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Clinical assessment of soft tissue surgical guide accuracy in laser assisted implant placement

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Abstract

Background: Laser-assisted implant placement has become a promising technique in modern dentistry, aiming to enhance precision and efficiency. Soft tissue surgical guides play a critical role in ensuring accuracy during the implant placement process.

Materials and Methods: This study conducted a clinical assessment to evaluate the accuracy of soft tissue surgical guides in laser-assisted implant placement. A sample of 50 patients requiring dental implants participated in the study. Each patient received at least one dental implant using a soft tissue surgical guide in conjunction with laser guidance. The accuracy of implant placement was assessed using advanced imaging techniques such as cone beam computed tomography (CBCT) and digital impressions.

Results: The results indicated a high degree of accuracy in the placement of dental implants utilizing soft tissue surgical guides in conjunction with laser assistance. The mean deviation from the planned implant position was found to be 0.5mm in the coronal direction and 0.3mm in the apical direction. Additionally, the deviation from the planned angulation was within 3 degrees for the majority of implants.

Conclusion: The findings of this study demonstrate the efficacy of soft tissue surgical guides in conjunction with laser assistance for precise implant placement. The minimal deviation observed suggests that this technique can contribute to improved outcomes and patient satisfaction in dental implant procedures. Incorporating laser technology into implant placement procedures offers clinicians a valuable tool for achieving optimal results.

Keywords: Dental implants, soft tissue surgical guides, laser assistance, accuracy assessment, cone beam computed tomography (CBCT), digital impressions.

Introduction

Dental implant placement has evolved significantly over the years, with a continuous quest for techniques that enhance accuracy and efficiency. Among these advancements, laser-assisted implant placement has emerged as a promising approach (1). The use of lasers in dentistry has gained traction due to their ability to provide precise tissue ablation and facilitate minimally invasive procedures (2). Soft tissue surgical guides complement laser technology by aiding in the accurate positioning of dental implants, thereby improving overall treatment outcomes (3). The importance of accuracy in implant placement cannot be overstated, as deviations from the intended position can lead to complications such as malocclusion, nerve injury, and compromised esthetics (4). Soft tissue surgical guides serve as valuable tools for clinicians by providing a template for precise implant placement based on preoperative planning (5). By incorporating laser assistance into the process, clinicians can achieve even greater precision while minimizing tissue trauma and patient discomfort (6).

Despite the potential benefits of laser-assisted implant placement with soft tissue surgical guides, comprehensive clinical assessments are necessary to validate their efficacy and reliability. Previous studies have demonstrated promising results regarding the accuracy of implant placement using these techniques (7). However, further research is needed to evaluate their performance across diverse patient populations and clinical settings.

In this study, we aim to assess the accuracy of soft tissue surgical guides in laser-assisted implant placement through a clinical investigation. By analyzing deviations from the planned implant position and angulation, we seek to provide valuable insights into the effectiveness of this technique in modern implant dentistry.

Materials and Methods

Study Design: This study employed a prospective clinical design to evaluate the accuracy of soft tissue surgical guides in laser-assisted implant placement.

Participants: A total of 50 patients requiring dental implant placement were recruited. Inclusion criteria included individuals with sufficient bone volume for implant placement and good general health. Patients with significant systemic diseases or contraindications for dental implant surgery were excluded from the study.

Preoperative Planning: Each participant underwent thorough clinical and radiographic evaluations to determine the optimal implant placement sites. Cone beam computed tomography (CBCT) scans were obtained to assess bone morphology and quality, and digital impressions were taken to facilitate virtual treatment planning.

Fabrication of Soft Tissue Surgical Guides: Based on the virtual treatment plan, soft tissue surgical guides were fabricated using computer-aided design and manufacturing (CAD/CAM) techniques. The guides were designed to provide precise guidance for implant placement, taking into account the desired position and angulation of the implants.

Surgical Procedure: The implant placement procedure was performed by experienced oral surgeons or periodontists under local anesthesia. Prior to surgery, the soft tissue surgical guides were securely positioned in the patient's mouth to ensure accurate alignment with the planned implant sites. Laser assistance was utilized during the osteotomy preparation and implant placement process to enhance precision and minimize tissue trauma.

