Assessment and Study of Types of Finish Lines in Tooth Preparation - An Observational Study

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Abstract

The fixed and removable prosthodontics aims at the maintenance and preservation of the tooth structure . Restoration of teeth is possible only if sufficient space is created for the application of thickness of material required . The types of finish lines given for all ceramic , metal ceramic and all metallic tooth preparations are Chamfer , Shoulder finish line, etc , The aim of this observational study is to assess the different types of finish lines given in the tooth preparation . The study is focused to assess the different types of finish lines in tooth preparation and to assess the most preferred type of finish line as the tooth margin . Around 1000 different tooth preparations were observed to assess the types of finish lines . The data was obtained from 86,000 archived patient records . All the collected data were reviewed and statistically analysed . In the present study , most of the patients were 31 to 45 yrs old (42 %) . Among the patients , 56% were Male . Majority of the tooth preparations were done in Sextant 2 (35%) . The most preferred type of finish line was the Shoulder finish line (77 %).The study has observed that the shoulder finish line was the most preferred type of finish line .

Keywords : *Tooth preparation ; Types of finish lines ; Choice of finish lines*

Introduction

The fixed and removable prosthodontics aims at the maintenance and preservation of the tooth structure . Restoration of teeth is possible only if sufficient space is created for the application of thickness of material required . It is given for better marginal adoption and fitting of the restoration [1 , 2 , 3] . The types of finish line given for all ceramic , metal ceramic and all metallic tooth preparations are Chamfer , Shoulder , Knife edge finish lines [4] . They are given on the basis of the requirement and tooth structure . Ideally , all finish lines should be placed supragingivally [5 , 6] . Due to esthetic and carious considerations [7 , 8 , 9] , however subgingival placement of the finish line is preferred [10 , 11 , 12] .

No one type of finish line can be used for all crown preparations . In lower anterior teeth or periodontally treated teeth [13] , the knife edge finish line appears to be the treatment of choice [14] . The long term goal desired by a patient and the doctor is durability and longevity [15] . This can be achieved initially by tooth preparations that are clinically sound [16] . But another important factor that contributes to this is the selection of the finish line . Preference for a particular type of finish line preparation allows ample room for various criteria like the position of the teeth contributing to esthetics [Anterior or Posterior] [17] , Restoration material [Metal or Ceramic] [18] and the bulk of the restorative material [19 , 20] . The indications and the contraindications for each type of finish line will be reviewed . The ultimate goal in fixed & removable prosthodontics is the maintenance & preservation of the remaining dentition [21] . In short teeth and preparation for Porcelain and Porcelain - Gold crowns , the full shoulder bevelled preparation is the treatment of choice

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. In full Gold and Acrylic veneered Gold crowns , as in endodontically treated , the Chamfer preparation is the treatment of choice [22] . The various types of finish lines are Chamfer , Heavy chamfer , Shoulder , Round/Radial shoulder , Slope shoulder , Shoulder with bevel , Knife edge , Chisel edge & Butt joint finish lines .The present study was conducted to assess and study the various different types of finish lines in tooth preparation and to assess the most preferred type of finish line as the tooth margin .

Materials and Methods

The observational study was done in a university setting . Samples of 10 months from June 2019 - March 2020 was reviewed . A collected data of 868 patients were examined by 2 reviewers , Finish lines and tooth preparation were the inclusion of the data . All available data were included without any sorting process to minimise sampling bias . Non probability inclusion was done to ensure internal validity and Homogenization & replication of experiment was done for external validity .

The data from 86,000 patients visited Saveetha dental college during the time period of June 2019 to March 2020 were reviewed and the data of all tooth preparations were collected . Non specific samples were excluded from study . The collected data was entered in an excel sheet and the data verification was done by an external reviewer . Then the data were imported to statistical analysis . The variables were defined and SPSS by IBM was the statistical software used for analysis . Chi - square test was done by keeping age & gender as independent variable and tooth preparation & type of finish line as dependent variable . Correlation analysis and association analysis were done.

