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Vertical Biologically Oriented Preparation Technique (BOPT)

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Abstract

The abutment tooth preparations for fixed prosthesis can be tried by a variety of methods, with the most common being the specified margin preparation and the vertical preparation or feather edge preparation. The second one was first utilised for prosthesis on abutment teeth that had periodontal disease and had been treated with resective surgery. In vertical preparation, we can alter gingival tissues to our desired contours using a rigorous, phased approach that includes preparation, provisionalization, and final prosthesis. The technique of vertical preparation in which finish line is absent, is a method in which the abutments are prepared by using a diamond rotary instrument into the sulcus to remove the existing cement-enamel junction and to make a new prosthetic cement-enamel junction controlled by the margin of the prosthesis.

Keywords: BOPT, Vertical preparation, feather-edge, edgeless preparation.

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1. Introduction

Rehabilitation using tooth-supported fixed partial dentures (FPDs) is one of the broadly carried out treatment modality for rehabilitating missing teeth and provides extraordinary long stretch clinical persistence. In any case, FPD may experience various loads, including gingival recession, which is reflected in the anterior region. The reason behind this type of complication includes the connection among abutment preparation and continuous gingival stimulation due to poor marginal fit amongst the abutment and FPD.[1]

Conventionally, when dentist prepare a dental abutment for receiving FPDs, a finish line is created on the tooth where the restoration seats. These finish lines can be supragingival or subgingival, the latter being more prone to gingival inflammation.[2] Apart from the gingival location, the finish lines are classified into 2 main groups: horizontal finish lines, which include chamfer and shoulder, or vertical lines, which consists of feather or knife-edge margins.[2]

For fixed restorations, another tooth preparation method without a finish line can be used, called biologically oriented preparation technique (BOPT). The dentist reduces the appearance of the anatomical crown that suits the existing cementoenamel junction (CEJ) to generate a new prosthetic junction based on the preferred location of the gingival margin.[3]

One of the major clinical problems of fixed prosthesis around natural teeth is the undesirable results due to the apical migration of the gingiva. With the use of BOPT (biologically oriented preparation technique) concept, clinicians and laboratory technicians can interconnect with adjoining tissues by altering the shape and scalloped structure of surrounding tissues without having to consider any pre-existing tooth or gum restrictions.[4]

It is known that gingival recession is related to different factors:[5,6]

1. Insufficient quantity and quality of keratinized gingiva i.e. gingiva with thin biotypes are more prone to gingival recession
2. Response to trauma while doing restoration work (tooth preparation, soft tissue isolation). Chronic inflammation caused by prosthetic errors i.e. open margins, infringement of biological width, excessive horizontal contour
3. Injuries caused by tooth brushing and poor oral hygiene.

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Using the BOPT concept, emergent anatomy of the tooth can be transferred to prosthetic crowns. This permits free interrelation with the gingiva to adapt, reshape and set new shapes and contours. According to the traditional definition of "overcontour", the profile of the crown obtained with BOPT technology may seem too obvious. Clinically, there is no excessive contour, but "different new contour" and the newly created PCEJ (prosthetic cementoenamel junction). There are various advantages, disadvantages and indications of BOPT technique.[7,8,9] (Table 1)

2. Clinical and Laboratory Steps

2.1 Armamentarium

Variety of diamond burs permits the execution of all the steps concerned within the preparation of teeth, from proximal separation of adjoining teeth to preparation of the axial walls, conforming to the vertical preparation technique. 17 diamond burs with various shapes grits and surface structure that offers them to work while not creating grooves indentations and roughness which will forestall the proper and natural remodelling of the mucosa. The various grits permit phased polishing of the tooth to achieve a favourable surface finish[9] (Table 2).

2.2 Tooth preparation steps to be followed according to BOPT

1. Proximal preparation
2. Incisal preparation
3. labial inclined reduction of incisal edge
4. Supragingival axial (labial/palatal) reduction
5. Intra-sulcular reduction
6. finishing of the tooth preparation
7. Temporization
8. Fabrication of definitive prosthesis in lab.

2.3 Clinical steps for Anterior tooth preparation as per BOPT (Figure 1)[10,11]

Step 1: Proximal preparation with thin flame drill FG862/010C. The final separation should be slightly over-tapered in terms of Total Occlusal Convergence (TOC) for two reasons: firstly iatrogenic damage to the adjacent teeth is less likely, and secondly it should be noted that in the subsequent "gingitage" (Ingraham *et al*, 1981) stages the TOC tends to reduce as the tooth is prepared. The slight initial over-taper compensates for this and avoids undercuts.

