EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 7
Issue: 9
267-273
Year: 2020

ENDOCROWN: AN ALTERNATIVE APPROACH FOR RESTORING OF ENDODONTICALLY TREATED TEETH – A CASE REPORT

Dr. Alakesh Singha*

3RD Year MDS Post Graduate Student, Department of Conservative Dentistry & Endodontics, Jaipur Dental College , Jaipur , Rajasthan , India.

***Corresponding Author: Dr. Alakesh Singha**
3RD Year MDS Post Graduate Student, Department of Conservative Dentistry & Endodontics, Jaipur Dental College , Jaipur , Rajasthan , India.

Article Received on 30/06/2020 **Article Revised on 20/07/2020** **Article Accepted on 10/08/2020**

ABSTRACT
Coronal rehabilitation of severely damaged endodontically treated teeth is the most challenging task as there is high risk of failure than vital teeth. Advances in adhesive dentistry have made great contributions to cosmetic & restorative dentistry over the past few decades. Endocrown is indicated for restoration of severely damaged molar, which requires specific restoration technique. This therapy promotes the stability and retention of the indirect restoration, without the need of a cast metal core or reconstruction with intracanal post, thereby reducing the treatment time. Endocrowns are formed from a monoblock containing the coronal portion integrated into the apical projection that fills the pulp chamber space and possibly the root canal ingresses. The major advantage of an endocrown is the use of the tooth structure remnant, particularly the pulp chamber, to promote retention and stability. This case report represents the restoration of severely damage mandibular molar teeth (46) by Endocrown which represented a conservative and aesthetic restorative alternative to full coverage crown. It was found that endocrown restorations could be made following the development of reinforced ceramics that can be acid etched, that have aggregate strength and esthetics, that bond to the dental structure, and that have developed from broader knowledge of the biomechanical behavior of depulped teeth restored with and without intraradicular posts. Clinical studies have shown that the endocrown has functional longevity, and has become a promising alternative in the esthetic and functional recovery of endodontically treated molar teeth.

KEYWORDS: Endocrown**,** Coronal rehabilitation, monoblock, mandibular molar, reinforced ceramics, intraradicular posts.

INTRODUCTION
In reconstructive dentistry, rehabilitation of severely damaged endodontically treated teeth (ETT) is one of the most difficult task.[1] Restoration of ETT with extensive coronal loss has followed a strict protocol, with the fabrication of total crowns supported on post-cores. The purpose of a post-core restoration is to stabilize the remaining coronal tooth structure & to replace missing coronal tissue.[2] Studies showed that the use of intraradicular posts restoration[3,4] and that it was necessary to fabricate a filling core that would offer greater stability to the restoration. Several studies support the utilization of post based on the clinical outcomes.[10] However, many studies have also quoted the risk for contingent root perforation and subsequent root fracture during the post-space preparation.[11] Moreover, the placement of posts in root canals could be limited by root anatomy, such as dilacerations or reduced root portions (short roots).[6] This was particularly true in the case of posterior teeth in which the direction of the main masticatory forces is parallel to the long axis of the tooth. In this case, the filling core favors retention of the restoration, even in cases of more extensive restorations such as full coverage crowns.[5] Therefore, with the advent of adhesive dentistry, it has become acceptable to restore teeth with extensive coronal destruction by performing onlays and overlays, without using intraradicular posts, and by using the entire extension of the pulp chamber as a retentive resource.[4,7-9] With the progress in technology, the need for the macro-retentive design like post is no longer a requisite for restoration of badly damaged tooth. Endocrowns have emerged as good restorative alternative in teeth with short, obliterated, dilacerated, or fragile root.[12] It is a total porcelain crown well adapted to root canal treated tooth, thus obtaining macromechanical retention (provided by the pulpal walls), and microretention (by utilizing adhesive cementation). It may also be utilized in situations of excessive loss of coronal dental tissue and limited interocclusal space, in which it is not possible to procure adequate thickness of the ceramic covering on the metal or ceramic substructures.[13] Reinforced, acid-etchable dental ceramics have been the materials

for the fabrication of endocrowns because of superior mechanical and bond strength. The first study published on endocrown restoration (or adhesive endodontic restoration) was conducted by Pissis[9] in 1995. In it, he described the ceramic monoblock technique for teeth with extensive loss of coronal structure. However, it was Bindl and Mörmann.[14] who named this restorative procedure "endocrown" in 1999. The endocrown is a total porcelain crown fixed to a depulped posterior tooth, which is anchored to the internal portion of the pulp chamber and to the cavity margins, thus obtaining macromechanical retention (provided by the pulpal walls), and microretention (by using adhesive cementation).[13,17,18] Endocrowns are especially indicated in cases of molars with short, obliterated, dilacerated, or fragile roots. They may also be used in situations of excessive loss of coronal dental tissue and limited interocclusal space, in which it is not possible to attain adequate thickness of the ceramic covering on the metal or ceramic substructures.[13]

