Creating Natural-Looking Removable Prostheses: Combining Art and Science to Imitate Nature

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ABSTRACT

Patient awareness of dental appearance has increased, resulting in more demanding esthetic requests. There is also strong evidence that increased esthetics is highly significant for complete denture acceptance and success. Taking notice of patients' perceptions of natural appearance and esthetics, the clinician can incorporate their preferences in the construction of individualized dentures that will be harmonized with their facial characteristics.

Despite the evolution of materials and techniques, the vast majority of dentures still fail to look natural. Thus, producing prostheses that defy detection and successfully restore the appearance of edentulous patients remains a challenge for the clinician.

This paper presents a clinical case where immediate loading of implants supporting a mandibular overdenture was combined with an opposing conventional maxillary denture to satisfy the high functional and esthetic demands of the patient. It also emphasizes the individualized esthetic performance through customization during their fabrication while taking into consideration the various clinical parameters affecting rehabilitation of the edentulous jaw.

CLINICAL SIGNIFICANCE

Implant-retained overdentures can significantly improve the patients' function. The esthetic performance of these restorations however, may not be satisfying the patients' expectations and demands. Customizing the artificial gingival areas and individual staining of the prefabricated acrylic teeth may improve the esthetic performance creating natural-looking removable prostheses.
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INTRODUCTION

Patient awareness of dental appearance has increased, resulting in more demanding esthetic requests, and the edentulous ones are no exceptions to that rule. There is also strong evidence that increased aesthetics is one of the predominant factors for complete denture acceptance and has a major impact on the overall success of the treatment. However, patients with complete dentures or implant-retained overdentures often complain about the esthetic appearance of their prostheses mainly because of the lack in natural profile.[1,2] Removable prostheses replace not only teeth but soft tissues as well, and for this reason, specific elements and structural characteristics should be taken into consideration during their fabrication in order to contribute toward a dental rehabilitation that imitates the natural dentition.[3]

The clinical appointments of centric relation and occlusal registration are very important for the orientation and dimensional accuracy of the

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FIGURE 1. Placement of four Ankylos implants in the mandible and fixation of conical Syncone abutments for immediate loading.

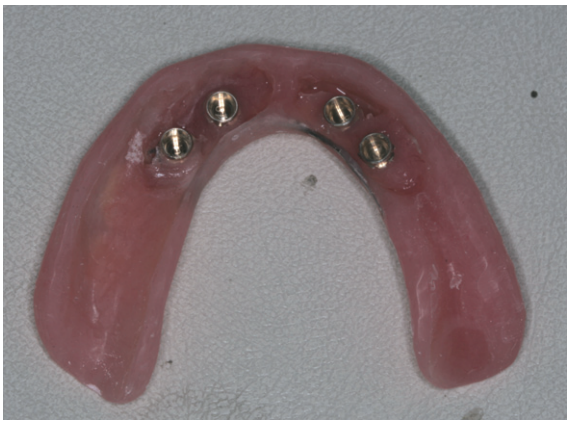

FIGURE 2. The Syncone conical crowns integrated in the basis of the existing denture.

prosthetic space, but at the same time principles and techniques that promote individual characterization and enhance the harmonious blending with intraoral and extraoral structures should be employed.[4,5] Removable prostheses consist of the denture base and the artificial teeth, two distinct components serving specific functions and being subject to different functional limitations and esthetic considerations.[6] Morphology, coloring, and texture of the denture flanges are critical parameters that can enhance the esthetic result generated by the teeth shape, size, shade, and arrangement.[7,8] It is a dual responsibility for the dentist and the dental technician to acquire individualized esthetics and mimic aging procedures while respecting established guidelines and basic biological principles.[9,10] Certain clinical reports describe various methods and techniques that may contribute to the fabrication of a removable prosthesis satisfying the need of a patient for a natural smile.[11]

AIM

The aim of this case report was to present some simple laboratory steps that can improve the natural appearance of complete dentures or implant-retained overdentures and provide patients with individualized esthetics.