Step 2: Perform the incisal preparation of 2 mm with coarse grit flame drill (FG862C/016C) till the DEJ is clearly visible.

Table 1. Indications, advantages and disadvantages of Biologically Oriented Preparation Technique (BOPT)

Indications of BOPT	Advantages of BOPT	Disadvantages of BOPT
The BOPT method is a conservative to the horizontal margin and is suitable for following clinical situations: • Pathological damage from erosive wear. • When quality and quantity of keratinized gingiva is inadequate • Biological width is violated • To change shape and size of crown	• Possibility of repositioning the final goal line i.e. controlled infringement of the gingival sulcus), without compromising the adaptation of the restoration edge. • To achieve ideal aesthetic gingiva structure (adaptive shape and contour) by creating a new prosthetic cementoenamel junction (PCEJ). • Preserves tooth structure. • Easy to replace and repair temporary crowns. Biological advantages: • Thickness of gingiva is maintained • Over time, the stability of the gingival margin increases. • The gingival margin can be coronalized.	• Un-esthetic as the thin layer of ceramic in the cervical area is opaque. • Overhanging uneven edges. • Injury to the epithelial junction and uncertain tissue healing. The delay for tissue healing in the interim repair phase is minimum 6 weeks. • Marginal seal and integrity cannot be controlled. • The ceramic is fragile in the cervical area. • Final crown fitting cannot be evaluated. It is difficult to remove excess cement. • Difficulties in working with laboratories, especially in providing information on the appropriate scope of prosthesis.

Table 2. Grit size and color coding of Diamond burs used in Tooth Preparation

Colour coding	Type	Grit in µm
Green	Coarse	125
Blue	Medium	105
Red	Fine	40
Yellow	Superfine	20

Step 3: 45° labial inclined reduction from the incisal edge with the drill FG862G/016C, till the DEJ previously exposed is approached.

Step 4: Supragingival axial reduction of labial and palatal surfaces with the coarse grit drill FG862G/012C is carried out. The preparation is done in such a manner so as to avoid touching the gingival margin.

Step 5: Intrasulcular preparation: The drills are designed in a manner so that they do not leave any indentations or rough surfaces and permits the fine adaptation of the gingival. The drill FG862C/012C is utilized as an inquest to enter in the gingival sulcus in a slanting manner. It allows the drill to prepare the tooth with its body excluding its tip. It is likely that the tip can lead to unevenness on the axial walls. Once the drill is placed at an angle, gradually make it vertical for the tooth preparation of the axial plane.

Step 6: Palatal/lingual preparation with the drill FG868C/023C. The burr is then kept mesiodistally and palatally in the same way until axial reduction is finished. The aim is for 10-20 degrees of taper with a minimum cingulum height of 3 mm.

Step 7: Tooth preparation is finished with fine grit drills. The cervical area where the crown margins are to be placed should be highly polished.

2.4 Clinical steps for Posterior tooth preparation as per BOPT (Figure 2)[10,11]

Step 1: Proximal preparation is done utilizing the coarse grit flame drill FG862/010C.

Step 2: In contrast to the anterior teeth, in posterior teeth the occlusal surface is reduced placing the tapered drill FG856/018 so as to follow the morphology of the cusps.

Step 3: 45° inclined buccal and lingual reduction from the occlusal margin is carried out with the bur FG862G/016C till the DEJ is approached.

Step 4: Supragingival axial reduction of buccal and lingual surfaces utilizing the coarse grit drill FG862G/012C is accomplished. The preparation is done in this manner to avoid any injury to the g ingiva. Overall preparation of the tooth is then carried out.

Step 5: Intrasulcular preparation: The bur FG862C/012C or FG862C/016C acts as a probe, to enter the gingival sulcus in an oblique manner. Once the drill is placed in a slanting manner, slowly make it vertical to carry out the preparation of the axial planes utilizing the drill FG862G/012 for the mesio-distal surfaces.

Step 6: Final tooth preparation is done with the fine grit burs and then if needed, yellow coded (superfine) drills can be utilized for the purpose. The surface is polished at the margin area where the restoration will be finally placed.

