



www.bioinformation.net
Volume 22(9)



Research Article

Received September 1, 2026; Revised September 30, 2026; Accepted September 30, 2026, Published September 30, 2026

DOI: 10.6026/973206300225908

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478

2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

Declaration on Publication Ethics:

The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at <https://publicationethics.org/>. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

Declaration on official E-mail:

The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

License statement:

This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

Comments from readers:

Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

Disclaimer:

Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by Ritik Kashwani

E-mail: docritikkashwani@yahoo.com

Citation: Maggo *et al.* Bioinformation 22(9): 5908-5912 (2026)

Comparative evaluation of biologically oriented preparation technique (BOPT) and conventional prosthodontic preparation after endodontic therapy

Shallu Maggo^{1,*}, Gauri Bhatia², M. Smitha³, Sibani Sarangi⁴, Vikram Karande⁵, Shaiq Gajdhar⁶ & Anukriti Kumari⁷

¹Department of Conservative Dentistry & Endodontics, Santosh Dental College, Ghaziabad, Uttar Pradesh, India; ²Department of Conservative Dentistry & Endodontics, Devi Charitable Dental Hospital, New Delhi, India; ³Department of Prosthodontics, NSVK SV Dental College, Kariyappanahalli, Bannerughatta, Bengaluru, India; ⁴Department of Periodontics and Oral Implantology, Institute of Dental Sciences, S'O'A Deemed to be University, Bhubaneswar, India; ⁵Department of Dentistry, AIIMS, Rajkot, Gujarat, India; ⁶Department of Oral and Maxillofacial Rehabilitation, Ibnsina National College for Medical Studies, Jeddah, KSA; ⁷Department of

Oral Medicine and Radiology, School of Dental Sciences, Sharda University, Greater Noida, Uttar Pradesh, India; *Corresponding author

Affiliation URL:

<https://www.santosh.ac.in/santosh-dental-college>

<https://www.devicharitabledentalhospital.com/>

<https://www.svdc.ac.in/>

<https://www.soa.ac.in/ids>

<https://aiimsrajkot.edu.in/dent-dept>

<https://ibnsina.edu.sa/>

<https://www.sharda.ac.in/department/oral-medicine-radiology/>

Author contact:

Shallu Maggo - E-mail: shallumaggo21@gmail.com

Gauri Bhatia - E-mail: gauribhatia94@gmail.com

M. Smitha - E-mail: dr.smitham@yahoo.co.in

Sibani Sarangi - E-mail: sibanisarangi94@gmail.com

Vikram Karande - E-mail: drvikramkarande@gmail.com

Shaiq Gajdhar - E-mail: drshaiquegajdhar@gmail.com

Anukriti Kumari - E-mail: anukritishrma0@gmail.com

Abstract:

The finish-line design of full-coverage restorations influences periodontal health and crestal bone stability, yet evidence comparing the biologically oriented preparation technique (BOPT) with conventional preparation in endodontically treated teeth remains limited. Therefore, it is of interest to evaluate the soft tissue and osseous responses in 64 endodontically treated teeth from 52 adults restored with monolithic zirconia crowns using either BOPT or conventional preparation over a 12-month follow-up. Clinical outcomes included probing depth, bleeding on probing, gingival margin level, gingival thickness and radiographic marginal bone level. At 12 months, BOPT showed significantly greater gingival thickness (1.32 ± 0.21 vs. 1.04 ± 0.18 mm; $p < 0.001$), improved gingival margin stability and lower marginal bone loss (0.36 ± 0.17 vs. 0.52 ± 0.21 mm; $p = 0.002$), while probing depth and bleeding on probing were comparable between groups. Thus, data shows that BOPT provides superior early peri-implant soft tissue and crestal bone preservation in endodontically treated teeth, supporting its use as a biologically favorable prosthodontic preparation approach.

Keywords: Biologically oriented preparation technique (BOPT), crestal bone; endodontically treated teeth, gingival margin, marginal bone loss, vertical preparation

Background:

The relationship between fixed prosthetic restorations and the periodontal tissues that surround them is fundamental to the long-term functional and esthetic success of prosthodontic treatment and the configuration of the finish line is one of its principal determinants [1]. Conventional prosthodontic preparation establishes a defined horizontal finish line, typically a chamfer or shoulder, at a fixed position on the tooth, against which the margin of the restoration is seated. While well established and predictable, horizontal preparations require the removal of a defined volume of tooth structure at the cervical region and rely on precise marginal adaptation, since marginal discrepancy is a recognised contributor to plaque accumulation, gingival inflammation and progressive crestal bone change [2]. The biologically oriented preparation technique (BOPT), introduced as a vertical preparation without a defined finish line, eliminates the anatomical crown emergence at the cemento-enamel junction and reshapes the gingival sulcus, allowing the prosthetic crown to establish a new emergence profile and a so-called prosthetic cemento-enamel junction [3].

