International Journal of
Digital Health & Patient Care
e-ISSN: 3023-851X
https://ndpapublishing.com/index.php/

Current Approaches Used to Transfer the Peri-Implant Soft Tissue Emergence Profile to the Impressions in Esthetic Zone

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Article Info
Received: 07.11.2024
Accepted: 19.12.2024
Published:30.12.2024

Keywords
Peri-implant Soft Tissue Emergence Profile
Conventional Impression
Digital Impression

ABSTRACT
It is crucial to transfer the emergence profile to the impression in addition to the implant position in implant-supported fixed restorations in esthetic zone. Current developments in digital dentistry is providing alternatives to conventional impression methods. Peri-implant soft tissue emergence profile (PSTEP) can be transferred with digital impression techniques. Implant position, surrounding hard and soft tissue contours, and emergence profile cannot be recorded with a single impression as in direct and indirect conventional impression methods. Soft tissue contours surrounding the implant and PSTEP can be recorded with an intraoral scanner after the removal of provisional restoration, this method is called the direct protocol. In the indirect protocol, the tissue surface of the provisional restoration is recorded outside the mouth. The position and angle of the implant should be recorded with an implant scanbody which is screw tightened on the implant. Definitive model is formed by superimposition of all scans obtained. When implant scanbodies are used with appropriate implant systems, accurate results can be achieved according to the manufacturer's instructions. Implant scanbodies have been developed with various characteristics in terms of material type, geometric design, surface properties, length-diameter, and tightening torque. The use of digital systems in the impressions of implant-supported fixed restorations increases patient comfort and provides a fast workflow.

1. INTRODUCTION

Achieving a natural appearance in implant-supported fixed restorations is important for successful esthetic outcomes, particularly in the anterior region. Therefore, it is recommended that the peri-implant soft tissue emergence profile (PSTEP) should be transferred to the impression in addition to the implant position [1-7]. The PSTEP is formed with a provisional restoration when a controlled and constant compression is applied, this technique is called the ''dynamic compression technique'' [8]. PSTEP, which ensures the long-term health of periodontal tissues around the implant, should be preserved during the impression, and transferred to the definitive restoration [2-7,9]. Current developments in digital dentistry allows PSTEP to be recorded in 3 dimensional (3D) [10-12].

The purpose of this review is to explain the impression techniques used to transfer the PSTEP in esthetic zone and to examine the current literature by indicating the similar and different aspects, advantages, and disadvantages of the impression techniques.

1. Transfer of the PSTEP to the Conventional Impression in Esthetic Zone:

In the esthetic zone, direct or indirect conventional methods are preferred to transfer the PSTEP. In the direct conventional method, after the standard impression post is screw tightened to the implant, flowable auto polymerizing acrylic resin is used to modify the impression post. The directly fabricated modified impression post helps to transfer the PSTEP to the conventional impression with minimal soft tissue irritation.

PSTEP might deform and collapse after the removal of provisional restoration. A polyvinyl siloxane index is formed to prevent this deformation. A copy of the tissue surface of the provisional restoration that creates the emergence

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How to cite this article
Koç, B., and Şen, D. (2024). Current Approaches Used to Transfer the Peri-Implant Soft Tissue Emergence Profile to the Impressions in Esthetic Zone. *Int. J. Digital Health & Patient Care, 1(1),75-79*

Review Article/ DOI: 10.5281/zenodo.14582337

profile is tried to be transferred to the index outside the mouth, this method is called the indirect conventional method (figure 1). The provisional restoration is screw tightened to the implant analog and placed in the polyvinyl siloxane index. The flowable impression material is adapted around the provisional restoration.

The condensation of the silicone material is followed by the removal of provisional restoration. A standard impression post is screw tightened to implant analog and a flowable auto polymerizing acrylic resin is used to modify the impression post. The indirectly fabricated modified impression post helps to transfer the PSTEP to the conventional impression with minimal soft tissue irritation [2-7,10,13].