2.5 Temporization

The vertical preparation method permits the gingival tissues to conform to the lineation of the restoration. The prosthetic convention i.e. biologically oriented preparation method, indicates that the soft tissues modify themselves to the preparation and the restoration. Temporary crown relining is executed primarily based on a diagnostic wax-up of an acrylic crown with a contour that is in accordance to the marginal gingiva. Subsequent to, assessing the fit of the crown it is adjusted with autopolymerising resin and relined properly. As soon as material sets, the crown indicates two prominent edges: an inner one, which represents the intrasulcular part of the abutment and the thicker outer one illustrates the gingival margin. The area between these 2 margins is the negative replica of the gingiva. The extra material is eliminated, which connects the crown margin with the marginal gingiva. With this an angular element could be shaped together with a CEJ that will be located within 0.5 to 1 mm in the gingival sulcus, thereby maintaining the periodontal health and biologic width[10]. The rotary tools permit preparation of teeth according to the B.O.P.T. technique. The rotary tools include tungsten carbide burs with variety of shapes, a diamond disc with superfine grit, a boar bristle brush, steel mandrels, Moore discs in medium grit corundum, and a rubber polisher with in-built diamond grit.

After a precise finishing, the restoration is luted and the unwanted cement is cleaned. The edgeless preparation will form a gap that will be taken by a clot which has

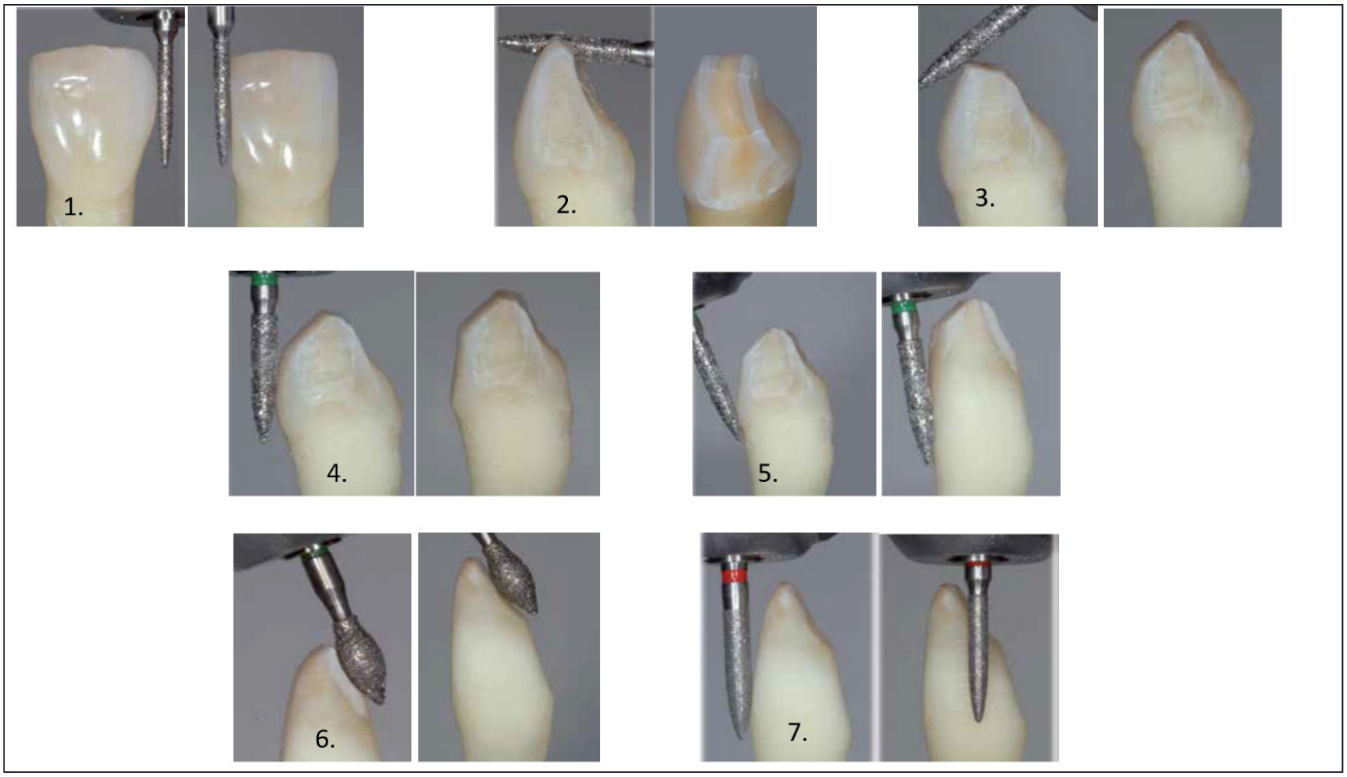


Figure 1. Clinical steps for Anterior tooth preparation according to BOPT**;** Step 1. Preparation with thin flame drill; 2. Proximal preparation with thin flame drill; 3. 45° labial inclined reduction from the incisal edge; 4. Supragingival axial reduction of labial and palatal surfaces; 5. Intrasulcular preparation; 6. Palatal/lingual preparation; 7. Final Tooth preparation is finished with fine grit burs.

