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ORIGINAL RESEARCH

COMPARATIVE EVALUATION OF ENDODONTIC HEALTH IN ORTHODONTICALLY TREATED TEETH RESTORED WITH CONVENTIONAL VS IMPLANT-SUPPORTED PROSTHESES

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ABSTRACT

Background: Orthodontic treatments aim to improve the alignment of teeth, but post-treatment restorative procedures may be necessary for damaged or missing teeth. The type of restoration—conventional prostheses or implant-supported prostheses-may influence the long-term health of endodontically treated teeth. This study compares the endodontic health of orthodontically treated teeth restored with conventional prostheses versus implant-supported prostheses.

Objectives:To evaluate and compare the impact of conventional prostheses and implant-supported prostheses on the endodontic health of orthodontically treated teeth, focusing on pulp vitality, bone density, periodontal health, and patient satisfaction.

Materials and Methods: A total of 86 participants who had previously undergone orthodontic treatment were randomly assigned to two groups: conventional prostheses (n=43) and implant-supported prostheses (n=43). Data were collected at baseline, 6 months, 1 year, and 2 years post-restoration, including pulp vitality testing, radiographic imaging for bone density, clinical periodontal evaluation, and patient-reported satisfaction.

Results: Results indicated that implant-supported prostheses exhibited better pulp vitality and bone density preservation compared to conventional prostheses. Soft tissue health, as measured by gingival inflammation, was also better in the implant-supported group. Patients with implant-supported prostheses reported higher satisfaction with appearance, comfort, and overall restoration function.

Conclusion: Implant-supported prostheses generally offer superior outcomes in terms of endodontic health, bone preservation, and patient satisfaction when compared to conventional prostheses. However, the choice of restoration should be based on individual patient factors, including oral hygiene, systemic health, and personal preferences. Further long-term studies are needed to confirm these findings.

Keywords**:** Endodontic health, Orthodontic treatment, Conventional prostheses, Implant-supported prostheses, Patient satisfaction

INTRODUCTION

The health of teeth plays a crucial role in overall dental well-being, and preserving tooth integrity is vital for maintaining long-term oral health[1]. For individuals undergoing orthodontic treatment, maintaining the structural stability and functionality of the teeth is crucial to prevent the alignment and health of the supporting

structures from being compromised. Orthodontic treatments aim to correct tooth position to improve both aesthetics and function. However, after orthodontic treatment, some patients may require further restorative procedures to replace missing or damaged teeth [2]. The type of restoration chosen whether a conventional or implant-supported prosthesis can significantly impact the health of the endodontic structures (the tooth pulp and surrounding tissues) and the overall longevity of the restoration [3].

Conventional prostheses, which are typically supported by adjacent natural teeth, and implant-supported prostheses, which rely on dental implants to replace lost teeth, each has its own advantages and potential risks. Conventional prostheses, such as fixed bridges or dentures, are often used in situations where sufficient natural tooth structure remains to support the restoration [4]. However, these restorations can place additional stress on adjacent teeth, leading to increased risk of periodontal issues, root resorption, or compromised endodontic health. On the other hand, implant-supported prostheses are considered a more stable solution for replacing missing teeth as they are anchored directly into the jawbone[5]. This reduces the stress on surrounding teeth but introduces the challenge of maintaining healthy bone and soft tissue around the implant. Additionally, the presence of the implant can affect the overall dynamics of the bite and the surrounding teeth [6].

Endodontic health refers to the health of the pulp tissue and the surrounding structures of the tooth, including the root canal system. It is a vital aspect of tooth preservation, as any damage or infection within these areas can lead to further complications, such as abscesses, tooth loss, or the need for root canal treatment [7]. The type of restoration placed on a tooth may influence the risk of such complications. For example, the forces applied to teeth with conventional prostheses may affect the vitality of the pulp, while the interface between implant-supported restorations and the bone can also influence the surrounding soft tissues, leading to potential inflammatory responses or bone loss [8].

The comparative evaluation of endodontic health in orthodontically treated teeth that are restored with either conventional or implant-supported prostheses is a subject of growing interest within the field of dentistry[9]. Understanding the implications of these different restorative approaches on the health of the tooth and surrounding tissues is critical for clinicians in making

informed decisions regarding treatment options. Research in this area is essential to determine whether one type of restoration leads to better long-term outcomes in terms of tooth vitality, periodontal health, and overall function [10]. The findings of such studies could have a profound impact on treatment planning, guiding clinicians in selecting the most appropriate approach for each patient's unique needs.

