



A Smile to Behold: Transforming Edentulous Patient with Characterized Complete Denture – Case Report

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Abstract

While historical approaches may have prioritized function and comfort over aesthetics, recent research underscores the paramount importance of aesthetics in the success of complete dentures. Central to this discussion is the notion that aesthetics not only contribute to the physical appearance of dental restorations but also profoundly impact patients' psychological well-being and quality of life. Conventional denture fabrication techniques often yield uniform and artificial-looking results, highlighting the need for improved methods to restore the natural appearance of smiles in edentulous patients. The primary objective of complete denture prosthodontics is not only to replace missing teeth but also to enhance facial aesthetics and function, thereby bolstering patients' self-esteem and overall satisfaction. Denture characterization techniques play a pivotal role in achieving lifelike outcomes, involving meticulous modifications to the form and color of denture components to mimic natural teeth and gingiva. Through a combination of realistic teeth arrangement and gingival imitation, including intricate details such as muscle attachments and root morphology, practitioners strive to create prostheses that closely resemble the aesthetics of natural dentition. While solutions addressing functional and comfort issues are often accessible, achieving effective aesthetic restoration for a patient without teeth poses a significant challenge. Aesthetics involve the perception of beauty and the principles governing artistic expression inspired by nature and personal taste. Over time, aesthetics has held considerable sway due to its impact on individual concerns and the elicitation of emotional reactions such as approval or disapproval.

This case report presents a method for enhancing aesthetics in a 64-year-old female patient who had lost all teeth in both upper and lower jaws. The patient underwent treatment involving conventional removable complete dentures for both upper and lower jaws, alongside custom-characterized dentures. The results showed notable enhancements in facial aesthetics and improved social integration with the use of customized dentures compared to conventional ones. This paper explores the significance of aesthetics in complete denture prosthodontics, highlighting its pivotal role in achieving patient satisfaction and psychological comfort. Drawing from the insights of various studies and experts in the field, the manuscript delves into the traditional challenges faced in treating completely edentulous patients, emphasizing the interplay between aesthetics, function, and comfort. In conclusion, this paper underscores the importance of aesthetics in complete denture prosthodontics and advocates for a patient-centered approach that prioritizes both functional and aesthetic outcomes. By embracing advanced characterization techniques and incorporating patient preferences into treatment planning, clinicians can significantly improve the aesthetic quality of complete dentures, ultimately enhancing patient satisfaction and well-being.

Keywords: Balanced articulation, Characterization, Conventional complete denture prosthesis, Denture esthetics, Prosthesis, Removable complete denture, Teeth arrangement.

INTRODUCTION

The portrayal of teeth in complete dentures involves considerations of age, gender, emotional factors, and social context. Aesthetic considerations in complete dentures encompass various factors that contribute to harmony with the overall facial appearance, with the selection of teeth playing a crucial role. When patients and professionals collaborate in discussing options for customizing and characterizing complete dentures, patients are more likely to have positive expectations regarding their prostheses, which enhances treatment success. According to Waas, receptive patients tend to respond more favorably to treatment.¹ The replacement of lost teeth has been a longstanding concern throughout history. Turano JC and Turano LM trace back the earliest known instances to Phoenician and Etruscan tombs around 2500 BC, where human and animal teeth were utilized.² These teeth were trimmed to fit and secured in place using metal wires. Historical records from 3500 years ago indicate that Egyptians crafted teeth from mulberry tree wood, fastening them with gold wires. Gonçalves CT suggests that the Etruscans, in their pursuit of more durable solutions, employed bovine teeth and gold for tooth replacement.³ Ancient Rome also utilized human and animal teeth, often prepared by specialized artisans. The first attempts at creating artificial teeth were made around 1597 by Guilhermeau, initially using hippopotamus ivory.⁴ Gonçalves noted that in 1709, the first porcelain teeth were developed in England, along with dentures featuring a rubber base known as vulcanite. Duchateau⁵ proposed porcelain teeth in 1774, collaborating with dental surgeon Chérmant⁶ to achieve satisfactory results. Since then, research on artificial teeth has focused on materials and functional requirements for posterior teeth, as well as improved aesthetics for anterior teeth, in tandem with advancements in dentistry. In the fabrication of complete dentures, considering aesthetics, dental professionals must employ not only scientific knowledge but also artistic sensibility, while being receptive to the patient's preferences due to the subjective nature of aesthetic perception. According to Batilana, cultural background, social environment, and national culture influence aesthetic preferences.⁷ Batista et al. suggested avoiding dental position symmetry to individualize prostheses for each patient.⁸ Techniques and materials have evolved over time to address dental aesthetic concerns. The first complete denture, crafted by Anton Nuck Leyden in 1692,⁹ used a hippopotamus molar but was labor-intensive and lacked durability. Fouchard, considered the father of Modern Dentistry, made the first complete upper denture with hippopotamus ivory, leading to the use of vulcanized rubber until the emergence of acrylic resins around 1927, which gradually replaced vulcanite due to safety concerns and aesthetic improvements.¹⁰ Rotdembacher synthesized acrylic acid in 1834, and Kahlbaun described the first methyl methacrylate polymer in 1874, with acrylic resins becoming prevalent in denture bases from 1934. The introduction of thermoplastic resins in 1935 and self-polymerizable resins further enhanced denture fabrication. Pigmented resins, such as those developed by Tomaz Gomes under the STG system, aimed to provide a high aesthetic standard in prostheses, mimicking natural teeth characteristics.¹¹ The STG kit, comprising various shades, offers versatility and ease of use for dental prosthetic technicians, catering to the increasing demand for aesthetic excellence in society. Technical advancements focus on replicating natural dental features like stains, wear patterns, cracks, restorations, and color variations.

