental ceramics have been the preferred materials for the construction of endocrowns [1].

Endodontically Treated Teeth

Planning is essential for the project of restorative therapy for molars with significant coronal damage. Because of this, the dentist must choose the best course of action to guarantee an effective procedure that will result in the clinical longevity of molars. All molars can benefit from the endocrown, although those with clinically low crowns, calcified root canals, or narrow canals will benefit the most. But if adhesion cannot be guaranteed, the pulpal chamber is less than 3 mm deep, or the cervical edge is less than 2 mm broad for most of its circumference, it is not advised. This method has been proven to be helpful since it is simple to use, makes it easier to take impressions, and safeguards the periodontium. The goal of the preparation is to create a robust, broad surface that can withstand the repeated compressive pressures found in molars. To offer stress resistance along the primary axis of the tooth, the prepared surface is parallel to the occlusal plane. Stress levels were lower in teeth with endocrowns than in teeth with artificial crowns [15]. Even though there have been several research on ETT, some specific factors must be considered while planning the therapy and selecting the material for the restoration. Important considerations in treatment planning include the functional requirements and surviving coronal tooth structure [2]. The pulpal chamber cavity offers stability and retention. Its triangular form in maxillary molars and trapezoidal shape in mandibular molars boost the restoration's stability and eliminate the need for extra preparation. The pulpal floor's saddle shape promotes stability. It is unnecessary to try further usage of post-involving root canals given this architecture and the bonding material's adhesive properties. Since the root canals don't need to be any certain form, drilling doesn't make them more fragile, and using post won't put stress on them either. The walls of the pulp chamber and the cervical butt joint get a greater distribution of the lowered compressive forces [15, 19-21]. The pulp chamber and endodontic access cavity of ETTs with low coronal tooth structure loss, in particular those with endodontic access cavities and marginally expanded pulp chambers, may be filled with adhesive restorative materials, such as composite resin, or covered with amalgam. Patients with parafunctional habits, group function guidance, and step cuspal inclination, which may require total occlusal covering, are contraindicated for this conservative treatment method [22]. Using varied extensions of endocrowns inside the pulp chamber, Dartora et al. investigated the biomechanical behaviour of endodontically treated teeth in 2018. They concluded that the longer extensions of endocrowns offered higher mechanical performance. Compared to a 1 mm extension, which had low fracture resistance and a significant likelihood of the component rotating while in use, a 5 mm extension had lower intensity and a better stress distribution pattern [15, 23, 24]. If the coronal tooth structure in an ETT is missing more than half of the tooth or not at all, onlay restoration or an endodontic crown may be the best option. It is also an option to post- and core-operative procedures. A composite resin liner-base was recommended in several studies as a way to cover undercuts and produce an even cavity preparation. When the majority of the coronal tooth structure is lost in severely deteriorated posterior teeth, extraction and dental implants are an alternative to traditional therapy. To achieve a ferrule effect, extensive crown lengthening should no longer be thought of as a practical alternative, and pluri-radicular teeth seldom undergo orthodontic extrusion [22].

