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Gingival Contour in BOPT: A Review of Provisional Crown Guidance

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Abstract: ***Background and Aims: In prosthetic dental medicine nowadays, there are a lot of challenges to obtain successful treatment with fixed crown restorations in anterior region. The aim is to achieve excellent aesthetic results, which are related not only to the shade, shape and position of the crown, but also to contour and harmony of the surrounding gingival soft tissues. Many clinical studies have found that the design of the crown margin and emergence profile can guide the contour of free gingival margin. This review explores the role of temporary crowns in guiding gingival contour in Biologically Oriented Preparation Technique BOPT. It presents the advantages and principles of this technique and the methods of manufacturing provisional crowns. Methods: The review includes 41 articles from various databases. Results: The results show different working approaches for fabrication of temporary crowns with appropriate emergence profile. Conclusion: The biologically oriented preparation technique (BOPT)offers many advantages, including the ability to modify and reshape the marginal gingiva contour creating new emergence profile of the crown. The BOPT concept ensures long-term stability of gingival tissues.***

Keywords: BOPT, gingival recontouring, provisional crowns, emergence profile

1. Introduction

In prosthetic dental medicine nowadays, there are a lot of challenges to obtain successful treatment with fixed crown restorations in anterior region. The aim is to achieve excellent aesthetic outcomes, which are related not only to the shade, shape and position of the crown, but also to contours and harmony of the surrounding gingival soft tissues. Temporary crowns, which can be manufactured through either direct or indirect approaches, plays a significant role in the prosthetic treatment process.

The provisional crowns provide both abutment teeth protection and the ability to shape the gingiva. Many clinical studies have found that the design of the crown margin and emergence profile can influence and guide the contour of free gingival margin.

2. Literature Survey

A vertical preparation technique is described by Morton Amsterdam in 1968. [1]This technique in combination with surgical periodontal treatment is implemented for remodeling the shape and contours of soft tissues. [2,3,4]In 2008 for the first time Ignazio Loi published the protocol of biologically oriented preparation technique (BOPT).[5] There is no well-defined line between prepared and nonprepared tooth surface. This method allows to guide the contours of free gingival margin and designa new emergence profile, which can be achieved by manufacturing specifically shaped temporary prosthetic restorations. [6,7]The aim of BOPT is to restore the natural anatomical shape of the teeth with permanent fixed crowns. In this this way is possible to create a free adaptation and remodeling of gingival tissues around the new profile. [8]Many biological and clinical advantages are established.

Clinical advantages

- Minimal invasive preparation of dental tissues
- Removing of cemento-enamel junction (CEJ) in teeth, that are unprepared, or erasure of old finish lines (horizontal or vertical) in prepared teeth
- The new finish line can be placed at different levels – more apically or coronally within the sulcus
- Fast and easy technique
- Relining of temporary prosthetic restorations is easy
- Simple impression taking

Biological advantages:

- Increase in gingival margin stability in long-term
- The thickness of gingiva is increased
- Free gingival margin can be coronalized by reshaping new emergency profiles [9,10,11,12,13,14,15,16]

Preparation technique

The initial phase starts with intrasulcular probing with periodontal probe is done, in order to estimate the level of epithelial attachment.

The BOPT includes three steps: supragingival, subgingival (intrasulcular) and finishing preparations. (Fig.1)

