IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 9 Ser. 4 (September. 2024), PP 52-56
www.iosrjournals.org

In Vitro Study Of Molar Tooth With Endodontic Treatment At Endocrown Successful Prosthetic Rehabilitation.

Gabriela Popa[1,3], Andrei Iliescu[2], Gabriel Valeriu Popa[3,*],Anamaria Zaharescu[3]
Phd Student, Doctoral School, Carol Davila University Of Medicine And Pharmacy Of Bucharest, România
Dental Medicine Faculty, Carol Davila University Of Medicine And Pharmacy, Bucharest, România
Dentistry Departament, Faculty Of Medicine And Pharmacy, University Of „Dunărea De Jos", Galați, România

Abstract:
Background*: Side teeth, having a decisive role for mastication, require special attention after endodontic treatment. The rehabilitation of these teeth includes the analysis of current restoration techniques, materials used, as well as aesthetic and functional impact on the patient. Through a multidisciplinary approach, it aims not only to recover dental function, but also to improve the quality of life of the patient by restoring a healthy and harmonious smile.*
Materials and Methods*: In this study, we conducted tests on 30 extracted teeth that had whole or partially whole dental crowns, the condition of selecting the tooth in the study being at least 3 mm of dental tissue present, and, necessary for the subsequent prosthetic preparation for endocrown prosthetics. The 30 teeth were divided into 6 batches, the control group (A) being made up only of integral teeth that were milling for covering crowns. The other teeth were divided into 5 batches (B-F) of 5 teeth, the teeth were endodontically treated and milling for prosthetic rehabilitation with endocrown. Each lot (B-F) benefited from a preparation of corono-radicular cylindrical shape of different depths between 0.5-2,5mm, on the occlusal face of the tooth in the endodontic access area, in order to increase the surface of the retention coronary dental tissues for the stability of the prosthetic crowns of the coating. Each tooth in A-F batches has benefited from 3 crowns made of the same material through 3 different technologies.*
Results*: The values recorded by the A-lot, rehabilitated with crowns of sheathing on integral teeth, recorded an average value of the crown extraction force on tooth of 25.42±0.55 for CAD-CAM technology, for crowns made by baro-thermo-polymerization technique an average of 24,14±0,37, and for hot polymerization technique an average of 23,66±0,37. For B-F batches, the closest values for the extraction of endocorons were obtained by lot D with a preparation in the corono-radicular axe of 1,5mm, both for the CAD-CAM technology with a average of 25,74±1,91, and for the technique baro-thermo polymerization with an average of 24,92±1,83. For the technique of hot polymerization batch E, who has a preparation of 2 mm in the corono-radicular axe, recording an average of the extraction force of the endocrown of 23.56±2.05.*
Conclusion: *The success of endodontic treatment also depends on prosthetic restoration for a long-term oral rehabilitation.*
Keyword*: Endocrown, oral rehabilitation, CAD-CAM technology*

Date of Submission: 01-09-2024 Date of Acceptance: 11-09-2024

I. Introduction

Prosthetic rehabilitation of the lateral teeth, the choice of reconstruction material, method and technique of realization, and, it is most often dependent on the degree of coronary destruction and the quality of the remaining hard structure. The design and realization of prosthetic work on the side teeth is not limited to the replacement of the missing dental structure, but must meet the needs of structural strength, of functional integration and intimate solidarity with the remaining dental element.

The decision to rehabilitate endodontically treated lateral teeth that exhibit extensive loss of coronary structure is a challenge in dental prosthetics. Coronary dental tissue is often significantly damaged after endodontic treatment and is traditionally restored with metal root devices and wrapping crowns [1]. Initially, it was considered that this procedure would provide better strengthening of the remaining dental structure [2]. However, it has been observed that the use of intra-crown-root retention exclusively helps to retain the prosthetic crown. As a result of the removal of a significant dental hard tissue to allow the placement of

exogenous material, devoid of mechanical behavior similar to that of natural dental tissue, and, the remaining structure is weakened as resistance [3].