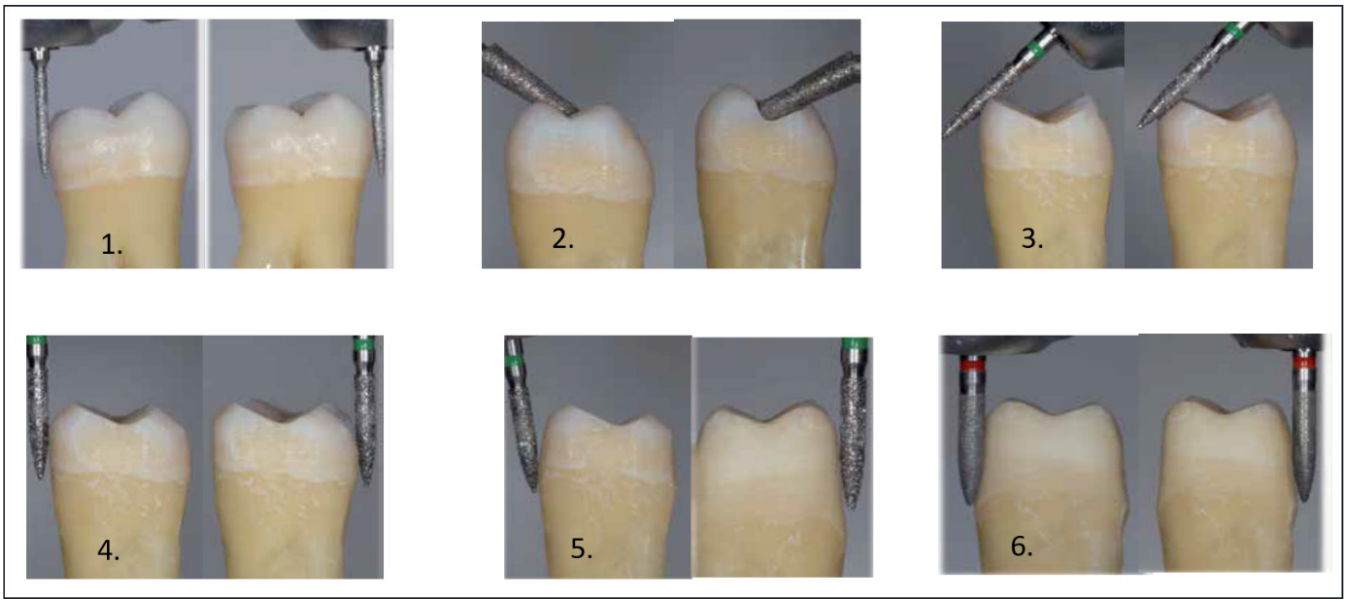


Figure 2. Clinical steps for Posterior tooth preparation according to BOPT; Step 1. Proximal preparation; 2. Occlusal reduction; 3. 45° inclined buccal and lingual reduction from the occlusal 4. Supragingival axial reduction of buccal and lingual surfaces; 5. Intrasulcular preparation; 6. Final Tooth preparation is finished with fine grit burs.

resulted from gingival sulcus bleeding. The sulcular part of the provisional crown's margin will support the overall marginal gingiva that allows the clot preservation into a totally organized soft tissue. The restoration method would decide the attachment and thickness of the gingival tissue, which follows the new emergence profile[2].

2.6 Impression technique and Laboratory procedure for fabrication of definitive prosthesis

After not less than 24-28 days, the soft tissue position might be established and it will be viable to make the impression for the definitive restoration. To make method quicker and trouble-free there should be no finish line. Utilization of retraction cord is advised to have a proper demarcation of the gingival sulcus so that it assists the technician throughout the laboratory procedures[3]. Final wax-up is done on the master cast acquired following the treatment plan and the dentist's instructions. Prime consideration for the lab protocol is to take up the wax-up of the cervical third prior to initiating the ditching of master cast, such that it acquires the gingival tissues as area of reference[3]. There is a variance between horizontal and vertical tooth preparations. In the horizontal preparations, margin is prepared by the dentist as a rightly placed line on the tooth surface, which is then recorded in the final impression and ultimately transferred to cast. While in vertical preparations, the finish line is determined by the lab technician by taking the cervical margin revealed on the impression as an area of reference. It is always better to have a control over the gingival contours before uncovering the prepared region. 0.5 mm pencil of black color is utilized to trace over the gingival profile jutting it on the tooth's axial wall (black line). Then, the gingival element across the abutment is detached, displaying the subgingival region of the prepared tooth replicated on the cast.[10]

The apical section of the cast is then highlighted by using a blue pencil it is traced. The part lying between the two edges i.e. black and blue, is now known as the "finishing area" and the lab expert will denote the "finish line" with a red colour pencil. This particular line will be the placement of coronal margin. Apical or coronal placement of this line will rely upon the floor of gingival sulcus and the cosmetic outcome needed. However, the edge of the restoration should never encroach upon the junctional epithelium. Reference line is a red colour line which should be considered for the ditching process and for removing the underlying section which is not useful to the technician. The emergence profile is obtained following the gingival tissue contours. The final wax-up is then processed followed by finishing and polishing of the definitive restoration[13].