Reinforced, acid etchable dental ceramics have been the materials of choice for the fabrication of endocrowns, because they guarantee the mechanical strength needed to withstand the occlusal forces exerted on the tooth, as well as the bond strength of the restoration to the cavity walls.[9,15,17,18] However, the success and longevity of the endocrown are directly related to the correct preparation of the tooth, the selection of the most suitable ceramic options, and the choice of bonding material, since adequate adhesive cementation is absolutely necessary for the success of this restorative treatment.[14,16,20]

The purpose of the present paper is to present a clinical case, in which an esthetic and conservative posterior endocrown was used to restore a mandibular right first molar that presented endodontic treatment and extensive coronal destruction.

Clinical case report

A 43-year old male patient reported at the Department of Conservative Dentistry and Endodontics, Jaipur Dental College, Rajasthan with chief complain of pain & decayed tooth in the lower right region of the mouth. He gave a history of pain while chewing or bitting food for last 4 months, but his symptoms resolved only temporarily after taking medications. There were no drug allergies or relevant medical history. On clinical examination tooth number 46 was grossly decayed in disto occlusally(DO)(Figure 1). On radiographic examination (Figure 2) radiolucency involving pulp of tooth 46 was seen. Based on the clinical and radiographic examination tooth 46 was diagnosed with acute irreversible pulpitis.

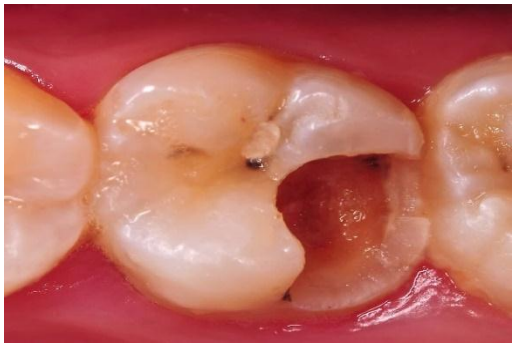

Fig 1: Preoperative occlusal view showing the decayed tooth & amount of residual tooth structure.

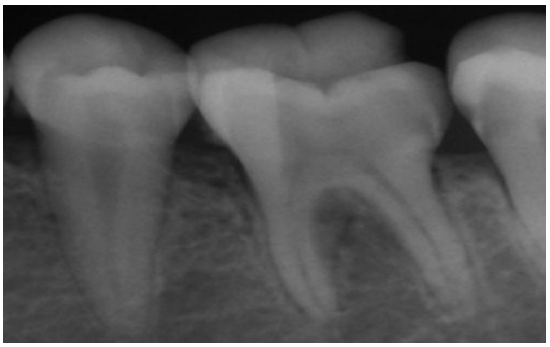

Fig 2: Radiographic aspect of the initial case showing involvement of pulp in relation to 46.

Root canal treatment was performed. Resin modified glass ionomer cement (Fuji II LC GC Corporation, Tokyo, Japan) was used for post endodontic buildup (Figure 3) & to achieve a flat pulpal floor and to block the undercuts.

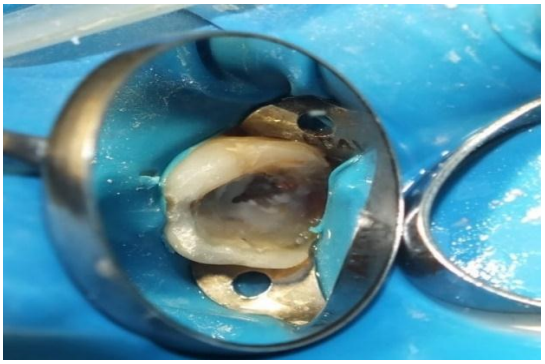

Fig 3: Glass ionomer cement used for Post endodontic buildup after obturation .

Based on the remaining tooth structure, that is, approximately 3-4 mm, occlusal evaluation, and After explained the entire procedure to patient & patients esthetic demands, IPS E.max Press endocrown was decided as the treatment option.