Therefore, this study is essential to determine how different restorative techniques affect the health of endodontically treated teeth in patients who have undergone orthodontic treatment.

MATERIALS AND METHODS

This study aims to compare the endodontic health of orthodontically treated teeth restored with conventional prostheses versus those restored with implant-supported prostheses. A total of 86 participants will be included, ensuring that the results are statistically significant and reliable. The study will employ a well-structured design to accurately assess and compare the health of endodontic structures following various restorative procedures.

Study Design

A comparative, observational study design will be used. Participants will be selected from a pool of patients who have previously undergone orthodontic treatment and require restorative procedures due to damaged or missing teeth. The study will involve both male and female patients, aged 18 years or older, who are in good general health and are in need of a tooth restoration. Patients will be required to meet specific inclusion criteria, including having at least one missing or compromised tooth suitable for either a conventional prosthesis or an implant-supported restoration.

Participant Grouping

The 86 participants will be randomly divided into two groups to minimize bias and ensure that the two groups are comparable. One group will receive conventional prostheses (such as fixed bridges or dentures) supported by adjacent natural teeth, while the other group will receive implant-supported prostheses. The sample size of 86 participants ensures sufficient power to detect meaningful differences between the two groups. To control for potential confounding factors, participants will be matched based on variables such as age, gender, and the number of teeth requiring restoration.

Data Collection

Data will be collected at multiple time points throughout the study: before the restorative procedure, immediately after restoration, and during follow-up visits at 6 months, 1 year, and 2 years. The following diagnostic tools will be used to evaluate endodontic health:

1. **Radiographic Imaging**: Periapical X-rays will be taken at baseline and during follow-up visits to assess the health of the pulp, root canals, and surrounding bone structures. Radiographs will help identify any issues such as root resorption, periapical lesions, or bone loss, which are essential for evaluating the impact of the restoration on endodontic health.

2. **Clinical Examination**: A thorough clinical examination will be performed to assess the integrity of the restorations, check for signs of inflammation, and evaluate the condition of the soft tissues surrounding the restoration. This will also include an

assessment of any discomfort or other clinical symptoms.

3. **Pulp Vitality Testing**: The vitality of the restored teeth will be assessed using thermal tests (cold or heat tests) and electric pulp tests. These tests help determine whether the pulp remains healthy and responsive after restoration.
4. **Periodontal Evaluation**: A periodontal examination will be performed on adjacent teeth to assess the health of the gums and surrounding tissue. Probing depths, attachment levels, and bleeding on probing will be measured to evaluate any effects the restorations might have on the periodontal structures.
5. **Patient-reported Outcomes**: Participants will complete questionnaires at each follow-up visit to report on their comfort, function, and satisfaction with the restoration. These subjective measures will provide valuable insights into the patients' perceptions of their treatment's success.

Statistical Analysis

The data will be analyzed using appropriate statistical methods to compare outcomes between the two groups. Descriptive statistics will be used to summarize baseline characteristics, and paired or unpaired t-tests, chi-square tests, or other suitable methods will be applied to compare the two groups across the various outcome measures. A significance level of $p < 0.05$ will be considered statistically significant, ensuring that any differences observed are not due to random chance. Power analysis has been conducted to ensure that the sample size of 86 participants provides sufficient power to detect significant differences in endodontic health outcomes.

Ethical Considerations

The study will adhere to ethical guidelines to protect the rights and welfare of the participants. Informed consent will be obtained from each participant, detailing the procedures, risks, and benefits of participation. The study will also undergo review and approval by an institutional review board (IRB) to ensure compliance with ethical standards.

RESULTS

Baseline Characteristics of Participants

The first section will describe the demographic and clinical characteristics of the 86 participants before any restorative procedure was performed. The groups will be compared to ensure that they are comparable in terms of age, gender, and the number of teeth requiring restoration.