CASE PRESENTATION

A 55-year-old white female patient was restored with a complete denture in the maxilla and a lower implant-retained overdenture. The patient was included in a clinical research protocol in the Department of Prosthodontics, University of Athens, that comprised the placement of four Ankylos implants (Dentsply-Friadent GmbH, Mannheim, Germany) in the interforaminal area of the mandible. The implants had increased initial stability and were loaded immediately conversing the existing mandibular denture to an implant-supported overdenture. For this purpose, prefabricated titanium conical abutments (with 4 degrees of conical divergence) were tightened on the implants and prefabricated gold telescoping crowns (Syncone system, Dentsply-Friadent GmbH) were fitted on the abutments according to the manufacturer's instructions (Figures 1 and 2). The telescopic secondary crowns were secured chair-side to the basis of the existing denture with self-cured PMMA resin. The overdenture was also reinforced with an orthodontic wire on the lingual border to avoid fracture during the osseointegration period. The patient was instructed on a soft diet for the healing period and recall appointments were scheduled.

After a 3-month period, the patient returned to the clinic presenting a vertical fracture of the mandibular

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FIGURE 3. Vertical fracture of the denture 3 months later.

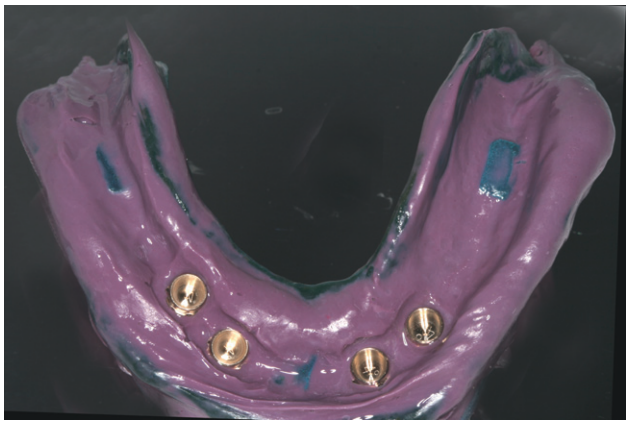

FIGURE 5. Pick-up impression of the Syncone conical crowns for the fabrication of new mandibular implant-retained overdenture.

implant-retained telescopic overdenture (Figure 3). As she needed an immediate solution, a pick-up impression was taken after fitting the two parts of the denture on the implant abutments. The denture was repaired in the laboratory and delivered to the patient (Figure 4).

The patient was totally satisfied with the function of the restoration, but not with the esthetic performance of the dentures, and wished a more lifelike appearance. More specifically, the patient was complaining that the mandibular anterior teeth were too short and not visible at smile. The visible part of the flanges looked unnatural because of the dull insufficient opacity of the denture base resin. A detailed examination focused on

FIGURE 4. Delivery of the repaired denture to the patient.

the patient's chief complaint, and the esthetic characteristics of the existing dentures also revealed the following features:

1 The shape and arrangement of the denture teeth were esthetically unacceptable.
2 The cervical part of the teeth did not show adequate translucency.
3 The teeth looked "very young" for a middle-aged heavy smoker.
4 The color of the teeth appeared uniform, "flat," and "dull."
5 The lips and the soft tissues needed additional support.

For these reasons, a new maxillary denture and a new implant-supported mandibular overdenture with a cast mesh as reinforcement were planned to be fabricated. In order to improve all the aforementioned elements, new telescopic secondary crowns were seated on the implant abutments and a new pick-up impression with polyether impression material was taken using a custom tray (Figure 5). A maxillary impression with zinc oxide and eugenol paste was taken also, utilizing the existing denture. The impressions were sent to the dental laboratory for the fabrication of working casts.

For the adequate reinforcement of the mandibular overdenture, a titanium mesh was casted and soldered to the telescopic crowns (Figure 6). The passive fit of the mesh with the secondary crowns was verified through a clinical try-in. Occlusal rims facilitated

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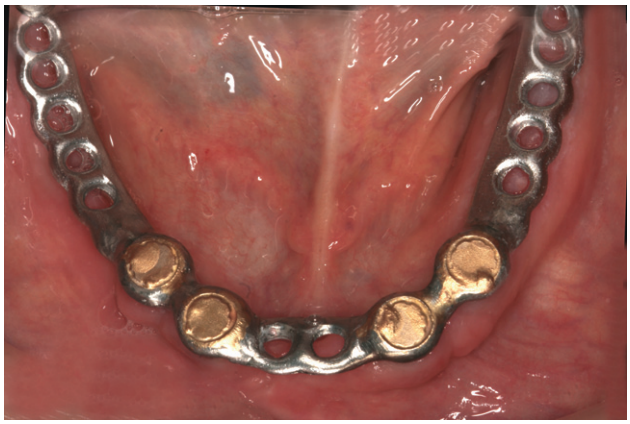

FIGURE 6. Intraoral try-in of a cast reinforcing titanium mesh welded on the conical secondary crowns.