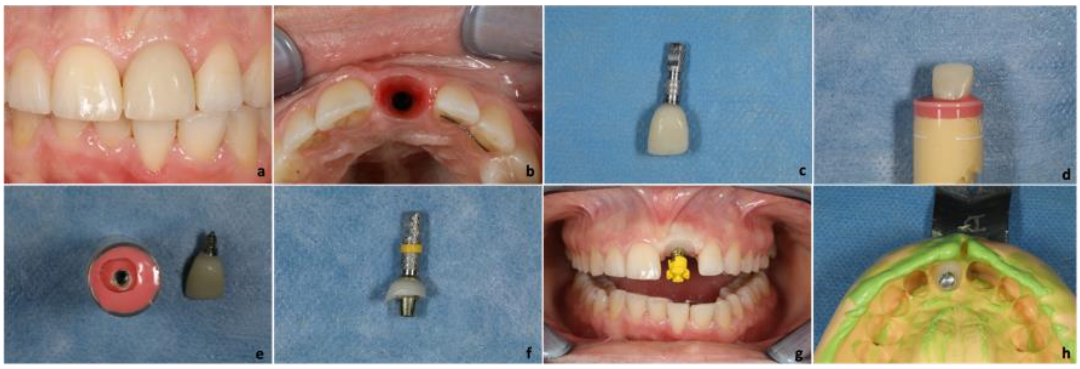

Figure 1. Stages of indirect technique which is used to transfer the PSTEP to the conventional impression in esthetic zone
[a] Intraoral view of implant-supported provisional restoration, [b] Intraoral view of PSTEP, [c] Provisional restoration screw tightened to implant analog, [d] Placing provisional restoration and implant analog in polyvinyl siloxane index, [e] Forming a copy of emergence profile in polyvinyl siloxane index, [f] Modified impression post, [g] Intraoral view of modified impression post, [h] Impression with indirectly fabricated modified impression post

2. Transfer of the PSTEP to the Digital Impression in Esthetic Zone:

Introduction of intraoral scanners provide alternatives to conventional impression methods in implant-supported restorations. Implant scanbodies must be used to record the position and angle of the implants instead of conventional impression posts. These digital impression posts, which consist of 3 parts: scan region, body, and base; are produced separately for each implant system, differing in terms of material type, geometric design, surface properties, length-diameter, and tightening torque (figure 2).

Implant scanbodies are manufactured from different materials including polyetheretherketone, titanium, aluminum alloys and resin-based materials. It has been reported that accurate results can be achieved when scanbodies are used according to the manufacturer's instructions. The number of repeated use and sterilization cycles, tightening torque value and the deformation it has on the scanbody material should be taken into consideration [14-20].

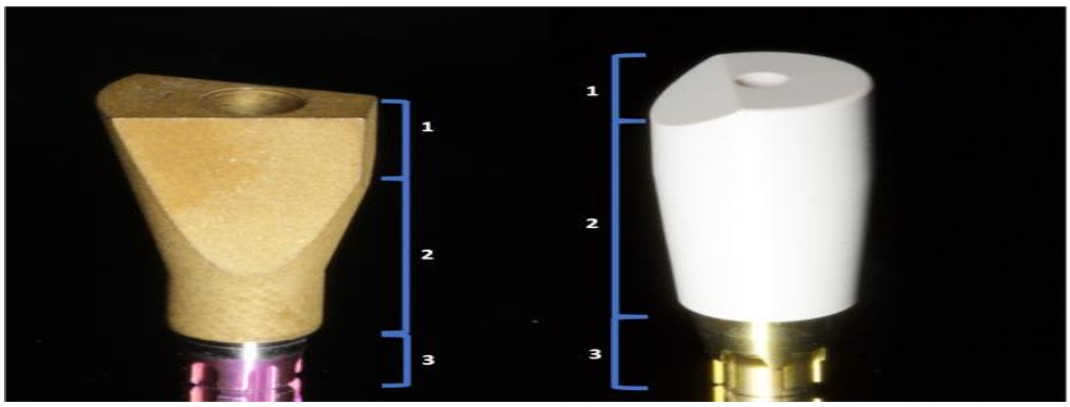

Figure 2. Components of implant scanbodies
[1]Scan region, [2]Body, [3]Base

A direct and indirect impression protocol was first defined with a digital approach by Monaco et al. [10,11] in 2019. Direct protocol is indicated when the peri-implant soft tissues are stable upon removal of the provisional restoration, on the other hand indirect protocol is indicated when the gingival tissue collapses rapidly after the removal of the provisional restoration. According to this study [10], direct protocol states that 3 different digital impressions must be obtained; an impression of the provisional restoration attached to the implant with surrounding gingival tissue, the PSTEP immediately after removal of the provisional restoration, and impression with the scanbody attached to the implant to capture the 3D location of the implant (figure 3). All digital impressions obtained and saved in the standard tessellation language (stl.) format must be superimposed to form the definitive cast.

The indirect protocol states that the tissue surface of the provisional restoration is scanned indirectly outside the patient's mouth and the emergence profile is preserved.

As a result of the superimposition of digital impressions in both protocols, position and angle of the implant, hard and soft tissue contours, occlusal relations, occlusal vertical dimension, and esthetic parameters are recorded on the definitive model. Described protocols allow a predictable definitive restoration in the esthetic zone, reducing the duration of clinical procedures [10-12].