Preparing a molar for a pivot at the level of relatively narrow root canals also involves the risk of accidental root perforation and fracture [4]. Minimally invasive dental preparation with maximum preservation of hard dental tissues, are currently considered the "gold standard for restoring the anatomical integrity of endodontically treated molars [5]. In 1995, the "endocrown" was described by Pissis, who is the precursor of the technique of the endocrown, as the „technique of mono-block porcelain" [6]. Currently, due to advances in methods and adhesive materials, intracoronary endocrown-type restorations have been proposed for damaged posterior teeth as a prosthetic alternative to classical therapies [7].

II. Material And Methods

A number of 30 teeth were selected, extracted upper and lower molars, integral or partially integral, those partially integral having a minimum height of 3 mm of coronary dental tissues. The teeth were divided into 6 batches (A-F) of five teeth each, each tooth being inserted with the root part, in a cylindrical socket shape with a diameter of 20 mm and a height of 50 mm, containing cold-polymerization acrylic resin. Each lots of teeth has undergone different procedures of preprotetic and prosthetic training in order to be able to generate through the analysis of the obtained data, a model of prosthetic rehabilitation of endodontically treated teeth by endodontically treated crowns of the endocrown type with the same characteristics and properties as a covering crown for a vital tooth.

Lot A was made up of 5 integral teeth that were tangentially polished and were made of each tooth, three crowns of coating by three different methods (CAD-CAM technology, CAD-CAM technology, etc, baro-thermo polymerization technology and classical heat polymerization technology). The wrapper crowns have on the occlusal surface attached a rod with a length of 5mm and a thickness of 3mm necessary for attaching the device for measuring the force of its detachment from the polished tooth.

The rest of the teeth that had at least 3 mm of crown structure were endodontic treated after which they were tangentially milled. The difference between the other 5 lots represented a preparation that was made to the teeth to obtain an occlusal retention with cylindrical shape located occlusal in the endodontic access area of the tooth, with varying depths ranging from 0.5mm to 2.5mm with progressive increase in retention height attached to the endodontic crown by 5mm per lots.

The crowns of the teeth are in the same axis as the cylinder axis, positioning necessary for the in vitro study of the extraction of the crowns coverged or the endocrowns adapted to the anatomical situation of the teeth of each lot. Endocrowns have a rod of 5mm length and 3mm diameter on the occlusal surface just like the crowns coveraged. The consignment A considered a martor lot, consisting of 5 teeth with the integral crown part were tangentially milling for crown covering using thin flame-looking diamond milling cutters.

The rest of the teeth (25) were endodontically treated, tangentially milling, and for ocluzal each tooth presents a cylindrical form cavity an ocluzal in order to optimize the support surface of the remaining dental structures for more efficiency to endocrown stability in order to have a successful solution prosthesis. Lot B comprises all teeth with an occlusal preparation of 0.5mm, lot C was made up of teeth with an occlusal preparation of 1mm, lot D consisting of teeth with an occlusal preparation of 1.5mm, and, lot E includes teeth with an occlusal preparation of 2mm, and lot F teeth with an occlusal preparation of 2.5mm. Each of the B-F batches has been made a crown by the three CAD-CAM methods, baro-thermo polymerization and thermal polymerization the material being PMMA (methyl polymethacrylate) in various forms presentation disc or powder and liquid.

To obtain the experimental data, a digital force measurement dynanometer type ZP-500N calibrated with measuring possibility from 0.1N was required, which has been attached to covering crowns or endocrown for measuring and recording the force necessary to detach the crowns from the tooth. For the measurement of the inner diameters of the V-O, M-D and the outer diameters of the teeth, a digital calliper with a measurement possibility of at least 0.01 mm was used.

III. Result

For this study, 6 batches of teeth were formed (lot A - F), being made crowns for tangentially milling and endodontically untreated teeth (lot A), and the other batches (B - F) were made endocrowns that present different heights for the pivot attached at the crown. The tests aimed at optimizing a identical model of prosthetic reconstruction specific for endodontically treated lateral teeth with the same testable characteristics similar to a vital teeth milling.