Results and Discussion

Among the sample size of 867 tooth preparations , 42 % of the patients were 31 to 45 yrs old , 32 % were 18 to 30 yrs old , 21 % were 46 to 60 yrs old and 5 % of the patients were above 60 yrs . In the total study population (Figure 1), 56 % were Male and 44 % were Female (Figure 2). 35 % of the total tooth preparation was done in Sextant 2 , 14 % in Sextant 3 , 14 % in Sextant 6 , 13 % in Sextant 4 , 13 % in Sextant 5 and 11 % of the preparations in Sextant 1 . There was a statistically significant difference between the sextants in receiving fixed partial denture treatment with Sextant 2 being the predominant one receiving treatment (Chi Square test ; $P < 0.05$)(Figure 3).

The most preferred type of finish line was Shoulder finish line - 77 % . Chamfer finish line was preferred in 13 % , Radial shoulder in 3 %, Heavy chamfer finish line in 3 % , Feather edge & Knife edge finish lines in less than 1 % of tooth preparations . There was a statistically significant difference between the finish lines placed in fixed partial denture treatment,with shoulder finish line being the predominant one receiving treatment (Chi Square test ; $P < 0.05$).

(Figure 4).There was a statistically significant difference between the sextants in receiving fixed partial denture treatment.with Sextant 2 being the predominant one receiving treatment (Chi Square test ; $P < 0.05$) (Figure 5).

Age of the patients in the study

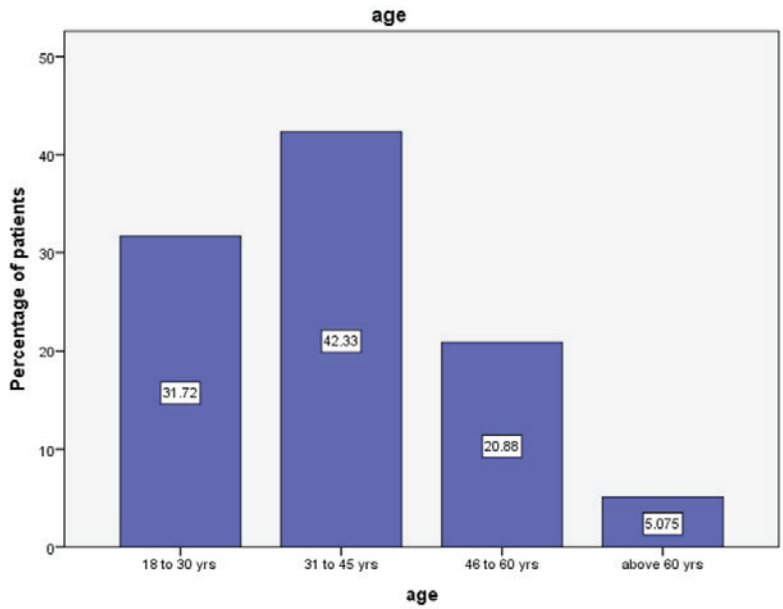

Figure 1 : The bar graph represents the age of the Patients in the study . The X - axis represents the Age groups and Y - axis represents the percentage of the patients . Among the total sample size of 867 patients , 31.7 % (275) were 18 to 30 yrs old , 42.3 % (367) were 31 to 45 yrs old , 20.9 % (181) were 46 to 60 yrs old and 5.1 % (44) were above 60 yrs old . Tooth preparations were predominantly done in patients of 31 to 60 yrs of Age (63.2 %) . N = 867 .