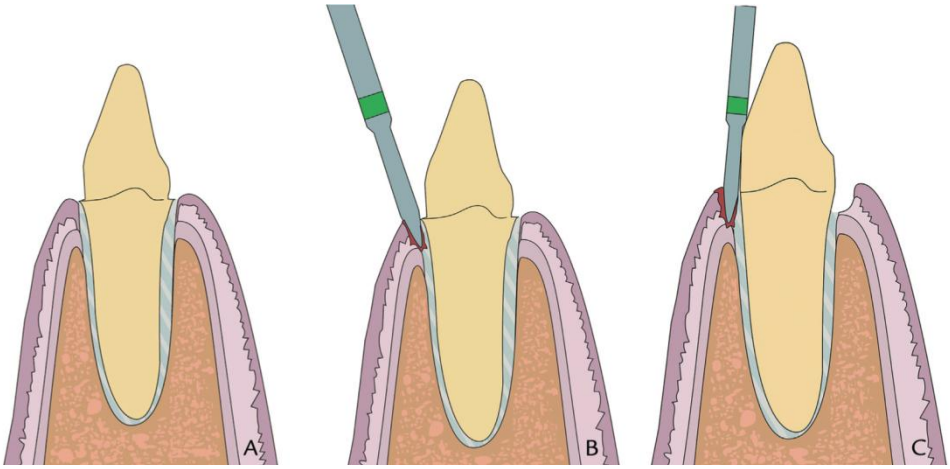

Figure 1: A- Supragingival preparation B и C- subgingival preparation [17]

First, the tooth is prepared supragingivally with flame shaped diamond bur (100/120 µm).[12] Subgingival preparation can be divided intothreestages.

1) The bur is entering the gingival sulcus 1 mm below CEJ, reaching the gingival attachment. The bur is raked obliquely 10-15 º tolongitudinal axis of the teeth. Thereby its tip is inactive and cuts only with its belly at the same time the gingival epithelium which covers the inner wall of sulcus, and the coronal part of emergence profile of the tooth. The gingitage is achieved by eliminating the epithelium attachment and superficialpart of connective tissue attachment in depth 0,3mm. [8,12,17,18,19,20,21,22]
2) The diamond bur is positioned parallel to axis of the tooth until a vertical flat axial wall is prepared. The existing CEJ or previously prepared finish lines are erased. The space where the future crown margin will be placed is created.[7]Position of vertical finish line should notinvade the biological width. [23,24,25]
3) After that in order to establish a right direction of insertion of crown, the bur is placed 3-6^{0}coronally converging. In that way the prepared tooth will be with convergence of around 6^0.[26]

The final step is refining and smoothen the entire surface with 20-30 µm diamond burs.

Temporary crowns

There are two working approaches for fabrication of provisional restorations – conventional and digital.

1) Conventional Method

The dental technician manufactures temporary crowns, based on wax up, which contours follow the gingival margin. The acrylic crowns are hollowed and subsequently relined directly in the oral cavity – egg-shell technique. [27] This is hybrid technique, combining indirect laboratory manufacturing of temporary crowns (shell) and direct clinical relining on the prepared teeth.[28] Themethod enables the dentist to create a new emergence profile of the crown in a specific way, which will assure good healing process of gingival tissues.

After isolation of the abutment teeth with glycerin, temporary restorations are relined with self-curing polymethyl methacrylate resin. Awhile before the final polymerization, the crowns are removed and there are clearly defined two margins. The internal one is thick and impresses the intrasulcular prepared area of abutment tooth. It is marked with sharp pencil. The external margin is thicker and represents the contour of gingival margin. The space between these two margins represents negative copy of gingiva. (fig.2)

Figure 2: Two clearly defined margins after relining of temporary crown

This space will be filled with flowable compositeto create thicker margin and appropriate contour of the crown.The excess of material is trimmed away and a cervical profile of temporary restorations is shaped with 45° angulation to longitudinal axis of the tooth, in order to support circumferentially gingival margin. A new emergence profile and a new prosthetic cemento-enamel junctions are created, which should be positioned around 0,5-1mm in gingival sulcus. [20]The surface of provisional crown has to be smooth and well-polished.[29]This will prevent the accumulation of plaque and promote good healing of gingiva.[30] (Fig.3)

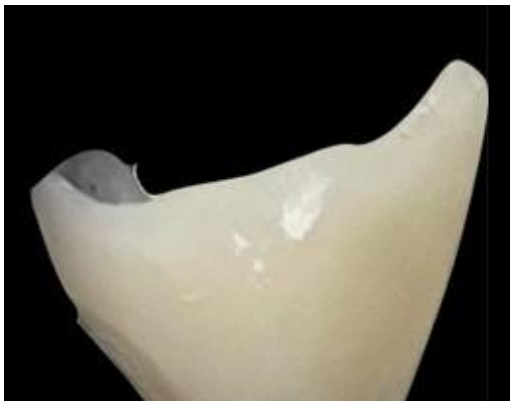

Figure 3: The finished crown with new emergence profile

The angular contour of temporary restoration stabilizes and preserves the formed clot, ensuring its development into matured connective gingival tissue. Through the healing process thickening and reattachment of soft tissues will be provided, and their adaptation to the new emergence profile. After four weeks the gingival tissues are stable,healthy and thickened. Now it is possible to reshape margogingivalis by shortening the crown margin and within a week it moves coronally. [8,12,18] This technique allows to correct the levels of gingival margins without any surgical procedures. [9,10,11]