3. Discussion

The important consideration in rehabilitation is to get premium cosmetic outcomes and also protection of the biological structures as much as is achievable. Vertical preparation also known as edgeless preparation is the 'rotary gingival curettage' (gingitage, verti prep, edgeless) procedure, developed by Di Febo, Carnevale[8], and recently by Ignazio Loi[3]. It is additionally called as the 'biologically oriented preparation technique' (BOPT) and comprises of:

1) subgingival finish line,
2) Tooth preparation seal coronal to the finish line,
3) Emergence profile should be such that it lies superior to the cemento-enamel junction (CEJ), by designing a new junction.

Finish line of the tooth preparation can be present at various levels of the gingival sulcus and it completely depends upon the available biological width[14,15].

Challenges of the procedure are to such an extent that it generally ends up in irreversible harm to the epithelial attachment with encroachment of the biological width. However, taking note of the usage of unique round-ended two degrees tapered diamond drills with non-working tip has obtained the recognition among dentists. This bur has a maximum diameter of 1.2 mm, apical diameter of 0.7 mm, and non-working tip of 1 mm, which decreases the injury to the epithelial attachment. Biological width will decide the length and width of the non-cutting end of the bur. Rotary gingitage causes slight bleeding however, is only restricted to sulcular epithelium. Literature based evidence suggests, recently developed epithelium is thick that binds intimately to newly fabricated restoration; but it is mandatory to manufacture an accurate, even and well finished temporary and final restoration[16].

The edgeless preparation is discrete from shoulderless approach which focuses on subgingival finish line and placement of the seal coronal to the finish line of prepared tooth for the indirect restoration. Vertical preparation helps in recording the emergence details in accordance to

the anatomy of the tooth to obtain the prosthetic crown. This permits adaptation of gingiva that will modify and alter itself around new anatomy and morphology. The restoration fabricated with the vertical preparation method can appear more prominent, which is in line with the definition of "overcontour".[18] Per se, there is no unanimity on how "normal" morphology should be. Sorensen[18] stated that a vertical contour up to 45 degrees can be recognized as optimum.

Vertical preparation is indicated for restorations wherein monolithic zirconia crowns are to be executed with narrow and specific the finish line. In case of teeth with short height, where enhanced retention is required parallel tooth preparation with BOPT design is utilized by the clinicians, such as in mandibular anteriors wherein, a shoulder finish line would result in virtually complete removal of tooth structure. If not carefully managed this margin creates high stress distributions in comparison with other margin types during firing and when occlusally loaded[18]. This may lead to a margin which is low in tension and hence may lead to distortion[20]. In the present literature, there are merely a number of clinical analysis studies relating to vertical preparation. The evidence-based dentistry still does not provide us the possibility to evaluate the accuracy of the vertical preparation technique. Therefore, it is vital to perform studies and research in relation to vertical preparation which has clinical relevance[21,22,23].

4. Conclusion

BOPT concepts allows us to look for biologically compromised clinical situations. With the exception of vertical preparation and over contoured crowns, Zenith position can be controlled and make our gingival biotype thicker. This gives the beauty of a stable long-lasting and esthetically acceptable tissues around the prosthesis.

Vertical preparation without the finish line of the teeth is an alternate process of preparation for the crown. It increases the thickness of the soft tissue and accomplish acceptable aesthetic outcome and stimulates healthy and stable soft tissue. However, clinical trials needs to be verify the consequences of these clinical reports and to verify technology.

In BOPT technology, clinicians and laboratory technicians interrelate with adjoining tissues and improve skills and outcome. Clinical outcomes are obtained through the provisional and final restoration (marginal placement, emergent profile, tooth shape). This prosthetic procedure is easier and faster than other preparation techniques (chamfer, shoulder, etc.) using the flapless feather edge preparation.

High quality clinical and esthetic outcome in relation to soft tissue stability can be achieved at the prosthetic/tissue articulation with a minimally invasive approach, preserving the biological structures as much as is feasible.

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