Preparation Technique

Endocrowns provide a more beneficial choice than conventional and post- and core-retained restorations because of the little and simple preparation required. This favourable outcome can be attributable to a number of variables, including the preparation method, occlusal thickness, and elastic moduli. A standard crown preparation can reveal the existence of a "ferrule" because of its retentiveness, but it also entails the loss of healthy enamel and dentin, which is necessary for a strong connection. The production of endocrowns without a ferrule eliminates this issue. Any prosthesis' fracture resistance, which is inversely related to occlusal thickness, is crucial to its long-term endurance [25]. The endocrown preparation builds the crown and core as a single unit monoblock construction and does not rely on the root canals for stability. It comprises of a circumferential 1.0-1.2 mm depth butt border and a central retention cavity inside the pulp chamber. For the first maxillary premolars, the recommended dimensions are a cylindrical pivot with a diameter of 3 mm and a depth of 5 mm, and for the molars, a cylindrical pivot with a diameter of 5 mm and a depth of 5 mm. However, the exact dimensions for the preparation of the central retention cavity were not clearly identified. Endocrowns typically have a ceramic occlusal part that is 3–7 mm thick. An in vitro study revealed that as occlusal thickness is increased, ceramic crown fracture resistance also rises [2]. Instead of butt joint, a number of finish line preparation strategies were suggested. In 2005, Bindl and his colleagues extended their investigation into adhesively bonded feldspathic ceramic crowns to three distinct types of premolar and molar preparations: the traditional stump preparation (with a shoulder width of 1.0 to 1.2mm), the reduced or irregular stump height (less than 3.0mm), and the endo preparation (complete loss of the clinical crown) for teeth that had undergone endodontic treatment. The survival of traditional and reduced crowns was assessed satisfactory for premolars and molars at baseline and after 55 months plus or minus 15 months using modified USPHS criteria, whereas the endo preparation was acceptable for molar crowns but insufficient for premolar crowns [22]. In contrast to traditional restorations, which typically have a thickness between 1.5 and 2 mm, endocrowns have a thickness between 3-6 mm, allowing for higher occlusal stress loading. Materials with various elastic moduli are used to construct post-retained manufactured prostheses, such as ceramic or composite for the core and glass or metal- or fibre-reinforced fibres for the post. This would result in many contacts between the restorative material, luting cement, and dentin, which would lead to stiffness mismatch. Endocrowns start with their monoblock nature, providing more stress loading [25]. The importance of ferrule height and its influence on load resistance are both significant. In 2019, Einhorn . et al. published new in vitro research that examined the failure strength of Endocrown with no ferrule, 1.0mm, and 2.0mm ferrule heights on removed molar teeth. This study indicated that ferrule-containing Endocrown has higher failure load resistance than Endocrown without ferrules. But if the enamel borders are close to the cementoenamel junction, creating a ferrule is not advised (CEJ). A concave bevel on the peripheral enamel of a tooth without a ferrule might increase the enamel bonding surface area and optimize the biomechanical performance of the Endocrown. Additionally, isolation surrounding the preparation of the Endocrown is the most crucial factor and may be accomplished utilizing a rubber dam for the best bonding process [22, 26-28].

Material Selection

The use of posts-cores has become less necessary with the development of adhesive dentistry. Additionally, the advent of ceramics with high mechanical strength and acid etch resistance (like those reinforced with leucite or lithium disilicate), combined with adhesive systems and resinous cements, allowed for the restoration of posterior teeth, particularly molars, without the use of cores and intraradicular posts. Wide cavities in posterior teeth can also be restored using indirect composite and porcelain laboratory techniques. Inlays made of indirect porcelain or composite resin, which are created in a lab, restore mechanical and biological function while offering the best possible aesthetics with the least amount of tooth preparation. Excellent marginal fit, optimum proximal contacts, high wear resistance, little polymerization shrinkage, and ideal aesthetics are all guaranteed by porcelain and indirect resins [2]. A clinical trial that utilized a feldspathic CAD/CAM glass-ceramic had the best clinical results. Every clinical trait was graded as Alfa after approximately a year. This finding supports the ideas that feldspathic, leucite reinforced, or lithium disilicate may be the best materials for the construction of an endocrown because they improve the bond between resin cement and tooth tissues, as suggested in several clinical reports that recommend glass ceramic materials. Since new generation materials are always being introduced, it is impossible to create a "material of choice." [29, 30, 31]. Due to its aesthetic, adhesive, and mechanical interlocking with resin cement, lithium disilicate ceramic-based material offers an advantage over the other materials. Research by Altier et al. comparing the fracture resistance of three distinct endocrowns composed of indirect resin composite and lithium disilicate ceramic concluded that the former had a greater fracture strength than the latter. Leucite, on the other hand, has a superior stress distribution and is a trustworthy substitute for lithium disilicate in a recent work by Tribst et al. for the creation of endocrown [25, 32, 33]. In 2013, Ramrez-Sebastià et al. came to the conclusion that leucite reinforced CAD/CAM glass ceramics did not outperform Cerec manufactured endocrowns built of millable resin composite blocks (MZ100 blocks, Paradigm, 3M ESPE) (IPS Empress CAD, Ivoclar Vivadent). In comparison to ceramics, which are more prone to fracture due to their brittle nature, the new resin nanoceramic restorative materials offer advantages related to their superior properties that resemble those of dentin, such as modulus of elasticity, less crack propagation, and higher fracture resistance. Resin composite materials, however, seem to exhibit more microleakage over time and to be less robust than lithium disilicate glass ceramics when subjected to non-axial loads [29, 34].