FIGURE 7. The acrylic denture teeth as delivered by the manufacturer.

FIGURE 8. The acrylic teeth after grinding of their incisal edges.

centric relation registration and corresponding mounting of the working casts. During the setup procedure, the following interventions were decided in order to customize the artificial teeth and individualize the esthetic performance of the final prostheses:

1 Reshaping of the prefabricated acrylic teeth (minor changes of the straight incisal edges, incorporation of facets).
2 Natural-looking asymmetries in tooth arrangement (mesial lapping of the lateral incisors, tipping of the cuspids, crowding of the lower incisors).
3 Creation of surface characteristics on the gingival area on the flanges (surface texture, root prominences).
4 Individualization of the denture teeth and addition of surface colors so as to embody aging procedures.

The prefabricated acrylic teeth were reshaped by grinding the incisal edges and proximal surfaces to match the patient sex and age (Figures 7 and 8). The modified teeth were arranged in the desired occlusal plane and were evaluated intraorally, confirming a pleasing composition along with the formation of proper buccal corridors. In order to mimic the natural color of the gingival tissues, a detailed color prescription of the patient's soft tissues was transferred to the laboratory utilizing pink shade tabs.

The dentures were processed in the conventional way. After deflasking, a surface layer of the labial flanges was grinded and the whole area was sandblasted in order to improve adhesion of the new composite layers and extrinsic colorants (Figure 9). The modified denture surface was coated with a primer and light-cured composite resins (Gradia, GC Co., Japan) were properly distributed using the incremental layering technique. Light pink shade without fibers was added in the area of the "attached tissue" and fibered light reddish pink color was layered at the "mucosal part" (Figure 10). Proper surface texture with color variations in the cervical areas of the acrylic teeth and smooth transitions were reproduced in the flanges of both dentures, thus simulating root eminences and soft-tissue topography. The prostheses were photopolymerized in a visible light-curing unit according to the manufacturer's instructions.

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FIGURE 9. The new denture after sandblasting.

FIGURE 10. Incremental layering on the gingival areas.

FIGURE 11. Light-cured stains for acrylic teeth.

FIGURE 12. Surface characteristics and individualization of the maxillary acrylic teeth.

Additionally, shallow cracks were created on the teeth surfaces with a thin disk and were covered by light-cured stains (Lightpaint-On, Dreve Dentamid, Germany) to give a natural appearance of the teeth (Figure 11). Proximal discolorations were also added so as to reproduce changes owing to patient's age and smoking habits.

The new dentures were coated with high-gloss polishing varnish and subjected to a final photopolymerization in the curing device (Figures 12 and 13). The comparison of pre-existing and new dentures clearly reveals the difference in the esthetic and natural appearance. Following a final intraoral evaluation and adjustment, the dentures were delivered to the patient who was satisfied with the esthetic result (Figures 14 and 15). The pre-existing dentures were kept as reserve from the patient in case of emergency.

DISCUSSION

The restorative dentist today has various therapeutic options to offer to an edentulous patient seeking treatment. At the same time, the mandibular removable denture presents for the majority of edentulous patients the most common reason for complaint. Lack of stability and retention leading to traumas of soft tissues and deficient function and phonetics may result in drawback from social activities, urging patients to benefit from the clinical application of dental

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FIGURE 13. Custom staining of the mandibular acrylic teeth.

FIGURE 15. The new dentures delivered to the patient.

implants.[12] Although regenerative techniques and modern implantology may allow for fixed rehabilitation on dental implants, there are still clinical indications and patient-specific situations where a removable prosthesis might be more advantageous.[13–15] Lip and buccal support provided by the flanges of the removable prosthesis is easier to accomplish, adjust, and maintain compared with a fixed restoration.