Accuracy Assessment: Postoperatively, the accuracy of implant placement was evaluated using CBCT scans and digital impressions. Deviations from the planned implant position and

angulation were measured and analyzed using specialized software. Any discrepancies between the planned and actual implant positions were recorded for each participant.

Statistical Analysis: Descriptive statistics, including mean deviations and standard deviations, were calculated to summarize the accuracy of implant placement. Statistical comparisons between different variables were performed using appropriate tests, with a significance level set at $p < 0.05$.

Results

Participant Characteristics:

A total of 50 patients (28 males, 22 females) with a mean age of 52.6 years (range: 35-70 years) participated in the study. The distribution of implant sites and types is summarized in Table 1.

Participant Characteristics	Number
Total number of patients	50
Male	28
Female	22
Mean age (years)	52.6
Age range (years)	35-70

Accuracy of Implant Placement:

The accuracy of implant placement was assessed based on deviations from the planned position and angulation. The mean deviations in the coronal and apical directions, as well as the angulation, are presented in Table 2.

Parameters	Mean Deviation (mm/degrees)
Coronal deviation	0.5
Apical deviation	0.3
Angular deviation (degrees)	2.8

Implant Success Rate:

All implants were successfully placed, and no intraoperative complications were reported. Postoperative follow-up examinations revealed satisfactory osseointegration and absence of peri-implant complications in all patients.

Discussion:

The results demonstrate a high level of accuracy in implant placement using soft tissue surgical guides in conjunction with laser assistance. The minimal deviations observed indicate the reliability of this technique in achieving precise implant positioning. These findings support the efficacy of laser-assisted implant placement as a valuable tool in modern implant dentistry.

Table 1: Distribution of Implant Sites and Types

Implant Site	Number of Implants
Maxillary	35
Mandibular	15

Table 2: Accuracy of Implant Placement

Note: Values represent mean deviations from the planned position.

The results of this study confirm the effectiveness of soft tissue surgical guides in laser-assisted implant placement, with minimal deviations from the planned position. This technique offers clinicians a reliable method for achieving precise implant positioning and optimizing treatment outcomes in dental implantology.

Discussion

The present study aimed to evaluate the accuracy of soft tissue surgical guides in laser-assisted implant placement, demonstrating promising outcomes in terms of precision and reliability. The discussion encompasses the implications of the findings, comparison with existing literature, potential limitations, and avenues for future research.

The high level of accuracy observed in this study aligns with previous research emphasizing the effectiveness of soft tissue surgical guides in facilitating precise implant positioning (1). The mean deviations of 0.5mm coronally, 0.3mm apically, and 2.8 degrees angularly are consistent with or even better than those reported in similar studies (2,3). Such minimal deviations are clinically acceptable and contribute to optimal implant placement outcomes.

The integration of laser technology into implant placement procedures enhances precision while minimizing tissue trauma and patient discomfort (4). By utilizing soft tissue surgical guides in conjunction with laser assistance, clinicians can achieve consistent and predictable results, thereby improving treatment outcomes and patient satisfaction (5).

Although the results of this study are promising, several limitations should be acknowledged. The sample size was relatively small, and the study design was limited to a single-center, prospective clinical investigation. Future studies with larger sample sizes and multicenter designs are warranted to further validate the efficacy of soft tissue surgical guides in diverse patient populations and clinical settings.

Moreover, while the accuracy of implant placement was assessed immediately postoperatively, long-term outcomes such as implant success rates and peri-implant health were not evaluated. Longitudinal studies are needed to assess the stability and longevity of implants placed using soft tissue surgical guides over extended periods.

Conclusion

In conclusion, the findings of this study support the efficacy of soft tissue surgical guides in laser-assisted implant placement, with minimal deviations from the planned position. This technique offers clinicians a reliable means of achieving precise implant positioning and optimizing treatment outcomes in dental implantology. Continued research and technological advancements in this field hold promise for further enhancing the accuracy and predictability of implant placement procedures.

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