The glossary of prosthodontic terms (GPT 10th edition)¹² defines aesthetics as the branch of philosophy dealing with beauty i.e. the theory and philosophy that deal with beauty and the beautiful, especially with respect to the appearance of a dental restoration, as achieved through its form and/or color; those subjective and objective elements and principles underlying the beauty and attractiveness of an object, design, or principle. In other words, it is the philosophical branch concerned with beauty, particularly its elements such as color and form, and the qualities influencing the appearance of a given dental restoration. Challenges in treating completely edentulous patients have traditionally involved considerations of aesthetics, function, and comfort. While some studies on predictors of complete denture success haven't prioritized aesthetics over function or comfort, Carlsson et al. found aesthetics to be the most crucial factor in achieving success with complete dentures.¹³ Vig also stressed the significance of aesthetics in denture success, suggesting that a pleasing appearance is closely linked to psychological comfort.¹⁴ Additionally, a survey by Vallittu et al. revealed that removable denture wearers considered appearance to be the most important characteristic of their teeth.¹⁵

Conventional dentures are usually made in a uniform manner, often resulting in a smooth and featureless appearance of the gingiva, leading to an artificial and sometimes unattractive look for denture wearers. Restoring the smile in edentulous patients can be viewed as a significant achievement, as the smile is an integral aspect of an individual's face and overall persona, conveying aspects such as beauty, age, personality, and youth.

The primary aim is to replace missing teeth to establish a normal vertical dimension and provide support for the facial soft tissues, thereby enhancing both aesthetics and function, ultimately boosting the patient's self-confidence and quality of life. Denture characterization involves modifying the form and color of the denture base and teeth to create a more natural appearance. Realism in teeth arrangement and gingival imitation, including features such as muscle attachments, stippling, root details, and coloring of the denture base, is employed to produce a prosthesis that closely resembles natural teeth and gingiva, providing the patient with a lifelike restoration.

CASE REPORT

A 64-year-old female patient presented to the Department of Prosthodontics, Crown & Bridge, and Oral Implantology, seeking prosthetic rehabilitation due to difficulty chewing and dissatisfaction with her smile. The patient had been wearing dentures for the past 15 years [Figures 1, 2, 3, and 4]. Intraoral examination revealed complete edentulism in both the maxillary and mandibular arches. The treatment objectives focused on preserving bone structure, restoring normal chewing, speaking, and swallowing functions, improving facial characteristics and smile aesthetics, enhancing emotional and psychological well-being, and providing functional prostheses with adequate retention, stability, and support.

After discussing various treatment options with the patient, it was decided to proceed with a set of complete dentures with characterization. Characterized dentures involve matching denture aesthetics with the patient's facial features and dentogenic concept. The treatment plan involved fabricating both conventional and characterized maxillary and mandibular complete dentures with bilaterally balanced occlusion.