Dhingra et al. [21], who combined the direct and indirect digital protocols in 2020, recorded PSTEP and tissue surface of the provisional restoration to form the definitive model by superimposing all 4 of the digital impressions. Obtained data is validated in the production of the definitive restoration (figure 4). In another study, Gallardo et al. [1] improved the protocol that was published by Dhingra et al. by creating a clear reference point during the superimposition of stl. data. A direct composite resin application to the vestibule surface of the provisional restoration was performed before the registration of digital impression.

Figure 3. Impression stages of direct protocol which is used to transfer the PSTEP to the digital impression in esthetic zone

[a] Intraoral view of implant-supported provisional restorations with surrounding tissue contours
[b] Intraoral view of emergence profile following removal of provisional restoration
[c] Intraoral view of the implant scanbodies used to record the position and angle of the implant

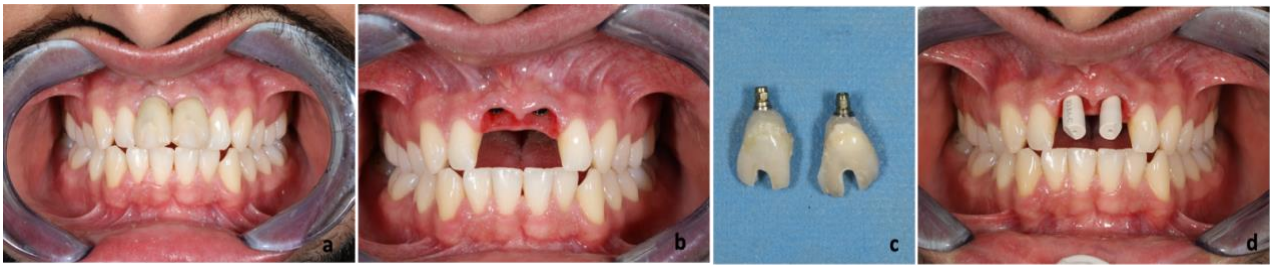

Figure 4: Impression stages of the combined protocol which is published by Dhingra et al. [21], in 2020 to transfer the PSTEP to the digital impression in esthetic zone

[a] Intraoral view of implant-supported provisional restorations with surrounding tissue contours
[b] Intraoral view of emergence profile following removal of provisional restoration
[c] Extraoral view of the tissue surface of provisional restorations
[d] Intraoral view of the implant scanbodies used to record the position and angle of the implant

In order to prevent technical sensitivity due to the superimposition of digital impressions, Yilmaz and Abou-Ayash [22] developed a combined healing abutment and scanbody system. This combination could be defined by the design program when the digital impression is transferred to the librarry (figure 5).

Figure 5: Combined healing abutment and scanbody [22]

3. Comparison of Current Approaches Used to Transfer the PSTEP to the Impressions in Esthetic Zone:

Indirect conventional method used in the transfer of PSTEP in the esthetic zone, requires technical sensitivity when compared to the direct conventional method however, it is reported that in terms of preserving the PSTEP without collapse indirect conventional method is more advantageous [2-7,10,13]. Similarly, to prevent errors that might occur due to the collapse of peri-implant soft tissue, indirect digital protocol is used in transfer of PSTEP to the digital impression [10,12].

The position and angle of the implant, PSTEP, and surrounding tissue contours are transferred with a single impression in conventional impression methods. However, the superimposition of the digital scans is required in order to provide the same data in digital impression systems. Impressions of implant supported restorations can be obtained with 3 or 4-step digital scanning strategies which enables the superimposition of stl. files [10-13].

Conventional impression methods are economical, but the fact that impression materials have a certain shelf life, are prone to distortion and the need to transfer the impression to a cast model are disadvantages of the conventional methods. The high probability of error due to being a multi-stage system should also be taken into consideration [13,23]. On the other hand, digital impression systems are faster and more comfortable according to patients [24]. In addition to increasing patient comfort, it also allows the evaluation of the position and angle of the implant, the existing status of the patient, the design of the abutment and the PSTEP during the treatment. It provides standardization by reducing errors that might occur due to material or impression technique [1,24,25].

Conclusion

Biological and mechanical complications due to the preference of conventional impression methods in implant-supported fixed restorations can be prevented by the integration of digital impression systems in clinical practice. With the use of these systems, patient comfort increases, and a fast workflow is provided.

Implant scanbodies are digital impression posts that are used to record the position and angle of the implant. It has been reported that accurate results can be achieved when used with appropriate implant systems according to the manufacturer's instructions.

Conventional impression gathers the information of position and angle of the implant, PSTEP, and surrounding tissue contours within a single impression, however superimposition of several digital impressions are required to obtain the same data.

Conflict of Interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Author Contributions

Study Design, BK, DŞ; Data Collection, BK; Data Interpretation, BK; Manuscript Preparation, BK, DŞ; Literature Search, BK, DŞ. All authors have read and agreed to the published version of the manuscript.

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