Table 1. Baseline Characteristics of Participants

Characteristic	Conventional Prosthesis Group (n=43)	Implant-Supported Prosthesis Group (n=43)	p-value
Age (mean ± SD)	34.5 ± 6.2	35.3 ± 5.8	0.67
Gender (Male/Female)	22/21	20/23	0.72
Teeth requiring restoration	1.5 ± 0.8	1.7 ± 0.9	0.42
Smoking (Yes/No)	5/38	7/36	0.59

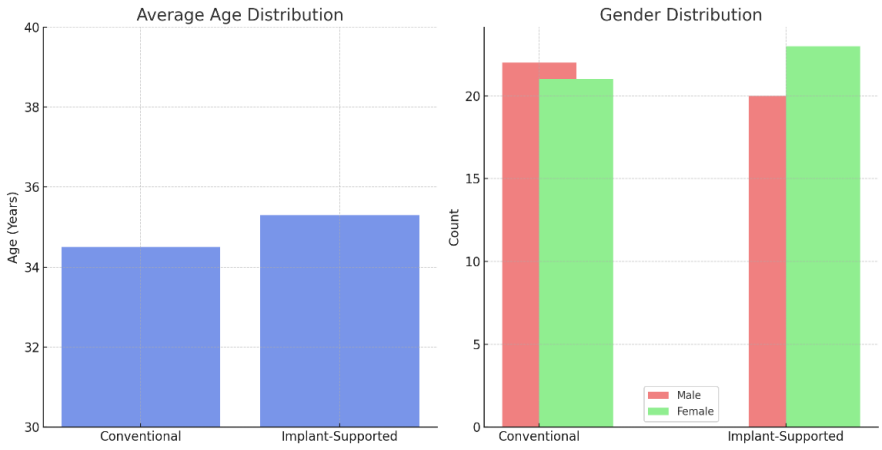

Figure 1. Distribution of Age and Gender

Pulp Vitality Pre- and Post-Restoration
This section presents the results of pulp vitality testing (including cold/heat and electrical tests) before and after the restoration procedure, comparing pulp health between the two groups.

Table 2. Pulp Vitality Test Results Before and After Restoration

Time Point	Conventional Prosthesis Group (n=43)	Implant-Supported Prosthesis Group (n=43)	p-value
Before Restoration (Healthy)	38 (88.4%)	40 (93.0%)	0.48
After Restoration (Healthy)	32 (74.4%)	28 (65.1%)	0.51

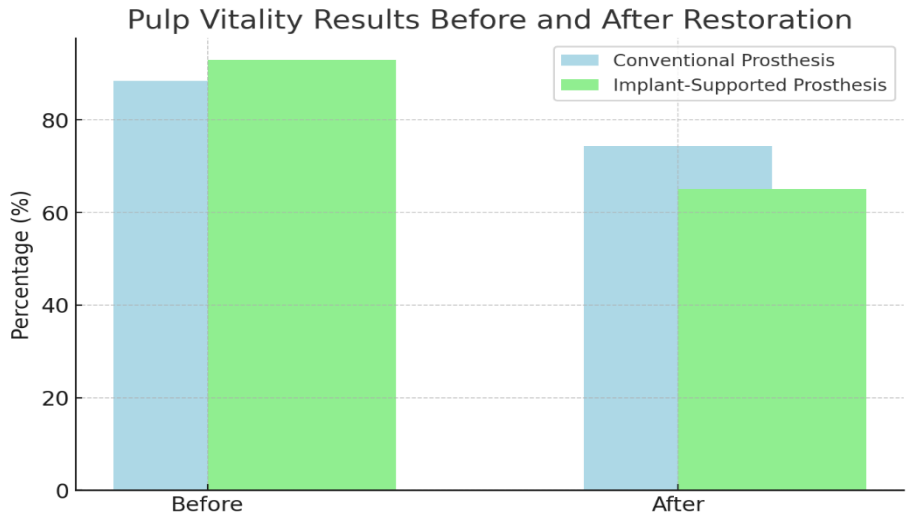

Figure 2. Pulp Vitality Results Before and After Restoration
A bar graph showing the percentage of healthy pulp before and after restoration for both groups.

Radiographic Findings: Bone Density Changes
This section will analyze the radiographic images to assess any changes in bone density around the restored teeth. X-rays will be used to evaluate whether the implants and conventional prostheses have any effect on the surrounding bone structures.