There are some disadvantages of this method. One of them is that the process of clinical relining and finishing the provisional restoration is time-consuming. Another major problem is that the materials which are used for direct temporary crowns are featured with existence of free monomer.It can harm pulp tissue when it is in contact with open dentin tubules, and also can cause gingival inflammation. Similarly, polymerization of resin materials is associated with an exothermic reaction and temperature rise may have negative effect on vital pulp and cause iatrogenic thermal trauma. [31,32,33,34,35,36,37,38]

2) Digital

New digital technologies in dentistry offer several advantages. The temporary crowns can be manufactured digitallyby means of CAD/CAM system that can improve esthetics and achieve harmonized gingival contour. CAD/ CAM provisional restorations have better marginal adaptation and accuracyto prepared teeth.Thereby chair time for clinical relining and finishing of provisional restorations can be reduced.

After preparation of the abutment teeth, impression with polyvinylsiloxane is taken. The cast and each die separately are scanned with extraoral scanner. By CAD software both images are superimposed – wax up on the prepared teeth and soft tissues profile.New emergence profile can be modified virtually considering the level of margogingivalis and depth of sulcus. According to conception of Dr. Abrams “Seagull Wings” an adequate compression of free gingival tissues can be designedin CAD-module.(fig.5) Variance of the angle created between crown and gingival margin determines different gingival profiles. Marginal gingiva tends to increase its volume, which allows thicker contours.Thereby temporary crowns with convex marginal contours are manufactured assuming to achieve better conditionsfor healing processes.Two pairs of temporary crowns are manufactured with different emergence profiles. [16,39,40,41]

Figure 5: The"seagulls wings" line in case of thin and thick gingival biotype is highlighted by the variation of the angle created between gingiva and crown. [39]

3. Results

The new emergence profile of provisional crowns, fabricated by conventional or digital method, influences the shape and volume of gingival margin. The biologically oriented preparation technique provokesa soft tissue response by increasing the thickness and stability of gingiva. These intended tissue changes can be reproduced and preserved in the marginal adjustment of the permanent crowns.

4. Conclusion

The Biologically Oriented Preparation Technique offers significant advantages in prosthetic dental medicine. It allows the modification of the gingival margin contour by creation of a new emergence profile of the crown, eliminating the need for surgical procedures. The BOPT concept ensures long-term stability of gingival tissues with the new shape of fixed prosthetic restorations.