The preparation consisted of a circular equigingival buttjoint margin and central retention cavity into the entire pulp chamber constructing both the crown and the core as a single unit.

Green diamond wheel bur was used to reduce occlusal surface at least 2mm in the axial direction by orienting the bur along the major axis of tooth & held parallel to occlusal surface. This ensured a flat surface and it determines the position of cervical margin. Cervical margin was kept supragingival.(Figure 4) Axial preparation included removal of undercuts in the access cavity which was carried by conical green diamond bur. The bur was oriented along the long axis of tooth & total occlusal convergence of 7^0 was used to make coronal pulp chamber & access cavity continuous. The depth of the access cavity should be kept, at least 3mm. (Care should be taken not too much tissue from the pulp cavity). Cervical band was polished with polishing bur which was kept around the entire surface of cervical band to produce flat & polished.

Fig 4: 2 mm occlusion reduction for preparing supragingival cervical margin for endocrown.

Fig 5: Tooth preparation for endocrown with 3 mm depth of a central retation cavity.

After evaluating the entire cavity and the interocclusal space, Then, retraction cords 00 (Ultrapak, Ultradent) were placed and an impression made with a polyvinyl siloxane material (Aquasil LV, DentsplyDeTrey, Germany) of light and heavy consistency using a putty wash technique. (Figure 6) After visualization and analysis of the quality of the impression, selected the ceramic shade (A2) and sent the impression to the laboratory. Provisional restoration was done using Give space between patient was recalled for cementation of the final restoration.

Fig 6: Final impression with retraction cord of prepared tooth for endocrown.

Laboratory Procedure: Impression was poured with Die stones and prepared for the fabrication of models. IPS E.max Press HO Lithium-disilicate glass ceramic ingots (Ivoclar/Vivadent, Schaan/Liechtenstein) were used for the press technology for fabrication of Endocrown (Figure 7) & was positioned on the master cast (Figure 8). The restoration was fabricated according to the lost wax technique of investing and wax pattern burnout followed by pressing of the ceramic ingot in the pressable furnace at a press temperature of 915–920 ^{0}C. It was then finished and polished with polishing paste.

Fig 7: IPS E.Max endocrown

Fig 8: Endocrown on the master cast

Next appointment after removing the temporary restoration, clean the prepared tooth, then the finished endocrown was checked for shade, fit**,** and occlusion in the patient's mouth & then cementation was done under a rubber dam for proper isolation, isolation, and then 37% phosphoric acid was applied onto the tooth surface for 15 sec on dentin and 30 sec on enamel, then abundantly washed and dried, applied with adhesive, and polymerized for 20 sec with light curing. A thin layer of a dual polymerizing resin was applied to the prosthetic endocrown and then was inserted into the tooth and polymerized at intervals of 5 seconds, making it easy to remove cement excesses. After that, it was polymerized for 60 seconds on all surfaces**.** The final restoration was found to be esthetically good and the margins were flushing well with the preparation (Figure9). High points and occlusion were checked, (Figure 10) the patient was satisfied, and postoperative radiograph was taken (Figure11). The patient was recalled at 12 months for evaluating both clinically & radiographically showed no secondary caries, fracture, discoloration or loosening/decementation of the crown. (Figure 12a,b)

Fig 9 : Occlusal view of final cementation.

Fig 10: Buccal view of tooth 36 depicting the occlusion & imperceptible margins.

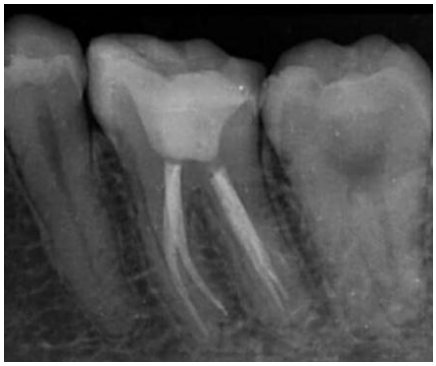

Fig11:Radiographic view, postcementation. Fig (12a, b): 1 year follow up clinical view & radiographic (The supragingival finish line is clearly visible) View.