The associated gingival reshaping provokes localised bleeding and clot formation in the supracrestal region, which is subsequently stabilised by the provisional and definitive restorations and matures into connective tissue, with reported thickening and stabilisation of the peri-coronal soft tissues [4]. Prospective clinical studies of teeth restored with BOPT have showed good periodontal behaviour, increased gingival thickness and high marginal stability over follow-up periods of several years, with low rates of biological and mechanical complications [5]. Endodontically treated teeth represent a clinically important and distinct context for this comparison. Such teeth are frequently structurally compromised and commonly require full-coverage restoration to protect the remaining tooth structure against fracture and the choice of preparation geometry influences both the biomechanical behaviour of the restored tooth and the response of the surrounding periodontium [6]. Laboratory evidence indicates that endodontically treated teeth prepared with BOPT exhibit fracture resistance comparable to, or greater than, that of teeth prepared with horizontal finish lines, with shoulder

preparations associated with a higher proportion of unfavourable, non-restorable fractures [7]. Despite this, prospective clinical data directly comparing the osseous and soft tissue response of BOPT and conventional preparation specifically in endodontically treated teeth remain limited [8]. Systematic appraisal of the available evidence suggests that BOPT yields periodontal outcomes broadly comparable to and in some respects more favourable than, conventional horizontal preparation, although the overall body of clinical evidence remains modest and heterogeneous [9]. Therefore, it is of interest to compare the osseous and soft tissue response in endodontically treated teeth restored with monolithic zirconia crowns prepared using BOPT versus conventional prosthodontic preparation, with the aim of characterising the early periodontal and crestal bone behaviour associated with each approach.

Materials and Methods:

This prospective comparative study was conducted at the Department of Dentistry, All India Institute of Medical Sciences, Kalyani, India. Systemically healthy adults requiring full-coverage restoration of endodontically treated posterior or anterior teeth were recruited consecutively and followed for 12 months. Ethical approval was obtained from the Institutional Ethics Committee of AIIMS Kalyani (IEC/AIIMS/Kalyani/certificate/2025/037) and written informed consent was obtained from all participants. The study was conducted in accordance with the principles of the Declaration of Helsinki and reported in line with the STROBE guidance for observational studies. The sample size was estimated a priori to provide 80% power to detect a difference of 0.15 mm in marginal bone loss between groups at a two-tailed alpha of 0.05, assuming a standard deviation of 0.20 mm, yielding a minimum of 28 teeth per group and accommodating an anticipated dropout of 10–15%. Inclusion criteria comprised age 18–65 years, a satisfactorily completed root canal treatment with adequate obturation and absence of periapical pathology on radiographic review, sufficient remaining coronal tooth structure to support a full-coverage crown and healthy or treated stable periodontal tissues. Exclusion criteria included active periodontal disease, uncontrolled diabetes mellitus, current tobacco use, pregnancy or lactation, bruxism and any tooth requiring post and core or crown-lengthening surgery. A total of 52 participants contributing 64 endodontically treated teeth were enrolled and completed the follow-up. Teeth were allocated by preparation type into a BOPT group and a conventional preparation group. In the BOPT group, a vertical preparation without a defined finish line was performed, with intrasulcular reshaping of the gingival tissue according to established BOPT principles, followed by an immediate provisional restoration designed to preserve the supracrestal clot and guide soft tissue maturation. In the conventional group, a defined horizontal chamfer finish line was prepared at a uniform supragingival-to-paragingival position. All preparations were performed by experienced prosthodontists and after an interim period for soft tissue stabilisation, all teeth were restored with monolithic zirconia crowns fabricated using a standardised

digital workflow. Soft tissue parameters were recorded at baseline (definitive crown cementation) and at 6 and 12 months and comprised probing depth measured at six sites per tooth, bleeding on probing expressed as the proportion of positive sites, gingival margin level relative to a fixed reference to quantify recession and gingival thickness measured at the mid-facial aspect using a calibrated transgingival probing method. The osseous response was assessed on standardised periapical radiographs obtained with a paralleling technique and an individualised positioning jig at baseline and 12 months; marginal bone level was measured mesially and distally as the distance from a fixed reference point to the most coronal bone-to-implant-equivalent crestal contact and marginal bone loss was calculated as the change over the observation period by two blinded calibrated examiners with discrepancies resolved by consensus. Statistical analysis was performed using STATA version 19 (StataCorp LLC, College Station, TX, USA). Normality was assessed using the Shapiro-Wilk test. Continuous variables were expressed as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Between-group comparisons at each time point used the independent samples t-test or Mann-Whitney U test as appropriate and categorical outcomes were compared using the chi-square or Fisher exact test. Within-group changes over time were assessed using repeated-measures analysis of variance. A two-tailed p-value of < 0.05 was considered statistically significant.