References

[1] Amsterdam M, Abrams L. Periodontal prosthesis. In: Goldman HM, Cohen DW (eds). Periodontal therapy, 4th ed St. Louis: CV Mosby Co, 1968
[2] Martignoni M, Shonenberger A, Precisione e contorno nella ricostruzione protesica. Quintessenza Biblioteca, 1987
[3] Carnevale G, Di Febo G, Fuzzi M. An in vivo study of teeth reprepared during periodontal surgery. Int J Period Res Dent 1990; 10(1): 40-55.
[4] Carnevale G, Di Febo G, Fuzzi M. A retrospective analysis of the perio pro- sthetic aspect of teeth re-prepared du- ring periodontal surgery. J Clin Period 1990; 17(5): 313-6.
[5] Loi I. Protesi su denti naturali nei settori estetici: descrizione della tecnica BOPT. Dental Cadmos 2008;76:51–59
[6] Lang NP, Kiel RA, Anderhalden K. Clinical and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. J Clin Periodontol. 1983. doi: 10.1111/j.1600-051X.1983.tb01295.x
[7] Comlekoglu M , Dundar M , Özcan M , Gungor M, Gokce B, Artunc C. Influence of Cervical Finish Line Type on the Marginal Adaptation of Zirconia Ceramic Crowns. Oper Dent. 2009; 34(5): 586–592. doi: 10.2341/08-076-L
[8] Agustín-Panadero R, Solá-Ruíz MF. Vertical preparation for fixed prosthesis rehabilitation in the anterior sector. J Prosthet Dent. 2015 Oct;114(4):474-8. doi: 10.1016/j.prosdent.2015.05.010. Epub 2015 Jul 26. PMID: 26213268.
[9] Carnevale G, Sterrantino SF, Di Febo G. Soft and hard tissue wound healing following tooth preparation to the alveolar crest. Int J Period Res Dent 1983; 3(6): 36-53.
[10] Loi I , Scutellà F . Galli F. Trcnica di preparazione orientata biologicamente (BOPT). Un nuovo approccio nella preparazione protesica in odontostomatologia. Quintessenza Internazionale 2008;5(24):69-75.
[11] Loi I. Protesi su denti naturali nei settori estetici: descrizione tecnica BOPT. Dental Cadmos 2008;76(10):51- 59.
[12] Loi I, Di Felice A. Biologically oriented preparation technique (BOPT): a new approach for prosthetic restoration of periodontically healthy teeth. Eur J Esthet Dent. 2013 Spring;8(1):10-23. PMID: 23390618.
[13] Abrams L. Graduate periodontal and prosthetic lectures. Boston University School of Graduate Dentistry, 1971. Boston: Boston University Press, 1971
[14] Kay HB. Criteria for restorative contours in the altered periodontal environment. Int J Periodont Rest Dent 1985; 5:42-63
[15] Di Felice A., Abad-Coronel C., Giovane V., Loi I., Pradies G. The importance of esthetic integration through laboratory adaptation profiles in the biologically oriented preparation technique. The International Journal of Esthetic Dentistry 2021;16(4):2-13.
[16] Bazzoli M, Loi I,Turillazzi O. La gestione delle parabole gengivali con tecnica B.O.P.T. Approccio con tecnica Cad/Cam. Teamwork clinic 2-2011, 42-53.
[17] Agustín-Panadero R , Solá-Ruíz MF , Chust C, et al. Fixed dental prostheses with vertical tooth preparations without finish lines: a report of two patients. J Prosthet Dent 2016;115: 520-526.
[18] Agustín-Panadero, R.; Martín-de Llano, J.J.; Fons-Font, A.; Carda, C. Histological study of human periodontal tissue following biologically oriented preparation technique (BOPT). J. Clin. Exp. Dent. 2020, 12, e597–e602.
[19] Moskow, B.S. Response of the gingival sulcus to instrumentation-A histological investigation of gingival curettage. J. Periodontol. 1964, 35, 112–126.
[20] Agustín-Panadero, R.; Serra-Pastor, B.; Fons-Font, A.; Solá-Ruíz, M.F. Prospective Clinical Study of Zirconia Full-coverage Restorations on Teeth Prepared with Biologically Oriented Preparation Technique on Gingival Health: Results After Two-year Follow-up. Oper. Dent. 2018, 43, 482–487.
[21] Paniz, G.; Nart, J.; Gobbato, L.; Mazzocco, F.; Stellini, E.; De Simone, G.; Bressan, E. Clinical Periodontal Response to Anterior All-Ceramic Crowns with Either Chamfer or Feather-edge Subgingival Tooth Preparations: Six-Month Results and Patient Perception. Int. J. Periodontics Restor. Dent. 2017, 37, 61–68.
[22] Serra-Pastor B, Bustamante-Hernández N, Fons-Font A, Fernanda Solá-Ruíz M, Revilla-León M, Agustín-Panadero R. Periodontal Behavior and Patient Satisfaction of Anterior Teeth Restored with Single Zirconia Crowns Using a Biologically Oriented Preparation Technique: A 6-Year Prospective Clinical Study. J Clin Med. 2021 Aug 6;10(16):3482. doi: 10.3390/jcm10163482. PMID: 34441778; PMCID: PMC8396819.
[23] De Waal H, Castellucci G The importance of restorative margin placement to the biologic width and periodontal health. Part IInt J Periodontics Restorative Dent, 13 (1993), pp. 461-471
[24] Padbury A Jr,Eber R, Wang H L Interactions between the gingiva and the margin of restorations, J Clin Periodontol, 30 (2003), pp. 379-385
[25] Llansana F, Magne I, Bauza G, Mesquida J, Transferring the finish line of an interim restorative to the definitive cast in biologically oriented preparation technique (BOPT) procedures: A dental technique, The Journal of Prosthetic Dentistry, Volume 128, Issue 5, 2022, Pages 847-85
[26] Serra-Pastor B, Loi I, Fons-Font A, Solá-Ruíz MF, Agustín-Panadero R. Periodontal and prosthetic outcomes on teeth prepared with biologically oriented preparation technique: a 4-year follow-up prospective clinical study. J Prosthodont Res. 2019 Oct;63(4):415-420. doi: 10.1016/j.jpor.2019.03.006. Epub 2019 Apr 8. PMID: 30975559.
[27] Георгиев Д., Приложение на временни конструкции получени чрез 3D принтиране на лазерен стереолитографски принтер. Дисертация, МУ-Варна, Варна 2021г.