DISCUSSION

A successful endodontic treatment has to be complemented with an appropriate postendodontic restoration to integrate the pulpless tooth with the masticatory apparatus.[21] Restorative treatment of molars with a large coronal destruction, a clinical challenge, requires careful planning. That is why the dentist has to decide for the best treatment option to ensure an efficient treatment providing clinical longevity of molars. The endocrown is convenient for all molars, particularly those with clinically low crowns, calcified root canals, or narrow canals.[20] But it is not recommended if adhesion cannot be assured, if the pulpal chamber is less than 3mm deep, or if the cervical margin is less than 2mm wide for most of its circumference.[24] Endocrowns appear to be a valuable option for endodontically treated posterior teeth with extensive loss of coronal structure. Studies have shown that although they are desirable for all the teeth in the arches, endocrowns should be restricted to the functional and esthetic recovery of posterior teeth, especially molars, since their performance in premolars against the action of masticatory forces has not been the same as that achieved in molars. It is believed that the smaller dental structure area of the pulp chamber and, consequently, of the adhesive surface of premolars, limits the bond strength of adhesive systems and resincements.[19] The configuration of premolar crowns in which the height of the piece is greater than the width may create a long lever arm, increasing the risk of adhesive rupture and displacement.[13,19] However, when restricted to the posterior molar teeth, endocrowns have shown satisfactory performance in relation to the action of occlusal forces, esthetic recovery, and bond strength.[9,15-18] Give space between that & preserve root tissue and keeps internal preparation of the pulp chamber to its anatomic shape. It also has advantages over conventional crowns like reduced number of interfaces in the restorative system. Stress concentration is less and the preparation design is conservative compared to the traditional crown.[23] In comparison to the post and core restorations, bonding surface offered by the pulpal chamber of the endocrown is often equal or even superior to that obtained from the bonding of aradicular post of 8 mm depth.[22] The use of ceramic has the advantages of biocompatibility and biomimicry and its wear coefficient is close to that of the natural tooth. Furthermore, the single interface of a 1-piece restoration makes cohesion look better.[25,26] The objective of the preparation is to get a wide and stable surface resisting the compressive stresses that are frequent in molars. The prepared surface is parallel to the occlusal plane to provide stress resistance along the major axis of the tooth.[30] The stress levels in teeth with endocrowns were lower than in teeth with prosthetic crowns.[25,28] The pulpal chamber cavity provides also retention and stability. The saddle form of the pulpal floor increases stability. This anatomy, along with the adhesive qualities of the bonding material, makes it unessential to attempt further use of post-involving root canals.[30] In 2018, Dartora et al. have evaluated the biomechanical behavior of endodontically treated teeth restored using different extensions of endocrowns inside the pulp chamber; it has concluded that the greater extension of endocrowns provided better mechanical performance. A 5mm extension presented lower intensity and a better stress distribution pattern than a 1mm extension which presented a low fracture resistance and a high possibility of rotating the piece when in function.[33,34] It has been also shown that butt joints design provided a stable surface that the compressive stresses because it is prepared parallel to the occlusal plane.[36] In 2012, Biacchi and Basting compared the fracture strength of 2 types of full ceramic crowns: indirect conventional crowns retained by glass fibre posts and endocrowns. They came to the conclusion that endocrowns were more resistant to compressive forces than the first ones. More recently, finite element analysis highlighted the role of endocrowns in stress distribution.[12] Altier et al. compared the fracture resistance of three different endocrowns made of lithium disilicate ceramic and two different indirect resin composites (Solidex compositeand Gradia composite) and determined that lithium disilicate ceramic endocrowns exhibited higher fracture strength than the indirect composite groups.[35] It has been shown that endocrowns made of lithium disilicate-based ceramics are considered among the best restorative materials because of their adhesive properties; also, they promoted micromechanical interlocking with resin cement.[12,38] The endocrown is luted with resin cement. The adhesive monoblock system achieved reduces the need for macroretentive geometry and provides more efficient outcome and better esthetics. Endocrowns have their own disadvantages like, debonding and risk of root fracture because of the difference in the modulus of elasticity between the harder ceramic and softer dentine. Hence, case selection is critical for ensuring clinical success with endocrowns. Endocrowns are indicated in cases where there are minimal functional and lateral stresses (Bernhart J et al 2010).[27] When there is evidence of increased functional and lateral stresses as evident with steep occlusal anatomy, wear facets or parafunction, full coverage crown with or without post is the treatment of choice.(Rocca GT et al 2008)[32] Based on current evidence, endocrowns fabricated using CAD/CAM and pressable ceramic technology can be considered as a reliable option for the restoration of moderately multilatedendodontically treated posterior teeth.