The correlation of the analyzed data with the statistics program SPSS 17 and introduced in table 1 is observed the correspondence between the extraction forces applied to the crowns for the vital teeth and tangentially milling by three methods different (CAD-CAM milling, thermo-baro polymerization and heat polymerization) and data collected

and processed for endocrowns extraction forces applied for teeth tangentially milling are returned similar identical same the values of lot A, for the, samples that have benefited from an additional intra-corono-radicular occlusal preparation with a depth of at least 1.5 mm deep at the endocrowns made by CAD-CAM technique and baro-thermo polymerization, and the endodontic crowns made by the heat polymerization technique approached the values of lot A for occlusal preparations to 2mm.

Table no 1. Average and standard deviation for the extraction force of crowns/endocrowns

	TIP COROANĂ					
	Lot A Crown Covering	Endocrown / H crown pivot / mm				
		Lot B 0.5 mm	Lot C 1,0 mm	Lot D 1,5 mm	Lot E 2,0 mm	Lot F 2,5 mm
CAD-CAM crown / mean±SD	25,42 ±0,55	20,46 ±2,16	22,62 ±2,01	25,74 ±1,91	29,01 ±1,81	32,8 ±1,91
Thermo-baro-polimerization crown / mean±SD	24,14 ±0,37	20,74 ±1,69	22,22 ±1,62	24,92 ±1,83	28,14 ±1,79	31,26 ±1,94
Hot polimerization crown / mean±SD	23,66 ±0,37	18,74 ±1,71	19,46 ±1,88	20,84 ±1,79	23,56 ±2,05	26,7 ±1,96

For covering crowns designed and made by the Exocad™ system and milled with CAM for teeth that have tangentially milled, calculation of the standard average and deviation of 25,42±0,55 to which the values obtained by batches of crowns made by the same method have been reported, but who benefited from intra-corono-radicular preparations of different depths, that the values of lot D with the preparation of 1.5mm are similar to lot A. The values of lot E and F of category endocrowns CAD-CAM obtained superior values to lot A.

For the crowns made by the thermo-baro-polymerization technique, the D-lot benefited an intra-corono-radicular preparation of 1.5 mm, and the extraction values of the endocrowns approached the value of lot A of 24,14±0,37, and batches B and C have lower recorded values than the control lot A.

For the classic crown manufacturing technology, the batch A, hot polymerization recorded an average of 23.66±0.37 for the applied force for the extraction of crowns, and for teeth to E group treated endodontically and with the 2mm corono-radicular preparation obtained a similar value to the A lot. Lot F achieving in this category an average value of 26,7±1,96 being higher than lot A.

For the latest crown manufacturing technology, the batch A, hot polymerization recorded an average of 23.66±0.37 for the applied force for the extraction of crowns, and for the teeth from the E group were treated endodontically and with the 2mm crown and dental root preparation obtained a similar value to the A lot. Lot F achieving in this category an average value of 26,7±1,96 being higher than lot A.

Figure 1 shows the graphical representation of values crown and endodontic crown, extraction force according manufacturing technology and the height of intra-crown-root preparations, with visualization of various forces applied to them.

By applying the Chi-square test, we have the relationship between the height of the root device attached to the endocrown and the extraction force applied to both the endodontic crown and the covering crowns that confirm the values in Table 1.

The Kaplan-Meier test returned a graph showing the values of the extraction forces of the endocorons on one side and on the other side of the values recorded by the cover crowns belonging to lot A, confirming necesary present for an additional preparation located intra-corono-radicular occlusal for a long-term prosthetic rehabilitation (figure no 2).

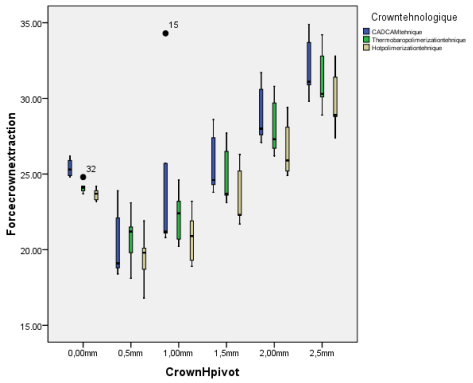

Figure no 1. Correlating the crown extraction force to crown technology and the crown-root with the highest pivot.