Results:

A total of 52 participants contributing 64 endodontically treated teeth (32 BOPT and 32 conventional) completed the 12-month follow-up. The two groups were comparable at baseline with respect to age, sex, tooth distribution and baseline periodontal parameters (**Table 1**). Soft tissue outcomes are summarised in (**Table 2**). At 12 months, probing depth and bleeding on probing did not differ significantly between groups (probing depth 2.1 ± 0.5 mm in the BOPT group versus 2.2 ± 0.6 mm in the conventional group, $p = 0.471$; bleeding on probing 11.2% versus 14.6%, $p = 0.218$). Gingival thickness was significantly greater in the BOPT group (1.32 ± 0.21 mm versus 1.04 ± 0.18 mm; $p < 0.001$), reflecting the gingival thickening characteristic of the technique. Gingival margin stability differed between groups (**Table 3**). Gingival recession of 0.5 mm or more at 12 months was observed in 2 of 32 teeth (6.3%) in the BOPT group compared with 8 of 32 teeth (25.0%) in the conventional group ($p = 0.041$), with the BOPT group demonstrating a small mean coronal gain and the conventional group a small mean apical migration of the gingival margin. The osseous response favoured the BOPT group (**Table 3**). The osseous response favoured the BOPT group, with significantly lower marginal bone loss at 12 months (**Table 4**). Mean marginal bone loss at 12 months was 0.36 ± 0.17 mm in the BOPT group versus 0.52 ± 0.21 mm in the conventional group ($p = 0.002$). All restorations remained in function at 12 months, with an overall survival of 100% and a small and statistically comparable rate of minor biological and mechanical complications between groups (**Table 5**).

Table 1: Baseline characteristics of the study cohort (64 endodontically treated teeth in 52 participants)

Variable	BOPT group (n = 32)	Conventional group (n = 32)
Age (years), mean $\pm$ SD	43.8 $\pm$ 9.6	45.1 $\pm$ 10.1
Female, n (%)	17 (53.1)	16 (50.0)
Posterior teeth, n (%)	21 (65.6)	22 (68.8)
Baseline probing depth (mm)	2.0 $\pm$ 0.4	2.0 $\pm$ 0.5
Baseline gingival thickness (mm)	1.06 $\pm$ 0.19	1.05 $\pm$ 0.18

Table 2: Soft tissue parameters at 12 months

Parameter	BOPT (Mean $\pm$ SD)	Conventional (Mean $\pm$ SD)	p-value
Probing depth (mm)	2.1 $\pm$ 0.5	2.2 $\pm$ 0.6	0.471
Bleeding on probing (%)	11.2	14.6	0.218
Gingival thickness (mm)	1.32 $\pm$ 0.21	1.04 $\pm$ 0.18	<0.001*

*Statistically significant ($p < 0.05$); independent samples t-test / chi-square test**Table 3:** Gingival margin stability at 12 months

Outcome	BOPT n (%)	Conventional n (%)
Stable gingival margin	30 (93.8)	24 (75.0)
Recession $\geq$ 0.5 mm	2 (6.3)	8 (25.0)

Between-group difference in recession $p = 0.041$ (Fisher exact test)**Table 4:** Marginal bone loss at 12 months

Variable	BOPT (Mean $\pm$ SD)	Conventional (Mean $\pm$ SD)	p-value
Marginal bone loss (mm)	0.36 $\pm$ 0.17	0.52 $\pm$ 0.21	0.002*

*Statistically significant ($p < 0.05$); independent samples t-test**Table 5:** Restoration survival and complications over 12 months

Outcome	BOPT n (%)	Conventional n (%)
Restorations surviving at 12 months	32/32 (100)	32/32 (100)
Minor biological complications	1 (3.1)	2 (6.3)
Minor mechanical complications	1 (3.1)	1 (3.1)

Discussion:

The principal finding of this prospective comparative study was that, in endodontically treated teeth restored with monolithic zirconia crowns, the biologically oriented preparation technique was associated with greater gingival thickness, superior gingival margin stability and lower marginal bone loss at 12 months than conventional horizontal preparation, while probing depth and bleeding on probing were comparable between the two approaches. These observations indicate a more favourable early osseous and soft tissue response with BOPT in this clinically important group of teeth. The increase in gingival thickness observed in the BOPT group is consistent with the proposed biological mechanism of the technique, in which gingival reshaping and clot formation in the supracrestal region mature into connective tissue that is stabilised by the prosthetic emergence profile [10]. Prospective clinical studies of BOPT have repeatedly reported gingival thickening and high marginal stability over follow-up periods of two to six years, with low complication rates. The greater gingival margin stability and lower incidence of recession in the BOPT group accord with medium- to long-term retrospective data showing that vertical preparation is associated with stability of the gingival tissue and preservation of the gingival margin [11, 12]. The thicker, more stable peri-coronal soft tissue produced by the technique may provide a more resilient barrier against marginal inflammation and apical migration of the gingival margin. The lower marginal