CONCLUSION

The restorative management of endodontically treated teeth has been widely discussed in the literature. Conservation of remaining salubrious dental structures is of prime importance for the stabilization of tooth‑restoration complex. The preparation for endocrowns is simple and can be achieved quickly. Root canals are not engaged in the process, and the procedure is less traumatic than others. The supragingival position of the cervical margin protects the marginal

periodontium, facilitates impression taking, and preserves the solid substance of the remaining tooth. Forces are dispersed over the cervical butt joint (compression) and axial walls (shear force), thus moderating the load on the pulpal floor. Endocrown increases surfaces available for adhesion, therefore impacting positively the treatment long‐term prosperity. In this case report, endocrowns were found to be a feasible option to full crowns or composite overlays for the restoration of nonvital molar teeth, especially those with minimal crown height and sufficient tissue available for stable and durable adhesive cementation.

ACKNOWLEGEMENT

The author thanks to Dr Deepak Sharma & Dr Manu Bansal for their clinical guidance and encouragement.

Conflict of interests: The authors do not have any financial interest in the companies whose materials are included in this article.

REFERENCES

1. Ree M, Schwartz R. The endo-restorative interface: current concepts. Dent Clin North Am, 2010; 54: 345-74.
2. ROSABIACCHI, DDS, MS*,†, BEATRIZ MELLO, DDS‡,ROBERTATARKANY BASTING, DDS, MS, SCD, PhD The Endocrown: An Alternative Approach for Restoring Extensively Damaged Molars Journal of Esthetic and Restorative Dentistry, 2013; 25(6): 383–390.
3. Asmussen E, Peutzfeldt A, Sahafi A. Finite element analysis of stresses in endodontically treated, dowel-restored teeth. J Prosthet Dent, 2005; 94: 321–9.
4. Zarow M, Devoto W, Saracinelli M. Reconstruction of endodontically treated posterior teeth—with or without post? Guidelines for the dental practitioner. Eur J Esthet Dent, 2009; 4: 312–27.
5. Ma OS, Nicholls JI, Junge T, et al. Load fatigue of teeth with different ferrule lengths, restored with fiber posts, composite resin cores, and all-ceramic crowns. J Prosthet Dent, 2009; 102: 229–34.
6. Raymond C, Payant L. In vitro fracture strength evaluation of ceramic endo-crowns with an In-Ceram core [text on the internet], 2004; 11.
7. Leirskar J, Nordbù H, Thoresen NR, et al. A four to six year follow-up of indirect resin composite inlays/onlays. Acta Odontol Scand, 2003; 61: 247–51.
8. 8.Tysowsky GW. The science behind lithium disilicate: a metal-free alternative. DentToday, 2009; 28: 112–13.
9. Pissis P. Fabrication of a metal-free ceramic restoration utilizing the monobloc technique. Pract Periodontics Aesthet Dent, 1995; 7: 83–94.
10. Ferrari M, Mannocci F, Vichi A, Cagidiaco MC, Mjör IA. Bonding to root canal: Structural characteristics of the substrate. Am J Dent, 2000; 13: 255‐60.
11. Goracci C, Tavares AU, Fabianelli A, Monticelli F, Raffaelli O, Cardoso PC, *et al.* The adhesion between fiber posts and root canal walls: Comparison between microtensile and push‐out bond strength measurements. Eur J Oral Sci, 2004; 112: 353‐61.
12. Biacchi GR, Basting RT. Comparison of fracture strength ofendocrowns and glass fiber post‐retained conventional crowns. Oper Dent, 2012; 37: 130‐6.
13. Valentina V, Aleksandar T, Dejan L, Vojkan L. Restoring endodontically treated teeth with all‐ceramic endo‐crowns – Case report. Serbian Dent J, 2008; 55: 54‐64.
14. Bindl A, Mörmann WH. Clinical evaluation of adhesively placed Cerec endocrowns after 2 years—preliminary results. J Adhes Dent, 1999; 1: 255–65.
15. Otto T. Computer-aided direct all-ceramic crowns: preliminary 1-year results of a prospective clinical study. Int J Periodontics Restorative Dent, 2004; 24: 446–55.
16. Göhring TN, Peters AO. Restoration of endodontically treated teeth without posts. Am J Dent, 2003; 16: 313–18.
17. Lander E, Dietschi D. Endocrown: a clinical report. Quintessence Int, 2008; 39: 99–106.
18. Biacchi GR, Basting RT. Comparison of fracture strength of endocrowns and glass fiber post-retained conventional crowns. Oper Dent, 2012; 37: 130–3.
19. Bindl A, Richter B, Mörmann WH. Survival ofceramic-computer-aided/manufacturing crowns bonded to preparations with reduced macroretention geometry. Int J Prosthodont, 2005; 18: 219–24.
20. R. Menezes-Silva, C. A. V. Espinoza, M. T. Atta, M. F. L. Navarro, S. K. Ishikiriama, and R. F. L. Mondelli, "Endocrown: a conservative approach," Brazilian Dental Science, 2016; 19: 2.
21. B. SureshChandra and V. Gopi Krishna, Grossman's Endodontic Practice,Wolters Kluwer, New Delhi, India, 13th edition.
22. B.Chang C Y, Linand J.S ,Chang Y H . Fracture resistence and failure modes of CEREC endocrowns and conventional post and coresupported CEREC crowns. *J Dent Sci*, 2009; 4: 110-117.
23. D.Vinothkumar TS, Kandaswamy D, Chanana P. CAD/CAM fabrication single-unit all- ceramic post-core-crown restoration. *J Conserv Dent*, 2011; 14: 86-9.
24. M. Fages and B. Bennaser, "The endocrown: a different type of all-ceramic reconstruction of molars," Journal of the Canadian Dental Association, 2013; 29; 79-140.
25. C. L. Lin, Y. H. Chang, C. Y. Chang, C. A. Pai, and S. F. Huang, "Finite element and Weibull analyses to estimate failure risks in the ceramic endocrown and classical crown for endodontically treated maxillary premolar," European Journal of Oral Sciences, 2010; 118(1): 87–93.
26. F. Zarone, R. Sorrentino, D. Apicella et al., "Evaluation of the biomechanical behavior of