Gender of the patients in the study

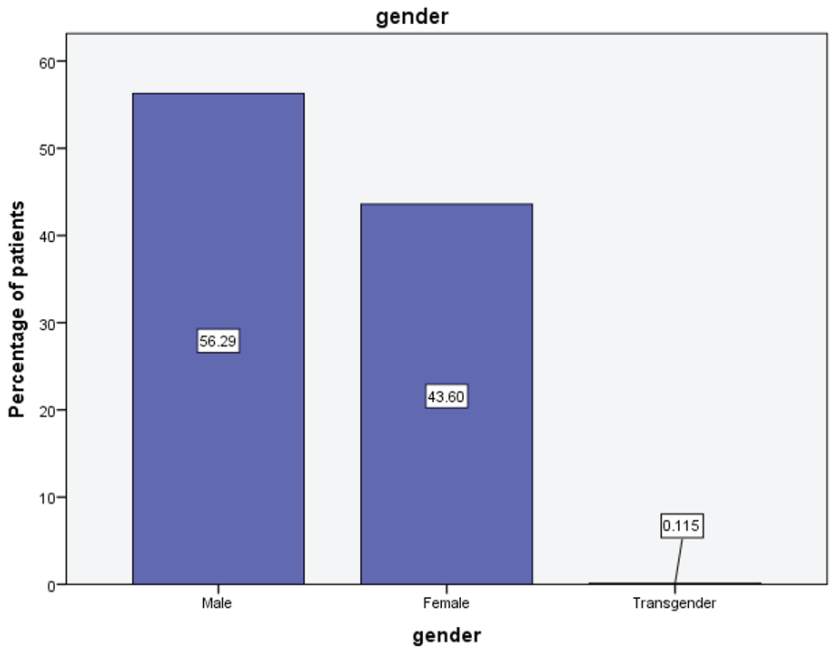

Figure 2 : The bar graph represents the gender of the Patients in the study . The X - axis represents the Gender and the Y - axis represents the percentage of the patients . Among the total sample size of 867 patients , 56.3 % (488) were Male , 43.6 % (378) were Female and 0.1 % (1) were Transgender . Thus Males were more prevalent to Fixed partial denture treatment than Females (56.3 %) . N = 867 .

Teeth sextants involved in the study

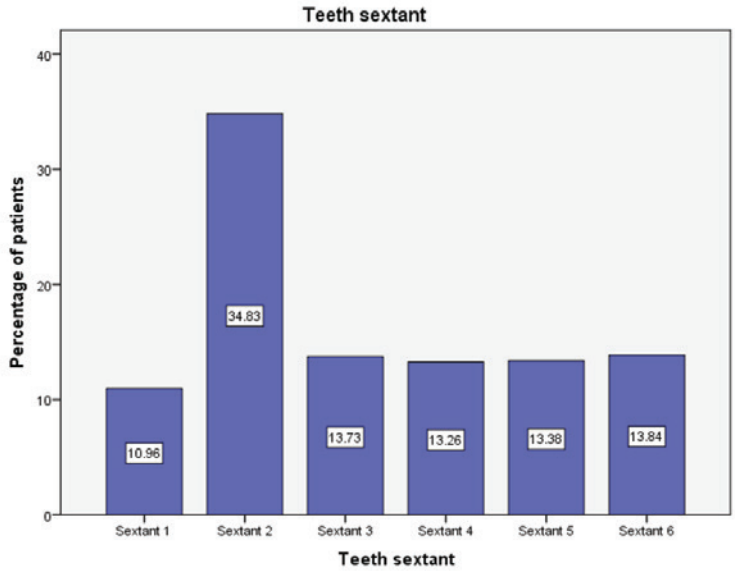

Figure 3 : The bar graph represents the teeth sextant of tooth preparation .The X - axis represents the Teeth sextant and the Y - axis represents the percentage of the patients . Among the total sample size of 867 patients , 11 % (95) of tooth preparations were done in Sextant 1 , 34.8 % (302) were in Sextant 2 , 13.7 % (119) were in Sextant 3 , 13.3 % (115) were in Sextant 4 , 13.4 % (116) were in Sextant 5 and 13.8 % (120) were done in Sextant 6. There was a statistically significant difference between the sextants in receiving fixed partial denture treatment with Sextant 2 being the predominant one receiving treatment (34.8 %) . N = 867 .