Table no 2. Chi-square test applied to the extraction force of the crown according to the height of the root pivot of the endocrown

Pairwise Comparisons													
		0,00mm		0,5mm		1,00mm		1,5mm		2,00mm		2,5mm	
	Crown Hpivot	Chi-Square	Sig.	Chi-Square	Sig.	Chi-Square	Sig.	Chi-Square	Sig.	Chi-Square	Sig.	Chi-Square	Sig.
Log Rank (Mantel-Cox)	0,00mm			27.668	.000	3.496	.062	1.398	.237	25.518	.000	33.960	.000
	0,5mm	27.668	.000			4.353	.037	22.046	.000	34.123	.000	34.123	.000
	1,00mm	3.496	.062	4.353	.037			3.347	.067	9.139	.003	13.152	.000
	1,5mm	1.398	.237	22.046	.000	3.347	.067			10.855	.001	31.645	.000
	2,00mm	25.518	.000	34.123	.000	9.139	.003	10.855	.001			11.232	.001
	2,5mm	33.960	.000	34.123	.000	13.152	.000	31.645	.000	11.232	.001		

Table no 3. The average and standard deviation of the diameters M-D and V-O of polished teeth and manufactured crowns

Tooth type		Natural tooth		Endocrown milling		Endocrown (baro-thermo-polymerized)		Endocrown (hot polymerized)	
		ØVO	ØMD	ØVO	ØMD	ØVO	ØMD	ØVO	ØMD
Upper molar	mean ±SD	11,29 ±0,9	9,01 ±0,7	11,31 ±0,9	9,03 ±0,7	11,33 ±0,96	9,07 ±0,8	11,74 ±0,9	9,39 ±0,7
Lower molar	mean ±SD	9,55 ±0,6	10,05 ±0,6	9,57 ±0,6	10,08 ±0,6	9,58 ±0,6	10,11 ±0,9	9,94 ±0,6	10,39 ±0,9

In order to see why there were differences in the measurement of the extraction forces at both cover crowns and endodontic crowns, measurements of the diameters M-D and V-O were made sets of crowns and endocrowns manufactured according to the technology used (CAD-CAM tehnique, baro-thermo-polymerization technique and hot polymerization), have been compared with the M-D and V-O diameters of teeth milling for covering crown (table 3).

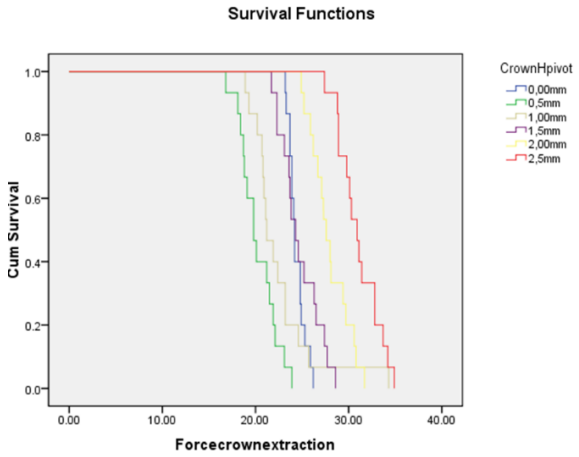

Figure no 2. Distribution of extraction forces in correlation with the height of the root device attached to the endocorona versus the crown (Kaplan-Meier test).

Analyzing the data in Table no 3, we could see the differences between the averages and standard deviations between the values recorded by the DOME and OVO of the polished teeth and the diameters recorded for the crowns manufactured by the 3 techniques. The closest values were recorded by crowns made by CAD-CAM technology which were on average 0.01% higher for the two diameters than of the coronar milling tooth. Endodontic crowns made by hot polymerization obtained values on average 0.05% higher than those of teeth polished for both measurements, and the endodontic crowns in the batch made by baro-thermo-polymerization obtained by comparing the data to the milling teeth an average of 0.03% higher values.

IV. Conclusion

Rosuvastatin 20 mg on every other regimen had equal effect when compared to daily dose regimen of atorvastatin 40 mg &rosuvastatin 20mg.

References

[1]. Dartora Nr, De Conto Ferreira Mb, Moris Icm, Brazão Eh, Spazin Ao, Sousa-Neto Md, Silva-Sousa Yt, Gomes Ea. Effect Of Intracoronal Depth Of Teeth Restored With Endocrowns On Fracture Resistance: In Vitro And 3-Dimensional Finite Element Analysis. J Endod. (2018);44(7):1179–85.