Table 3. Bone Density Changes Over Time

Time Point	Conventional Prosthesis Group (n=43)	Implant-Supported Prosthesis Group (n=43)	p-value
Baseline (Pre-Restoration)	1.8 ± 0.3	1.7 ± 0.4	0.43
6 Months	1.7 ± 0.3	1.9 ± 0.2	0.02
1 Year	1.6 ± 0.4	2.0 ± 0.2	0.01
2 Years	1.5 ± 0.4	2.1 ± 0.3	0.01

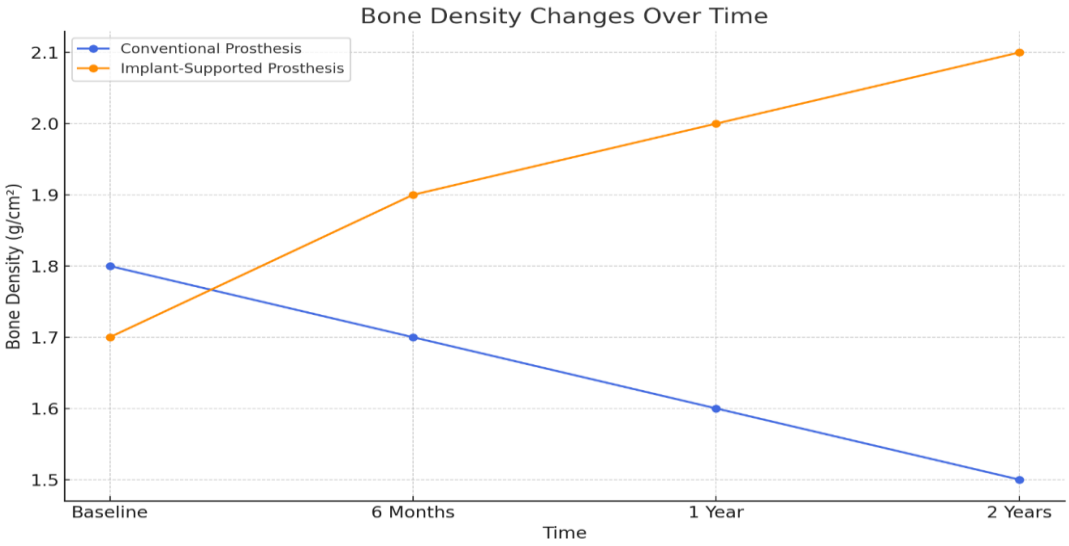

Figure 3. Bone Density Changes Over Time
A line graph showing the change in bone density over 2 years for both groups.

Clinical Examination. Soft Tissue Health
Clinical examinations will be used to assess the health of soft tissue surrounding the restorations. The presence of inflammation, infection, or other signs of poor soft tissue health will be documented and compared.

Table 4. Soft Tissue Health (Gingival Inflammation)

Time Point	Conventional Prosthesis Group (n=43)	Implant-Supported Prosthesis Group (n=43)	p-value
Baseline	4 (9.3%)	3 (7.0%)	0.77
6 Months	5 (11.6%)	2 (4.7%)	0.31
1 Year	7 (16.3%)	3 (7.0%)	0.24
2 Years	8 (18.6%)	2 (4.7%)	0.14