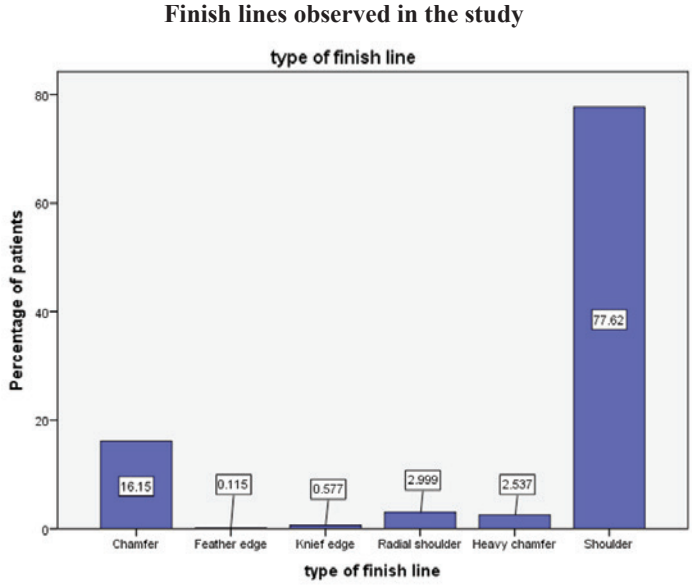

Figure 4 : The bar graph represents types of finish lines in tooth preparation . The X - axis represents the type of finish line and the Y - axis represents the percentage of the patients . Among the total sample size of 867 patients, 16.1 % (140) of the finish lines were Chamfer finish line , 0.1 % (1) were Feather edge finish line , 0.6 % (5) were Knife edge finish line , 3 % (26) were Radial shoulder finish line , 2.5 % (22) were heavy chamfer finish line and 77.6 % (673) were Shoulder finish line .There was a statistically significant difference between the finish lines placed in fixed partial denture treatment, with shoulder finish line being the predominant one receiving treatment (77.6 %) . N = 867

Finish lines in Teeth sextants in the study

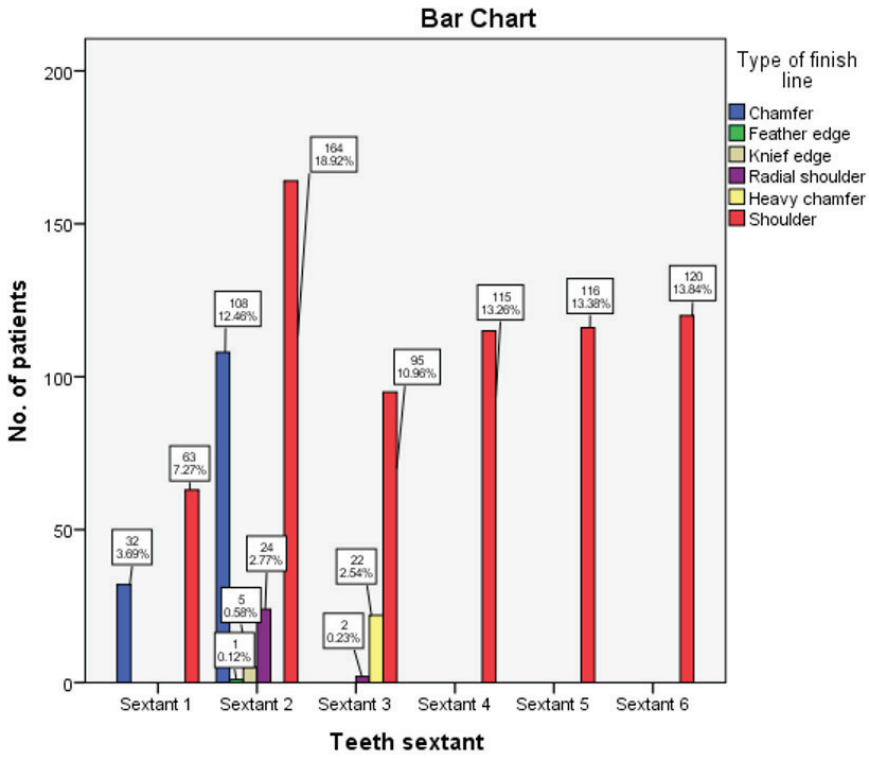

Figure 5 : The bar graph represents the association of Teeth sextant and the type of finish lines . The X - axis represents the Teeth sextant and the Y - axis represents the frequency of type of finish line such as Chamfer (Blue) finish line , Feather edge (Green) finish line , Knife edge (Tan yellow) finish line , Radial shoulder (Violet) finish line , Heavy chamfer (Yellow) finish line and Shoulder (Orange) finish line .There was a statistically significant difference between the finish lines in various Sextants and type of finish line placed in fixed partial denture treatment, with Sextant 2 being the predominant one receiving treatment and Shoulder finish line being the predominantly preferred one as the tooth margin . This was found to be statistically significant ; p = 0.01 (Pearson Chi Square test ; P < 0.05) . N = 867 .