Conclusion

Endocrown restorations are recommended for endodontically treated molar teeth that have suffered a considerable loss of coronal structure. Endocrown is used as a minimally invasive technique. Endocrowns are particularly recommended for molars with short, destroyed, dilacerated, or unstable roots. Endocrowns provide a more beneficial choice than conventional and post- and core-retained restorations because of the little and simple preparation required. When it comes to material selection it is impossible to create what is called the material of choice since new material is constantly being introduced.

Conflict of Interest

None

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References

1. Biacchi GR, Mello B, Basting RT. The endocrown: an alternative approach for restoring extensively damaged molars. Journal of Esthetic and Restorative Dentistry. 2013 Dec;25(6):383-390.
2. Sevimli G, Cengiz S, Selçuk OR. Endocrowns. Journal of Istanbul University Faculty of Dentistry. 2015 Apr 29;49(2):57-63.
3. Tzimas K, Tsiafitsa M, Gerasimou P, Tsitrou E. Endocrown restorations for extensively damaged posterior teeth: clinical performance of three cases. Restor Dent Endod. 2018;43(4):e38.
4. Alshabib A, Abid Althaqafi K, AlMoharib HS, Mirah M, AlFawaz YF, Algamaiah H. Dental Fiber-Post Systems: An In-Depth Review of Their Evolution, Current Practice and Future Directions. Bioengineering (Basel). 2023;10(5):551.
5. Vârlan C, Dimitriu B, Vârlan V, Bodnar D, Suciu I. Current opinions concerning the restoration of endodontically treated teeth: basic principles. J Med Life. 2009;2(2):165-172.
6. Zhi C, Binwen C. Hua Xi Kou Qiang Yi Xue Za Zhi. 2015;33(2):115-120. doi:10.7518/hxkq.2015.02.002
7. Huang C, Zhu J, Wang Q. The infection control of post-and-core crown restoration. Hua Xi Kou Qiang Yi Xue Za Zhi. 2023;41(3):247-253. doi:10.7518/hxkq.2023.2023030
8. Zarow M, Devoto W, Saracinelli M. Reconstruction of endodontically treated posterior teeth--with or without post: Guidelines for the dental practitioner. European Journal of Esthetic Dentistry. 2009 Dec 1;4(4).
9. Ma PS, Nicholls JI, Junge T, Phillips KM. Load fatigue of teeth with different ferrule lengths, restored with fiber posts, composite resin cores, and all-ceramic crowns. The Journal of prosthetic dentistry. 2009 Oct 1;102(4):229-234.
10. Ozcan N, Sahin E. In vitro evaluation of the fracture strength of all-ceramic core materials on zirconium posts. Eur J Dent. 2013;7(4):455-460.
11. Lander E, Dietschi D. Endocrowns: a clinical report. Quintessence international. 2008 Feb 1;39(2):1-5.
12. Seow LL, Toh CG, Wilson NH. Strain measurements and fracture resistance of endodontically treated premolars restored with all-ceramic restorations. J Dent. 2015;43(1):126-132.
13. Iaculli F, Rengo C, Lodato V, Patini R, Spagnuolo G, Rengo S. Fracture resistance of endodontically-treated maxillary premolars restored with different