[2]. Ferrari M, Sorrentino R, Juloski J, Grandini S, Carrabba M, Discepoli N, Ferrari Ce. Post-Retained Single Crowns Versus Fixed Dental Prostheses: A 7-Year Prospective Clinical Study. J Dent Res. (2017);96(13):1490–7.

[3]. Soares Cj, Santana Fr, Silva Nr, Preira Jc, Pereira Ca. Influence Of The Endodontic Treatment On Mechanical Properties Of Root Dentin. J Endod. (2007);33(5):603–6.

[4]. Ferrari M, Vichi A, Grandini S. Efficacy Of Different Adhesive Techniques On Bonding To Root Canal Walls: An Sem Investigation. Dent Mater. (2001);17(5):422–9.

[5]. Dietschi D, Duc O, Krejci I, Sadan A. Biomechanical Considerations For The Restoration Of Endodontically Treated Teeth: A Systematic Review Of The Literature, Part Ii (Evaluation Of Fatigue Behavior, Interfaces, And In Vivo Studies). Quintessence Int. (2008);39(2):117–29.

[6]. Pissis P. Fabrication Of A Metal-Free Ceramic Restoration Utilizing The Monobloc Technique. Pract Periodontics Aesthet Dent. (1995);7(5):83–94.

[7]. Shin Y, Park S, Park Jw, Kim Km, Park Yb, Roh Bd. Evaluation Of The Marginal And Internal Discrepancies Of Cad/Cam Endocrowns With Different Cavity Depths: An In Vitro Study. J Prosthet Dent. (2017);117(1):109–15.

[8]. Aldabeeb, D. S., Alakeel, N. S., Al Jfshar, R. M., & Alkhalid, T. K. (2023). Endocrowns: Indications, Preparation Techniques, And Material Selection. Cureus, 15(12), E49947.

[9]. Do, T. T., Trinh, T. M., Tran, T. T. P., Nguyen, V. T. T., & Le, L. N. (2024). Clinical Performance Of Computer-Aided Design/Computer-Aided Manufacture Lithium Disilicate Ceramic Endocrown Restorations: A 2-Year Study. Journal Of Conservative Dentistry And Endodontics, 27(1), 51–56.

[10]. Papalexopoulos, D., Samartzi, T. K., & Sarafianou, A. (2021). A Thorough Analysis Of The Endocrown Restoration: A Literature Review. The Journal Of Contemporary Dental Practice, 22(4), 422–426.

[11]. Pedrollo Lise, D., Van Ende, A., De Munck, J., Umeda Suzuki, T. Y., Cardoso Vieira, L. C., & Van Meerbeek, B. (2017). Biomechanical Behavior Of Endodontically Treated Premolars Using Different Preparation Designs And Cad/Cam Materials. Journal Of Dentistry, 59, 54–61.

[12]. Junxin Zhu, Qiguo Rong, Xiaoyan Wang, Xuejun Gao,Influence Of Remaining Tooth Structure And Restorative Material Type On Stress Distribution In Endodontically Treated Maxillary Premolars: A Finite Element Analysis, The Journal Of Prosthetic Dentistry, Volume 117, Issue 5, 2017, Pages 646-655, Issn 0022-3913,

[13]. Caldas, R. A., Bacchi, A., Barão, V. A. R., & Versluis, A. (2018). Should Adhesive Debonding Be Simulated For Intra-Radicular Post Stress Analyses? Dental Materials, 34(9), 1331–1341.

[14]. Panagiotis Zoidis, Eleonora Bakiri, Gregory Polyzois, Using Modified Polyetheretherketone (Peek) As An Alternative Material For Endocrown Restorations: A Short-Term Clinical Report, The Journal Of Prosthetic Dentistry, Volume 117, Issue 3, 2017, Pages 335-339, Issn 0022-3913 (Https://Www.Sciencedirect.Com/Science/Article/Pii/S0022391316303614)

[15]. Alshali, S., & Attar, E. (2023). Fracture Strength Of Endocrowns Fabricated From Three Different Computer-Aided Design/Computer-Aided Manufacturing Ceramic Materials: An In-Vitro Study. Cureus, 15(7), E41531.