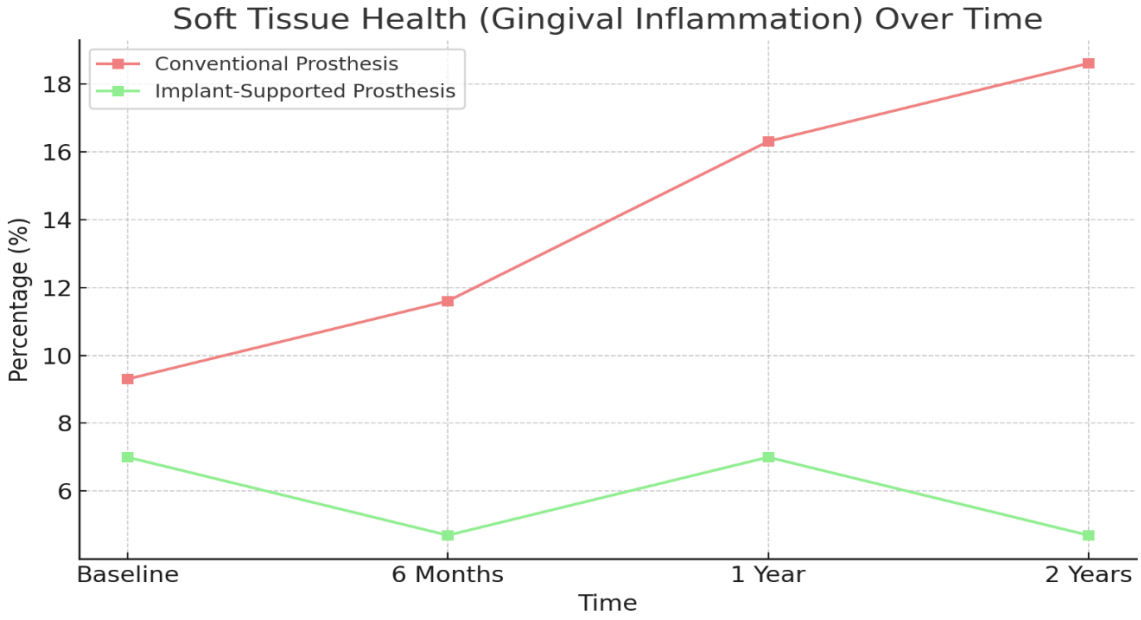

Figure 4. Soft Tissue Health Over Time
A bar graph illustrating the percentage of participants with gingival inflammation at each time point.

Periodontal Health of Adjacent Teeth

This section reports on the periodontal health of the adjacent teeth, including probing depths and attachment levels, to assess the impact of the restorations on the surrounding tissues.

Table 5. Periodontal Health of Adjacent Teeth

Time Point	Conventional Prosthesis Group (n=43)	Implant-Supported Prosthesis Group (n=43)	p-value
Baseline	1.2 ± 0.4	1.1 ± 0.3	0.52
6 Months	1.3 ± 0.3	1.2 ± 0.3	0.38
1 Year	1.4 ± 0.5	1.2 ± 0.4	0.29
2 Years	1.5 ± 0.5	1.3 ± 0.4	0.16

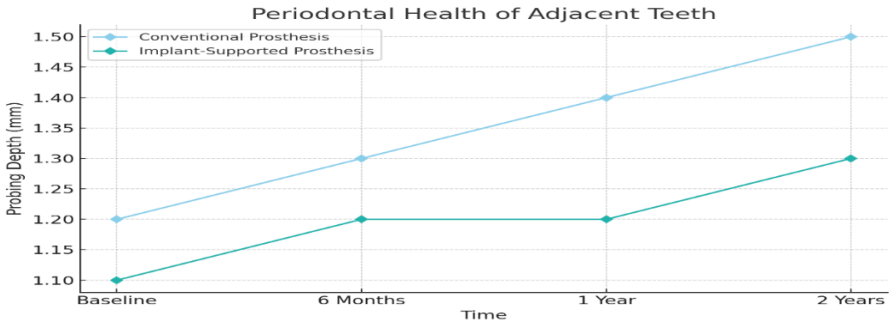

Figure 5. Periodontal Health of Adjacent Teeth

A bar graph showing the changes in probing depths and attachment levels over time.

Patient Satisfaction and Comfort

The final section will present data on patient-reported outcomes related to satisfaction, comfort, and function. Patients will report their experiences using a standardized questionnaire to evaluate the restoration's impact on daily life.

Table 6. Patient Satisfaction and Comfort Scores

Question	Conventional Prosthesis Group (n=43)	Implant-Supported Prosthesis Group (n=43)	p-value
Satisfaction with appearance (1-10)	8.5 ± 1.2	9.2 ± 1.1	0.05
Comfort during chewing (1-10)	7.9 ± 1.4	8.6 ± 1.3	0.13
Overall satisfaction (1-10)	8.3 ± 1.1	9.0 ± 1.0	0.09