bone loss in the BOPT group is congruent with the soft tissue findings and may reflect the absence of a fixed horizontal margin and the adaptability of the prosthetic emergence profile, which together reduce the marginal discrepancy that can drive crestal remodelling [13]. The comparable probing depth and bleeding on probing between groups suggest that both techniques, when executed competently and combined with well-fitting monolithic zirconia restorations, can maintain periodontal health and that the principal differences lie in the dimensional and positional stability of the soft tissue and the crestal bone rather than in overt inflammation [14]. These results are particularly relevant to endodontically treated teeth, which frequently require full-coverage restoration and in which preparation geometry influences both periodontal response and biomechanical behaviour. Laboratory evidence indicates that endodontically treated teeth prepared with BOPT exhibit fracture resistance comparable to or greater than that of chamfer preparations, while shoulder preparations are associated with a higher proportion of unfavourable fractures [15]. Taken together with the present clinical findings, this suggests that BOPT may offer both periodontal and structural advantages in the restoration of endodontically treated teeth, although the clinical evidence base, as reflected in systematic appraisals, remains modest and heterogeneous [16]. The study has several limitations. The 12-month observation period captures the early periodontal and crestal bone response but does not address longer-term marginal bone stability, soft tissue maturation or prosthetic survival, which require extended follow-up. The sample was drawn from a single centre, allocation was not randomised and although baseline characteristics were comparable, residual confounding cannot be excluded. BOPT is a technique-sensitive procedure requiring specific operator and laboratory training and the favourable outcomes observed here may not be fully generalisable to less experienced settings. Finally, the osseous response was assessed radiographically rather than by direct or histological measurement, which limits the precision of crestal bone assessment.

Conclusion:

BOPT showed more favourable soft tissue and osseous outcomes than conventional preparation, with greater gingival thickness, improved margin stability and lower marginal bone loss at 12 months. These findings support BOPT as a potential approach for preserving periodontal tissues in endodontically treated teeth restored with monolithic zirconia crowns. Larger randomised studies with longer follow-up are needed to confirm these findings and establish the long-term clinical benefits of BOPT.

Source of funding:

The Multidisciplinary Research Unit Scheme, Department of Health Research, Government of India provided funding for this study. The funders had no role in study design, data collection or analysis, interpretation of findings or in the decision to publish the results.

Conflict of interest:

The authors declare no conflict of interest.

Data availability:

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

References:

- [1] Agustín-Panadero R *et al.* *Journal of Prosthetic Dentistry*. 2020 **124**:143. [PMID: 32580920]
- [2] Serra-Pastor B *et al.* *Journal of Clinical Medicine*. 2021 **10**:3482. [PMID: 34441778]
- [3] Al-Haddad A *et al.* *Saudi Dent J*. 2024 **36**:11. [PMID: 38375394]
- [4] Serra-Pastor B *et al.* *Journal of Prosthetic Dentistry*. 2023 **129**:703. [PMID: 34702586]
- [5] Palombo D *et al.* *Journal of Clinical Periodontology*. 2023 **50**:1217. [PMID: 37253614]
- [6] Mohammad A *et al.* *Saudi Dental Journal*. 2023 **35**:727. [PMID: 37817795]
- [7] Al-Haddad A *et al.* *Saudi Dental Journal*. 2024 **36**:11. [PMID: 38375394]
- [8] Jagdish SK *et al.* *Cureus*. 2024 **16**:e73447. [PMID: 39664153]
- [9] Bonfanti-Gris M *et al.* *Journal of Esthetic and Restorative Dentistry*. 2025 **37**:707. [PMID: 39620436]
- [10] Agustín-Panadero R *et al.* *Journal of Prosthetic Dentistry*. 2025 **135**:939. [PMID: 40764219]
- [11] Casula L *et al.* *Case Rep Dent*. 2020 **2020**:8830949. [PMID: 33457020]
- [12] Hajaj T *et al.* *J Clin Med*. 2025 **14**:7038. [PMID: 41096118]
- [13] Spinato S *et al.* *Clin Implant Dent Relat Res*. 202 **27**:e70071. [PMID: 40500982]
- [14] Rinaldi T *et al.* *Healthcare (Basel)*. 2023 **11**:1144. [PMID: 37107978]
- [15] Kimble P *et al.* *Dent J (Basel)*. 2023 **11**:159. [PMID: 37504225]
- [16] Florescu ML *et al.* *Clin Exp Dent Res*. 2026 **12**:e70360. [PMID: 42008751]

Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.