Soft Tissue Waxup and Mock-Up as Key Factors in a Treatment Plan: Case Presentation

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Abstract

Rehabilitation of edentulous spaces in esthetic areas is a challenge to the clinician due to the loss of soft tissues. In these clinical situations, it would be desirable to evaluate and predict the gingival architecture to recover in the oral rehabilitation. To fulfill this need, the diagnostic wax should anticipate the final rehabilitation with the integration of hard and soft tissue. Thus, it is essential to produce a diagnostic waxup that integrates these two components that are simultaneously seeking to recreate the harmony of white and pink esthetic. This diagnostic waxup will be the basis for the creation of the provisional prosthesis and a soft tissue mock-up. After placing the provisional prosthesis in the mouth, the soft tissue mock-up can be applied to assess its esthetic impact at facial and intraoral level. Dentist and patient should objectively assess the appearance of the final result. After approval of this rehabilitation concept, the virtual surgical planning can be performed and the surgical guide can be designed, allowing the treatment to take place.

This protocol allows the development of a rigorous treatment plan based on the integration of teeth and gingiva component. The waxup and the soft tissue mock-up play a significant role, since they allow an earlier evaluation of the esthetic result, better prosthetic and surgical planning, and it allows us to anticipate the need for gingiva-colored ceramics use.

The authors present a clinical case report of the importance of the wax-up and soft tissue mock-up in the treatment plan. *(Eur J Esthet Dent 2012;7:310–323)*
Introduction

Bone resorption is a physiological consequence of tooth loss or compromised periodontal conditions. In these situations, the alveolar crest suffers a change in its vertical and horizontal dimensions, resulting in an unfavorable gingival architecture with major consequences in esthetic rehabilitation.\(^1\)

In these clinical situations, it would be desirable to evaluate and predict the gingival architecture to recover in the oral rehabilitation. To fulfill this need, the diagnostic wax should anticipate the final rehabilitation, not only with the tooth crowns,\(^2-4\) but also with the integration of soft tissue. Thus, it is essential to produce a diagnostic waxup that integrates these two components that are simultaneously seeking to recreate the harmony of white and pink esthetic. This diagnostic waxup will be the basis for the creation of the provisional prosthesis and a soft tissue mock-up.

Only after the study of this diagnostic waxup can it be possible to establish a treatment plan, where two general clinical approaches may be considered: surgical or prosthetic. The former can be considered as more biological, or natural, and may achieve excellent results that mimic the anatomy of the dento-gingival complex. However, it requires more surgical interventions, with guided bone and soft tissue regenerations. These are more time consuming, more traumatic, and are less predictable due to the physiological healing process, especially when large volumes of soft and hard tissue are missing.\(^1,5\)

Compared to the surgical approach, the prosthetic rehabilitation with gingiva-colored ceramics is faster, much more predictable and not traumatic. However, it requires special considerations by the dentist/prosthodontist and the dental technician in order to achieve a natural integration with an esthetic and functional harmony between the periodontal tissues, the artificial gingiva and the dental crown.\(^1\)

Although this is a current topic in the dental science community, a literature search in Medline about gingiva-colored ceramics retrieved a small number of papers published in dental journals in the last 10 years.\(^6-18\) Most of the re-
The retrieved articles are concerned with clinical reports and, with exception to Coachman and Salama, do not describe a protocol to establish a correct diagnosis of these situations.

**Aim**

With this clinical case report, we intend to propose a new concept of diagnostic waxup and mock-up that includes a reconstruction of the gingival architecture and a conventional dental reconstruction. This approach is more complete and comprehensive, enabling better treatment planning.

**Case presentation**

**Medical and dental history**

A female patient, 47 years old, healthy and a non-smoker had a long history of dental treatments starting from an early age. This resulted in good oral hygiene, with periodontal levels considered normal.
Chief complaint

Essentially, the patient did not like having a removable denture and was concerned with her appearance, intra- and extraorally.