The ideal finish line should have the following characteristics including , Shallow levels nearly parallel to cavosurface should be avoided because the restoration will be too thin at this area and may chip easily . The discrepancy decreases with the increase in angulation of the bevel and the bevel should not produce a very acute margin , which can lead to fracture of the wax pattern during removal [23] . Shoulder finish line has a gingival finish wall perpendicular to the axial surfaces of the teeth . If the marginal wall was at 120 degree to the axial wall , then it is termed a sloping shoulder. A shoulder finish line was preferred for all ceramic restorations [24] , where sufficient thickness of the margin was required for structural durability [16] . All anterior restorations were fabricated with a shoulder margin where aesthetics was the primary concern . The placement of finish lines influences the fabrication of the restoration and the final outcome of the treatment [25] .

In the present study , we concluded that among the total sample patients , Male gender was predominant. On the other hand , the study by Geiballa GH , et , al ,. [26] had opposing findings of female predominance. Also the study by Shillingburg HT , et , al ,.[16] had opposing findings of Female predominance . This opposing finding may be due to personal hygiene of the individual . In the present study , we concluded that the majority of the tooth preparations were done in Sextant 2 . The study by Rosenstiel SF , et , al ,. [22] had similar findings . In the present study , we concluded that the Shoulder finish line was the most preferred type of finish line done in tooth preparations. The study by Shillingburg HT , et , al

,. and Cho L , et , al ,. [27 , 16] had similar findings . On the other hand , the study by Tjan AHL , et , al ,. , Grajower R , et , al ,. and Noonan JE , et , al ,. [28–30] had differential opposing findings .

This study was single centered and large data for various different finish lines needs to be analysed further.. This study also doesn't represent all ethnic groups and populations .Future scopes were observation of more population , Assessment of the expectations of the patients , Assessment of adaptation of the prosthesis and other choices of finish lines .

Conclusion

This study observed that there was a statistically significant difference between the finish lines in various Sextants placed in fixed partial denture treatment,with shoulder finish line being the predominant one as the tooth margin . Predominantly tooth preparations were done in Sextant 2 , the Anterior region .

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References

1. Rimmer SE, Mellor AC. Patients' perceptions of esthetics and technical quality in crowns and fixed partial dentures. Quintessence Int. 1996 Mar;27(3):155–62.
2. Ganapathy D, Sathyamoorthy A, Ranganathan H, Murthykumar K. Effect of Resin Bonded Luting Agents Influencing Marginal Discrepancy in All Ceramic Complete Veneer Crowns. J Clin Diagn Res. 2016 Dec;10(12):ZC67–70.
3. Ajay R, Suma K, Ali SA, Kumar Sivakumar JS, Rakshagan V, Devaki V, et al. Effect of Surface Modifications on the Retention of Cement-retained Implant Crowns under Fatigue Loads: An In vitro Study. J Pharm Bioallied Sci. 2017 Nov;9(Suppl 1):S154–60.
4. Gupta A, Dhanraj M, Sivagami G. Status of surface treatment in endosseous implant: a literary overview. Indian J Dent Res. 2010 Jul;21(3):433–8.
5. Reeves WG. Restorative margin placement and periodontal health. J Prosthet Dent. 1991 Dec;66(6):733–6.
6. Kannan A, Venugopalan S. A Systematic Review on the Effect of Use of Impregnated Retraction Cords on Gingiva. Research Journal of Pharmacy and Technology. 2018 May 30;11(5):2121–6.
7. Subasree S, Murthykumar K, Dhanraj. Effect of Aloe Vera in Oral Health – A Review. Research Journal of Pharmacy and Technology. 2016 May 31;9(5):609–12.
8. Selvan SR, Ganapathy D. Efficacy of fifth generation cephalosporins against methicillin-resistant Staphylococcus aureus-A review [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1815. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00369.3
9. Vijayalakshmi B, Ganapathy D. Medical management of cellulitis [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 2067. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00422.4
10. Ranganathan H, Ganapathy DM, Jain AR. Cervical and Incisal Marginal Discrepancy in Ceramic Laminate Veneering Materials: A SEM Analysis. Contemp Clin Dent. 2017 Apr;8(2):272–8.
11. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, Sivaprakasam AN. Compatibility of Non Original Abutments With Implants [Internet]. Vol. 28, Implant Dentistry. 2019. p. 289–95. Available from: http://dx.doi.org/10.1097/id.0000000000000885
12. Ganapathy DM, Kannan A, Venugopalan S. Effect of Coated Surfaces influencing Screw Loosening in Implants: A Systematic Review and Meta-analysis [Internet]. Vol. 8, World Journal of Dentistry. 2017. p. 496–502. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1493
13. Jyothi S, Robin PK, Ganapathy D, Anandiselvaraj. Periodontal Health Status of Three Different Groups Wearing Temporary Partial Denture. Research Journal of Pharmacy and Technology. 2017;10(12):4339–42.