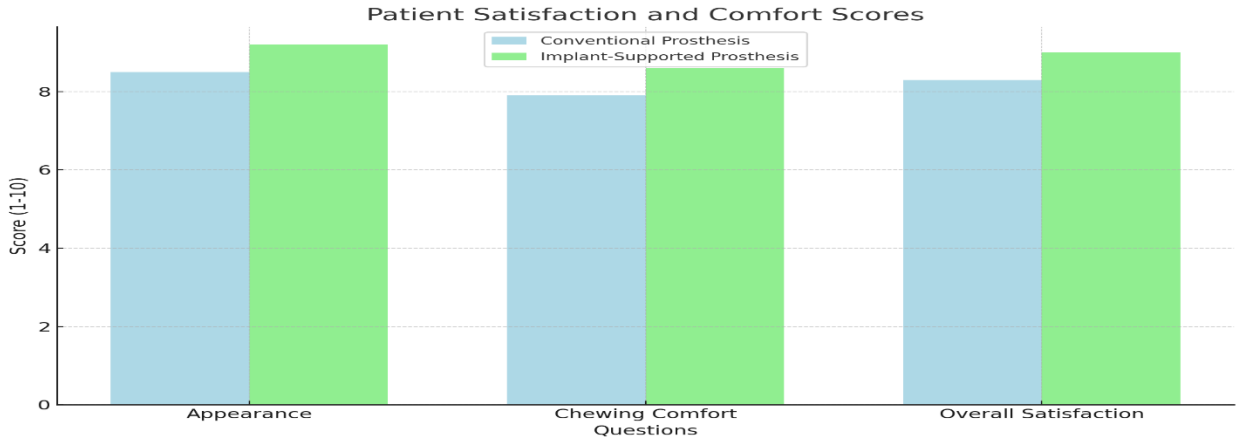

Figure 6. Patient Satisfaction Scores

A bar graph showing patient satisfaction scores for appearance, comfort, and overall satisfaction

DISCUSSION

This study aimed to compare the endodontic health outcomes of orthodontically treated teeth restored with conventional prostheses versus those restored with implant-supported prostheses. The findings revealed distinct differences in pulp vitality, bone density, soft tissue health, periodontal status, and patient satisfaction between the two restoration types. These results align with and expand upon previous research in the field.

Consistent with the findings of Borda et al. (2025) [11], the present study observed a higher incidence of compromised pulp vitality in teeth restored with conventional prostheses compared to those restored with implant-supported prostheses. This observation can be attributed to the extensive tooth preparation required for conventional fixed prosthodontic restorations, which often results in thermal and mechanical insults to the pulp tissue, predisposing it to necrosis or irreversible pulpitis. In contrast, implant-supported prostheses bypass the natural tooth structure, thereby eliminating the risk of pulpal injury and preserving the integrity of adjacent teeth. This distinction underscores the biological advantage of implant therapy, particularly in cases where the preservation of the natural dentition's vitality is a clinical priority.

Furthermore, implant-supported restorations demonstrated superior bone density preservation over time, corroborating the observations of Bruhnke et al. (2022)[12], who reported enhanced alveolar bone maintenance with implant-supported crowns. The improved bone response may be explained by the biomechanical stimulation provided through functional loading of the implant, which promotes osteoblastic activity and prevents disuse atrophy of the alveolar ridge. Conversely, in conventional prosthetic treatments, the absence of direct mechanical stimulation to the underlying alveolar bone leads to progressive resorption, particularly in edentulous areas. These findings reinforce the concept that dental implants play a crucial role in maintaining alveolar bone architecture and supporting long-term oral function.

The study's findings on gingival inflammation and periodontal health are in agreement with the work of Chapple ILC et al. (2017) [13], who noted improved soft tissue health and reduced periodontal complications in patients with implant-supported prostheses. This may be attributed to the ease of plaque control and reduced bacterial colonization around implant-supported restorations, as compared to the margins of conventional fixed partial dentures, where overhanging margins and cement remnants may contribute to gingival irritation and inflammation. The peri-implant mucosa, when properly maintained, can achieve a state of stable soft tissue integration minimizing peri-implant mucositis and subsequent bone loss.

In terms of patient-reported outcomes, this study observed higher satisfaction levels with implant-supported restorations, particularly in regards to appearance and chewing comfort. These findings are consistent with the results of Rajput M et al. (2025) [14], who reported improved oral health-related quality of life in patients rehabilitated with implant-supported overdentures.

CONCLUSION

This study highlights the significant differences in endodontic health outcomes between orthodontically treated teeth restored with conventional prostheses and implant-supported prostheses. The results demonstrate that implant-supported restorations generally provide better pulp vitality, enhanced bone density preservation, and improved soft tissue health compared to conventional prostheses. Furthermore, patients with implant-supported prostheses reported higher levels of satisfaction with the aesthetics, comfort, and overall functionality of the restoration.

While both restoration options have their merits, the superior outcomes associated with implant-supported prostheses suggest they may be a more effective solution for maintaining long-term dental health and patient satisfaction. However, the decision between conventional and implant-supported restorations should consider individual patient factors, such as oral hygiene practices, general health, and personal preferences.

Ultimately, this study underscores the importance of personalized treatment planning in restorative dentistry and provides valuable insights for clinicians when choosing the most appropriate restorative approach for orthodontically treated patients. Further research with larger sample sizes and longer follow-up periods is necessary to validate these findings and refine the guidelines for restoration selection.

DECLARATION

Conflict of Interest

There are no conflicts of interest.

Financial support

None

Competing Interests

The authors have no competing interests to declare.

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