Extraoral findings

The patient presented a decreased facial height of the lower third of the face and a drooping of the labial commissure, due to a reduced vertical dimension (Fig 1).

Fig 5  Facebow registration.

Fig 6  Teeth waxup in the maxilla and mandible.
Intraoral findings and radiographic analysis

Intraoral examination and radiographic analysis revealed the absence of teeth 16 to 14, 21 to 26, 36 to 37 and 46 to 47. Teeth 17, 12, 11, 38 and 48 had dental restorations, and tooth 13 had an acrylic crown with a post. A reduced vertical dimension was observed, with a high overbite in the anterior teeth, and an extremely reduced prosthetic space in the edentulous areas (Figs 2 to 4).

Diagnostic casts (study models)

In the first visit, preliminary impressions were performed and a facebow was used (Fig 5) to accurately transfer the maxilla position to a semi-adjustable articulator.

In the study models obtained, the dental technician created a hard and soft tissue waxup (Figs 6 and 7), anticipating what should be the final result. The soft tissue waxup had a thickness of 4 to 5 mm, a height of 11 mm and a width of 38 mm, approximately (Fig 8).

Fig 7  Detail of teeth and soft tissue waxup in the study model. Major horizontal discrepancy in the second quadrant covered by wax simulating gingiva.
The hard tissue waxup was then converted to a radiographic guide (Fig 9). This guide had a fillet of composite resin in the middle-buccal wall of the teeth. Then a cone-beam computed tomography (CT) scan was performed to study the implants’ placement in a virtual implant planning software (Simplant® Materialise, Fig 10). The fillet of resin composite allows us to easily identify the correct position of the teeth’s’ buccal wall, allowing a prosthetically driven implant surgery.

This analysis revealed the need to increase the bone width, in order to obtain sufficient bone in the buccal wall to allow a prosthetically driven implant surgery. Two options were then considered:

1. Two-stage approach: reconstruction of the atrophic maxilla with an autogenous bone graft surgery (eg iliac crest bone, or other donor site)
**Fig 10** 3D images from implant surgery planning in Simplant® Materialise software.

**Fig 11** Provisional fixed partial denture in gypsum models.
to allow bone augmentation and provide an environment for better implant placement in a second surgery intervention. This approach needs a longer treatment time, but allows for a better outcome of long-term stability of hard and soft tissues.

- One-stage approach: implant placement in the atrophic maxilla with a buccal entrance to maintain the palatal vertical bone dimension. Due to the reduced buccal–lingual dimension, the surgery will entail a full exposure of the implants in the buccal wall and, consequently, the need for guided bone regeneration procedures with a xenogenous bone graft performed by a highly skilled surgeon.

Treatment plan

Following the evaluation of the waxup and CT scan, the two options of the surgery intervention were explained to the patient. Due to the patient’s desire for a shorter treatment time, and the clinical team’s opinion that a successful treatment could be achieved with a one-stage approach, the following treatment plan was established:

1. Provisional fixed partial denture (at sites 17, 13, 12, 11, and 27) reinforced with cast metal.
2. Dental implants in positions 16, 14, 21, 23, and 26, with guided bone regeneration procedures in the second quadrant.
3. Fixed partial denture over implants at sites 16 to 14, 21 to 23, and 26.
4. Fixed partial denture over tooth abutments at sites 13, 12, and 11.
5. Metal-ceramic crowns at sites 17 and 27.
6. Fixed partial denture over teeth at sites 33, 34, 37, and 43, 44, 45, and 47.

The previously described waxup was converted into a provisional fixed partial denture (Fig 11). A gingival epiphysis, acting as a mock-up, was placed in the mouth during the second visit, in order to obtain the patient’s opinion about the expected rehabilitation, and to confirm functional and esthetic parameters related to teeth and soft tissue architecture (Fig 12).