type of posts and direct composite reconstructions: A systematic review and meta-analysis of in vitro studies. Dent Mater. 2021;37(9):e455-e484.
14. Soares PV, Santos-Filho PC, Martins LR, Soares CJ. Influence of restorative technique on the biomechanical behavior of endodontically treated maxillary premolars. Part I: fracture resistance and fracture mode. The Journal of prosthetic dentistry. 2008 Jan 1;99(1):30-37.
15. Dogui H, Abdelmalek F, Amor A, Douki N. Endocrown: An alternative approach for restoring endodontically treated molars with large coronal destruction. Case reports in dentistry. 2018 Aug 30;20(1):1-10.
16. El-Damanhoury HM, Haj-Ali RN, Platt JA. Fracture resistance and microleakage of endocrowns utilizing three CAD-CAM blocks. Oper Dent. 2015;40(2):201-210.
17. Hassouneh L, Jum'ah AA, Ferrari M, Wood DJ. Post-fatigue fracture resistance of premolar teeth restored with endocrowns: An in vitro investigation. J Dent. 2020;100:103426.
18. Ardjanggi S, Mardiyah AA, Wahjuningrum DA. Endocrown restoration on postendodontics treatment on lower first molar. Journal of International Society of Preventive & Community Dentistry. 2019 May;9(3):303.
19. Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: a review. International Journal of Prosthodontics. 2001 Jul 1;14(4).
20. Rocca GT, Daher R, Saratti CM, Sedlacek R, Suchy T, Feilzer AJ, et al. Restoration of severely damaged endodontically treated premolars: The influence of the endo-core length on marginal integrity and fatigue resistance of lithium disilicate CAD-CAM ceramic endocrowns. Journal of dentistry. 2018 Jan 1;68:41-50.
21. da Cunha LF, Mondelli J, Auersvald CM, Gonzaga CC, Mondelli RF, Correr GM, et al. Endocrown with leucite-reinforced ceramic: case of restoration of endodontically treated teeth. Case reports in dentistry. 2015 Oct 18;20(1):1-10.
22. Zainon NA, Kassim ZH, Lim TW. Endocrown: an alternative approach for restoring endodontically treated teeth. Malaysian dental journal. 2019;2:581952.
23. Dartora NR, de Conto Ferreira MB, Moris IC, Brazão EH, Spazin AO, Sousa-Neto MD, et al. Effect of intracoronal depth of teeth restored with endocrowns on fracture resistance: in vitro and 3-dimensional finite element analysis. Journal of endodontics. 2018 Jul 1;44(7):1179-1185.
24. Lin CL, Chang YH, Hsieh SK, Chang WJ. Estimation of the failure risk of a maxillary premolar with different crack depths with endodontic treatment by computer-aided design/computer-aided manufacturing ceramic restorations. Journal of endodontics. 2013 Mar 1;39(3):375-379.
25. Gupta R, Thakur S, Pandey NK, Roopa B, Fares KT. Endocrown–A paradigm shift in rehabilitation: A report of two cases. Contemporary Clinical Dentistry. 2021 Apr;12(2):195.
26. Einhorn M, DuVall N, Wajdowicz M, Brewster J, Roberts H. Preparation ferrule design effect on endocrown failure resistance. Journal of Prosthodontics. 2019 Jan;28(1):e237-42.
27. Veneziani M. Posterior indirect adhesive restorations: updated indications and the Morphology Driven Preparation Technique. Int J Esthet Dent. 2017 Jun 1;12(2):204-230.
28. Machry RV, Dapieve KS, Pereira GK, Valandro LF. Do We Still Need Intraradicular Retainers: Current Perspectives on the Treatment of Endodontically Treated Teeth. Current Oral Health Reports. 2023 Mar;10(1):8-13.
29. Park HJ, Seo MS, Moon YM. Root canal volume change and transportation by Vortex Blue, ProTaper Next, and ProTaper Universal in curved root canals. Restorative Dentistry & Endodontics. 2017 Dec 24;43(1):1-10.
30. Gergi R, Arbab-Chirani R, Osta N, Naaman A. Micro–computed tomographic evaluation of canal transportation instrumented by different kinematics rotary nickel-titanium instruments. Journal of endodontics. 2014 Aug 1;40(8):1223-1227.
31. Mahesh B, Vandana G, Sanjay P, Jaykumar G, Deepika C, Aatif N. Endocrown: conservative treatment modality for restoration of endodontically treated teeth–a case report. Endodontology. 2015 Jul 1;27(2):188-191.
32. Altier M, Erol F, Yıldırım G, Dalkilic EE. Fracture resistance and failure modes of lithium disilicate or composite endocrowns. Nigerian journal of clinical practice. 2018 Jul 16;21(7):821-826.
33. Tribst JP, Dal Piva AM, Madruga CF, Valera MC, Borges AL, Bresciani E, et al. Endocrown restorations: Influence of dental remnant and restorative material on stress distribution. Dental Materials. 2018 Oct 1;34(10):1466-1473.
34. Ramirez-Sebastia A, Bortolotto T, Roig M, Krejci I. Composite vs ceramic computer-aided design/computer-assisted manufacturing crowns in endodontically treated teeth: analysis of marginal adaptation. Operative dentistry. 2013 Nov 1;38(6):663-673.