Digital Prosthetic Treatment Planning Using Intraoral Scanner Technology: Impact on Treatment Accuracy and Patient Satisfaction in Community-Based Dental Care

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ABSTRACT

This study aimed to evaluate the effectiveness of digital prosthetic treatment planning using intraoral scanner technology on treatment accuracy and patient satisfaction in community-based dental care settings. A total of 80 patients requiring prosthetic treatment were randomly divided into two groups: the digital group (n=40) using intraoral scanner-based treatment planning, and the conventional group (n=40) using traditional impression techniques for 6 months of follow-up. Treatment accuracy was measured using 3D deviation analysis, while patient satisfaction was assessed using a validated questionnaire. The results showed significantly higher treatment accuracy ($p<0.001$) and patient satisfaction scores ($p<0.05$) in the digital group compared to the conventional group. The digital group demonstrated 23% improvement in prosthetic fit accuracy and 18% higher patient satisfaction scores. In conclusion, digital prosthetic treatment planning using intraoral scanner technology significantly improves treatment outcomes and patient experience in community dental care settings.

Keywords: Digital Dentistry, Intraoral Scanner, Prosthodontics, Community Dental Care, Treatment Accuracy, Patient Satisfaction

INTRODUCTION

Digital technology has revolutionized modern dentistry, particularly in the field of prosthodontics where precision and accuracy are paramount for successful treatment outcomes. Intraoral scanners have emerged as a transformative technology that enables precise digital impressions, eliminating many limitations associated with conventional impression techniques. The integration of digital workflows in prosthodontics not only enhances treatment accuracy but also improves patient comfort and treatment efficiency.

Community-based dental care faces unique challenges including limited resources, diverse patient populations, and the need for efficient treatment delivery systems. The implementation of digital prosthetic treatment planning in these settings has the potential to address these challenges while maintaining high-quality care standards. Digital impression techniques using intraoral scanners offer several advantages over conventional methods, including improved accuracy, reduced treatment time, enhanced patient comfort, and better communication between dental professionals and patients.

Previous studies have demonstrated the clinical effectiveness of digital impression systems in controlled clinical environments, but limited research has been conducted specifically in community-based dental care settings. The diverse patient population and varying clinical

conditions in community practice require specific evaluation to determine the real-world effectiveness of digital prosthetic treatment planning. Furthermore, patient satisfaction in community dental care settings may differ from private practice environments due to different expectations and accessibility factors.

Therefore, this study aimed to evaluate the effectiveness of digital prosthetic treatment planning using intraoral scanner technology on treatment accuracy and patient satisfaction in community-based dental care settings, with the goal of establishing evidence-based guidelines for digital technology implementation in community dental practice.

METHODS

This study was conducted as a randomized controlled trial over a 6-month period at the Community Dental Care Center, Universitas Kadiri. Ethical approval was obtained from the institutional review board, and all participants provided informed consent before participation.

Study Population: Eighty patients aged 25-65 years requiring prosthetic treatment (single crowns, bridges, or partial dentures) were recruited from the community dental care center. Inclusion criteria included: good oral hygiene, adequate bone support, and willingness to participate in follow-up visits. Exclusion criteria included: severe periodontal disease, active oral infections, pregnancy, and inability to cooperate during digital scanning procedures.

Randomization and Groups: Participants were randomly allocated using computer-generated randomization into two equal groups:

- Digital group (n=40): Prosthetic treatment planning using intraoral scanner (CEREC Primescan, Dentsply Sirona)

- Conventional group (n=40): Traditional impression techniques using polyvinyl siloxane materials

Treatment Protocol: For the digital group, intraoral scanning was performed following standardized protocols with powder-free scanning technique. Digital treatment planning was conducted using CAD/CAM software with virtual articulation and occlusal analysis. For the conventional group, traditional polyvinyl siloxane impressions were taken and sent to dental laboratory for conventional prosthetic fabrication.

Outcome Measurements:

1. Treatment Accuracy: Measured using 3D deviation analysis comparing planned versus delivered prosthetic restorations. Measurements included marginal fit, occlusal contact accuracy, and overall dimensional accuracy.

2. Patient Satisfaction: Assessed using a validated 10-item questionnaire covering comfort during impression taking, treatment duration, communication quality, and overall treatment experience. Scores ranged from 1 (very dissatisfied) to 5 (very satisfied).

Statistical Analysis: Data were analyzed using SPSS version 26.0. Independent t-tests were used to compare continuous variables between groups, while chi-square tests were used for categorical variables. Statistical significance was set at $p<0.05$.

RESULTS AND DISCUSSION

The results demonstrated significant advantages of digital prosthetic treatment planning over conventional methods in community-based dental care settings. The digital group showed significantly superior treatment accuracy compared to the conventional group ($p<0.001$). Specifically, marginal fit accuracy was 127 ± 15 μm in the digital group versus 165 ± 23 μm in the conventional group, representing a 23% improvement. Occlusal contact accuracy was also significantly better in the digital group, with 94.2 ± 5.8% accurate contact points compared to 78.6 ± 8.2% in the conventional group. Patient satisfaction scores were significantly higher in the digital group (4.3 ± 0.6) compared to the conventional group (3.6 ± 0.8), representing an 18% improvement ($p<0.05$). Patients in the digital group particularly appreciated the comfort during impression taking (4.5 ± 0.5 vs 3.2 ± 0.9, $p<0.001$) and shorter treatment duration (4.4 ± 0.6 vs 3.4 ± 0.7, $p<0.01$).

The superior treatment accuracy achieved with digital prosthetic treatment planning can be attributed to several factors. First, intraoral scanners eliminate dimensional changes associated with impression materials and laboratory procedures. Second, digital workflows allow for precise virtual treatment planning with immediate visualization of treatment outcomes. Third, CAD/CAM fabrication provides consistent material properties and precise manufacturing.

The improved patient satisfaction in the digital group reflects the enhanced patient experience provided by digital technology. The elimination of impression materials reduces patient discomfort and gag reflex issues, which are particularly important in community dental care where patient anxiety levels may be higher. Additionally, the ability to show patients digital treatment plans improves communication and treatment acceptance.

These findings have important implications for community-based dental care, where efficiency and patient satisfaction are crucial for successful treatment delivery. The implementation of digital prosthetic treatment planning can help community dental centers provide high-quality care while optimizing resource utilization and improving patient experience.

CONCLUSION

Digital prosthetic treatment planning using intraoral scanner technology significantly improves both treatment accuracy and patient satisfaction in community-based dental care settings. The 23% improvement in prosthetic fit accuracy and 18% increase in patient satisfaction scores demonstrate the clinical value of implementing digital workflows in community dental practice. These findings support the integration of digital technology in community-based dental care as a means to enhance treatment quality while improving patient experience. Future research should focus on cost-effectiveness analysis and long-term clinical outcomes to further establish the value of digital prosthetic treatment planning in community dental care settings.

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