Immediate loading of mandibular implants is an evidenced-based clinical practice and in the case presented herein it was employed in the form of a mandibular overdenture.[16] Passive fit of the superstructure is of paramount importance for the successful osseointegration during healing and intraoral activation of telescopic copings with careful adjustment and evaluation of occlusion can help to accomplish this.

FIGURE 14. The new dentures delivered to the patient.

Prefabricated conical copings of appropriate height provide not only retention but also stability and support, helping the patient to adapt to the removable prosthesis in a more comfortable way.[17] Conversion of an existing denture into an implant-supported overdenture offers the additional advantage of a simple and reliable clinical procedure without the need of numerous laboratory steps. Following this procedure, possible sore spots and occlusal interferences have already been eliminated. In that way the intraoral activation of the retentive elements can be a simple procedure for the dentist and the patient.[18] Relieving the intaglio surface of the denture for the incorporation of the retentive components may lead to the weakening of its structure and increase susceptibility for fracture during function. Metal reinforcement is the safest way to prevent denture fracture.[19,20]

For the reinforcement of a mandibular overdenture, a metal wire of appropriate cross-section or a cast mesh can be embedded in the denture base during its fabrication, providing space for the accommodation of the attachment elements.[21,22] Some authors have presented clinical reports where a bendable rod was soldered intraorally on abutment copings to provide the necessary support and rigidity for the final restoration.[23]

Dental appearance is of major concern for many edentulous patients nowadays. Life standards and mass-media priorities activate patients' awareness regarding smile and facial appearance, thus triggering more demanding requests. Contemporary dental

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prostheses have to correspond to the age and lifestyle of the patient and look natural.[24,25] Psychological problems may arise for edentulous patients whose prostheses have an artificial look and do not blend with the facial characteristics.[26,27] Those individuals fear being recognized as edentulous or being embarrassed in their social activities because of improper denture fabrication.[28] At the same time, a natural-looking denture is easily accepted, although a longer adaptation period may be needed for the patient.[29,30] Individualized esthetics can be accomplished in various ways, therefore providing natural-looking teeth in an analogous frame. Careful selection of artificial teeth, custom reshaping in form and size, three-dimensional positioning respecting the biological boundaries yet creating natural beauty and custom staining are methods and techniques that unfortunately are not applied often in daily-routine procedures.[31–34]

In this clinical report, special attention was paid to the esthetic enhancement of both teeth and denture bases by means of custom tinting.[35–37] The method described utilized extrinsic photopolymerized stains that are easy to paint on, correct, adjust, and eventually meet patient's desires. Other authors have presented techniques incorporating various elements in denture teeth, such as occlusal amalgam fillings, cervical erosions, gingival recessions, faulty composite fillings, decay, or smoking stains in an effort to overcome stereotype oral perceptions and further improve the natural image of one's smile.[38–40]

Implant supported restorations revolutionized the way dentistry is practiced today. However, removable restorations are still the treatment option for numerous edentulous patients.[41,42] In those cases, the restorative dentist should be aware of the fact that the evolution of dental materials and conventional laboratory techniques enable him to offer removable restorations that can defy detection and create the illusion of natural appearance.

The Ankylos implant system combined with Syncone abutments and telescoping crowns has already been examined in a clinical study with 204 implants. The cumulative success rate was 97.54% in 2 years.[43] A similar concept with early functional loading (the implants were functionally loaded within 5 days after surgery) was published using the Branemark system. After 2 years of loading, a cumulative survival rate of 96.3% was reported.[44] Eccelente and colleagues[45] reported a cumulative success rate of 98.7% for the implants and 100% prosthesis survival in a clinical study of 39 patients with 156 immediately loaded Ankylos implants and Syncone crowns.

Although immediate loading of implants cannot be recommended in every clinical case, it can greatly contribute to a functional result with mandibular overdentures. Even if patients may be satisfied with the function of the restoration at the end of the treatment, an esthetic result is still always demanded to assure self-confidence and esthetic performance. With the described technique a better esthetic result can be achieved through simple and cost-effective laboratory procedure.

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