This protocol allows the development of a rigorous treatment plan in which the placement of implants, tissue regener-
ation, and rehabilitation of the dental arches is made from the integrated rehabilitation of the tooth and gingiva component. The waxup and the soft tissue mock-up play a significant role.

Three days later, the patient underwent implant surgery and guided bone regeneration procedures took place to fill up the soft tissues in the second quadrant.

Due to the buccal bone resorption verified in the atrophic maxilla, the implant surgery technique selected was a lateral entrance in the buccal bone wall. In this way, the palatal bone crest is spared, and this bone height can be maintained. An implant surgical intervention with the implant entrance in the bone crest would have led to bone crest vertical resorption and, consequently, a more complex surgical intervention to gain not only bone width, but also height. The implants at sites 21 and 23 were placed with the neck more labially, but without compromising the prosthetic rehabilitation that was predicted by the waxup and the provisional prosthesis.

The gingival epithesis previously planned and executed in the diagnostic phase allows the oral surgeon to easily predict the necessary amount of bone for this procedure.

Five months later, the patient was recalled in order to evaluate the position of hard and soft tissues compared to the initial situation. Although there was a gain in the volume of hard and soft tissues, with a significant change in its position (Fig 13), a lack of soft tissue in the interproximal areas of the provisional prosthesis teeth was also observed (Fig 14). No natural gingival architecture could be visualized.

Fig 15 Top image: working model of teeth and implant abutments; middle image: metal framework of all fixed prosthesis components; bottom image: metal-ceramic fixed prosthesis.
Therefore, after discussing the situation with the dental technician, the patient was informed of the treatment options of ceramic fixed prosthesis with a teeth component and a gingiva-colored ceramic to simulate the nature of the gingival architecture. With the patient’s agreement, we have initiated the common clinical and laboratorial steps of fabricating a fixed metal-ceramic rehabilitation (Fig 15).

The final situation of this rehabilitation can be observed in Figures 16 to 18. The gingiva-colored ceramic allows the prosthodontist/ceramist to recreate a natural and stable gingival architecture, compensating for the low predictability of this type of oral surgery.

Discussion

These clinical situations require a careful multidisciplinary approach in order to establish the correct treatment plan. To rebuild the lost natural harmony of the tissues, the first key element to be produced is the diagnostic waxup, an essential element in developing a treatment plan. However, most of the studies on the diagnostic waxup and the consequent mock-up, are only concerned with teeth reconstruction, and do not include the soft tissues, which currently represent a major part of the esthetic rehabilitation. Coachman et al and Salama et al published a three-part paper about “Prosthetic gingival reconstruction in fixed partial restorations” where they describe how to perform a correct diagnosis and treatment plan (Part 2), and the laboratory procedures and maintenance (Part 3). The protocol described in the diagnosis part includes a waxup of soft tissues together with a radiographic template that mimics this situation. However, no soft tissue mock-up of the gingiva–teeth architecture has been developed that shows the transitions of hard and soft tissues, nor a gingival epithesis to help the oral surgeon before the surgery. This gingival mock-up allows us to evaluate the need for gingiva-colored ceramics in the final prosthetic rehabilitation in two separate treatment phases: at the beginning of the treatment, and also at a re-evaluation at the surgery follow-up.

Fig 16 Final situation. The fixed dental prosthesis with a gingiva-colored ceramic was cemented over the teeth and implant abutments.
The study of a clinical case should integrate soft tissue planning together with teeth planning, in order to produce a more predictable prosthetic rehabilitation. The waxup and the soft tissue mock-up allow an early evaluation of the esthetic result, the development of a better prosthetic and surgical plan, and at last, it permits us to anticipate the need for using gingiva-colored ceramics.

**Fig 17** Patient’s smile with a natural appearance of the gingiva-colored ceramics’ rehabilitation.

**Fig 18** Panoramic radiograph of the rehabilitation with fixed dental prosthesis over teeth and implants.
References