[28] Mizrahi B. Temporary restorations: the key to success. *Br Dent J.* 2019;226(10):761-768. doi:10.1038/s41415-019-0360-10
[29] Magallanes Ramos R, Clark D, Mazza M, Venuti P, Maiolino M, Kopanja S, Cirimpei V, Tawfik AA, Bordonali D, Acatrinei B, Sutradhar JC, Czerwinski M, A Sienkiewicz JK. The Shoulderless Approach A New Rationale in Prosthetic Dentistry. Tomorrow Tooth Journal. 2017;1:1-29
[30] Guler A U, Kurt S, Kulunk T. Effects of various finishing procedures on the staining of provisional restorative materials. *J Prosthet Dent* 2005; **93:** 453–458.
[31] Wolcott RB, Paffenbarger GC, Schoonover IC. Direct resinous filling materials: temperature rise during polymerization. J Am Dent Assoc 1951;42: 253-63.
[32] Grossman LI. Pulp reaction to the insertion of self-curing acrylic resin filling materials. J Am Dent Assoc 1953;46:265-9. ; Plant CG, Jones DW, Darvell BW. The heat evolved and temperatures attained during setting of restorative materials. Brit Dent J 1974;137:233-8.
[33] Grajower R, Shaharbani S, Kaufman E. Temperature rise in pulp chamber during fabrication of temporary self-curing resin crowns. J Prosthet Dent 1979;41:535-40.
[34] Driscoll CF, Woolsey G, Ferguson WM. Comparison of exothermic release during polymerization of four materials used to fabricate interim restorations. J Prosthet Dent 1991;65:504-6.
[35] Michalakis K, Pissiotis A, Hirayama H, Kang K, Kafantaris N. Comparison of temperature increase in the pulp chamber during the polymerization of materials used for the direct fabrication of provisional restorations. J Prosthet Dent. 2006 Dec;96(6):418-23. doi: 10.1016/j.prosdent.2006.10.005. PMID: 17174659.
[36] O'Brien WJ. Dental materials and their selection. 3rd ed. Chicago: Quintessence; 2002. p. 121-2.
[37] Moulding MB, Teplitsky PE. Intrapulpal temperature during direct fabrication of provisional restorations. Int J Prosthodont 1990;3:299-304.
[38] Moulding MB, Loney RW, Ritsco RG. Marginal accuracy of indirect provisional restorations fabricated on polyvinyl siloxane) models. Int J Prosthodont 1994;7:554-6.
[39] Rancitelli D, Healing and remodeling of connective tissue graft around implants with poor keratinized mucosa. Influence of provisionalization timing (delayed vs immediate) using BOPT abutments. A clinical observational controlled pilot study, Doctoral Thesis, University of Milan, 2015
[40] Kingman A. A procedure for evaluating the reliability of a gingivitis index. J Clin Periodontol 1986;13(5):385-91.
[41] Zucchelli G, De Sanctis M. Long-term outcome following treatment of multi- ple Miller class I and II recession de- fects in esthetic areas of the mouth. J.Periodontol 2005; 76(12): 2286-92

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