14. Seymour KG, Samarawickrama DY, Lynch EJ. Metal ceramic crowns--a review of tooth preparation. Eur J Prosthodont Restor Dent. 1999 Jun;7(2):79–84.

15. Basha FYS, Ganapathy D, Venugopalan S. Oral Hygiene Status among Pregnant Women [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 3099. Available from: http://dx.doi.org/10.5958/0974-360x.2018.00569.3

16. Shillingburg HT, Sather DA. Fundamentals of Fixed Prosthodontics. Quintessence Pub.; 2012. 574 p.

17. Ariga P, Nallaswamy D, Jain AR, Ganapathy DM. Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review [Internet]. Vol. 9, World Journal of Dentistry. 2018. p. 68–75. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1509

18. Venugopalan S, Ariga P, Aggarwal P, Viswanath A. Magnetically retained silicone facial prosthesis. Niger J Clin Pract. 2014 Mar;17(2):260–4.

19. Walton TR. A 10-year longitudinal study of fixed prosthodontics: clinical characteristics and outcome of single-unit metal-ceramic crowns. Int J Prosthodont. 1999 Nov;12(6):519–26.

20. Ashok V, Nallaswamy D, Benazir Begum S, Nesappan T. Lip Bumper Prosthesis for an Acromegaly Patient: A Clinical Report. J Indian Prosthodont Soc. 2014 Dec;14(Suppl 1):279–82.

21. Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: An art form based on scientific principles [Internet]. Vol. 85, The Journal of Prosthetic Dentistry. 2001. p. 363–76. Available from: http://dx.doi.org/10.1067/mpr.2001.114685

22. Rosenstiel SF, Land MF. Contemporary Fixed Prosthodontics - EBook. Elsevier Health Sciences; 2015. 888 p.

23. Thom LW. Principles of Cavity Preparation in Crown and Bridge Prosthesis III. The Inlay Abutment [Internet]. Vol. 41, The Journal of the American Dental Association. 1950. p. 541–4. Available from: http://dx.doi.org/10.14219/jada.archive.1950.0223

24. Ashok V, Suvitha S. Awareness of all Ceramic Restoration in Rural Population. Research Journal of Pharmacy and Technology. 2016 Oct 28;9(10):1691–3.

25. Nallaswamy D. Textbook of Prosthodontics. JP Medical Ltd; 2017. 1550 p.

26. Geiballa GH, Abubakr NH, Ibrahim YE. Patients' satisfaction and maintenance of fixed partial denture. Eur J Dent. 2016 Apr;10(2):250–3.

27. Cho L, Choi J, Yi YJ, Park CJ. Effect of finish line variants on marginal accuracy and fracture strength of ceramic optimized polymer/fiber-reinforced composite crowns [Internet]. Vol. 91, The Journal of Prosthetic Dentistry. 2004. p. 554–60. Available from: http://dx.doi.org/10.1016/j.prosdent.2004.03.004

28. Tjan AHL, Sarkissian R, Miller GD. Effect of multiple axial grooves on the marginal adaptation of full cast-gold crowns [Internet]. Vol. 46, The Journal of Prosthetic Dentistry. 1981. p. 399–403. Available from: http://dx.doi.org/10.1016/0022-3913(81)90445-5

29. Grajower R, Lewinstein I. A mathematical treatise on the fit of crown castings. J Prosthet Dent. 1983 May;49(5):663–74.

30. Noonan JE, Goldfogel MH. Convergence of the axial walls of full veneer crown preparations in a dental school environment [Internet]. Vol. 66, The Journal of Prosthetic Dentistry. 1991. p. 706–8. Available from: http://dx.doi.org/10.1016/0022-3913(91)90457-8