maxillary central incisors restored by means of endocrowns compared to a natural tooth: a 3D static linear finite elements analysis," Dental Materials, 2006; 22(11): 1035–1044.
27. A.Bernhart. J, Brauning. A, Altenburger M. J and Wrbas K. T. Cerec 3D endocrowns-two-year clinical examination of CAD/CAM crowns for restoring endodontically treated molars. Int J Compt Dent, 2010; 13:141-154.
28. B. Dejak and A. Młotkowski, "3D-finite element analysis of molars restored with endocrowns and posts during masticatorysimulation," Dental Materials, 2013; 29(12): 309–317.
29. G. T. Rocca, R. Daher, C. M. Saratti 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; 68: 41–50.
30. M. Fages and B. Bennasar, "The endocrown: a different type of all-ceramic reconstruction for molars," Journal Canadian Dental Association, 2013; 79: 140.
31. L. Fernandes da Cunha, J. Mondelli, C. M. Auersvald et al., "Endocrown with leucite-reinforced ceramic: case of restoration of endodontically treated teeth," Case Reports in Dentistry, 2015; 4: 750313.
32. C. Rocca G.T & Serge. B – Alternative treatment for restoration of non-vital teeth. Revue d' Odonto Stomatology, 2008; 37: 259 -272.
33. N. R. Dartora, M. B. de Conto Ferreira, I. C. M. Moris et al., "Effect of intracoronal depth of teeth restored with endocrowns on fracture resistance: in vitro and 3-dimensional finite element analysis," Journal of Endodontia, 2018; 44(7): 1179–1185.
34. Y. Silva-Sousa, E. A. Gomes, N. R. Dartora et al., "Mechanical behavior of endodontically treated teeth with different endocrowns extensions," Dental Materials, 2017; 33(1): 73– 74.
35. M. Altier, F. Erol, G. Yildirim, and E. E. Dalkilic, "Fracture resistance and failure modes of lithium disilicate or composite endocrowns," Nigerian Journal of Clinical Practice, 2018; 21(7): 821–826.
36. 36.D. Taha, S. Spintzyk, C. Schille et al., "Fracture resistance and failure modes of polymer infiltrated ceramic endocrown restorations with variations in margin design and occlusal thickness," Journal of Prosthodontic Research, 2018; 62(3): 293–297.
37. M. M. M. Gresnigt, M. Özcan, M. L. A. van den Houten, L. Schipper, and M. S. Cune, "Fracture strength, failure type and Weibull characteristics of lithium disilicate and multiphase resin composite endocrowns under axial and lateral forces," Dental Materials, 2016; 32(5): 607–614.