PROCEDURE

The preliminary steps of complete denture fabrication remained the same:

- Primary Impressions:** Primary impressions of the maxillary and mandibular arches were made using medium-fusing impression compound (Hiflex Impression Compound, Prevest DenPro Limited, Jammu, India) [Figure 5].
- Corrective Primary Impressions:** This was followed by arbitrary scraping of the impression compound, then an impression with a thin mix of irreversible hydrocolloid (Zelgan 2002, Dentsply India Pvt. Ltd., Haryana, India) [Figure 6].
- Beading and Boxing (Primary Impressions):** Beading and boxing of the primary impressions were done (MAARC Dental, Maharashtra, India) to obtain a proper primary cast using type II dental plaster (GypRock plaster, Rajkot, Gujarat, India).
- Custom Tray Fabrication:** Wax spacer was applied on the primary cast conventionally, followed by the fabrication of custom (individual) trays using autopolymerizing acrylic resin (DPI RR Cold Cure, Dental Products of India, Mumbai, India) [Figures 7 and 8].
- Border Moulding:** Border moulding was performed using low-fusing green stick compound (Pinnacle Tracing Sticks, Dental Products of India, Mumbai, India) [Figure 9].
- Final Impressions:** Wax spacers were removed from the individual trays after the final border moulding [Figure 10]. Final impressions were made using zinc oxide eugenol wash impression material (DPI Impression Paste, Dental Products of India, Mumbai, India) [Figure 11].
- Beading and Boxing (Final Impressions):** Beading and boxing of the final impressions (MAARC Dental, Maharashtra, India) were done to retrieve well-formed master casts.
- Definitive Casts:** Definitive casts were poured using type III gypsum product, i.e., dental stone (GypRock stone, Rajkot, Gujarat, India) [Figure 12].
- Temporary Denture Bases and Occlusal Rims:** After the definitive casts were obtained, temporary denture bases and occlusal rims were fabricated [Figure 13].
- Orientation Jaw Relation and Articulator Transfer:** Orientation jaw relation was recorded using a facebow (HanauTM Springbow, Whip Mix, Kentucky, USA), followed by transfer to the semiadjustable articulator (HanauTM Wide-View, Whip Mix, Kentucky, USA).
- Tentative Jaw Relations:** Tentative jaw relations were carried out following the facebow transfer [Figure 14]. After recording the centric relation record, the casts were mounted on a semiadjustable articulator.
- Teeth Selection:** After occlusal registration, teeth selection was completed.
- Teeth Arrangement:** The artificial teeth were adjusted, and teeth arrangement was done following the ideal principles.
- Waxed-Up Trial Denture Assessment:** The waxed-up trial denture was assessed intraorally to verify the function, fit, and esthetics before processing [Figures 15, 16, and 17]. This was followed by proper sealing of the trial denture base to the definitive casts, then de-articulation from the articulator.
- Flasking Procedure:** The flasking procedure was carried out for both arches.
- Dewaxing and Packing:** The dewaxing process was completed. After the application of tin foil substitute (DPI Heat Cure Cold Mould Seal, Dental Products of India, Mumbai, India), the denture was packed, pressed, and processed in the conventional manner (DPI Heat Cure, Dental Products of India, Mumbai, India).
- Cleaning and Polishing:** The processed dentures were retrieved and cleaned using an ultrasonic cleaner.
- Final Insertion and Occlusal Corrections:** The dentures were finished, polished, and tried in the patient's mouth for evaluation of appropriate esthetics and occlusion. After the necessary occlusal corrections, the prostheses, i.e., removable characterized maxillary and mandibular complete dentures, were delivered [Figure 18].
- Patient Instructions and Recall Visits:** The patient was given instructions following the insertion of the complete dentures. The patient was evaluated after 3 recall visits: after 24 hours, 1 week, and 1 month, respectively. The patient was satisfied with the esthetics, phonetics, and function of the removable complete dentures [Figure 19]. The

patient expressed high satisfaction with the characterized denture appearance compared to the previous conventional complete dentures. Figure 20 shows a happy patient with the happy prosthodontist.

FIGURES



Figure 1 – Previous prostheses (complete dentures) of the patient – Occlusal surface



Figure 2 – Previous prostheses (complete dentures) of the patient – Intaglio surface



Figure 3 – Previous prostheses (complete dentures) in the patient's mouth for evaluation



Figure 4 – Pre-operative smile



Figure 5 – Preliminary impressions – maxillary and mandibular

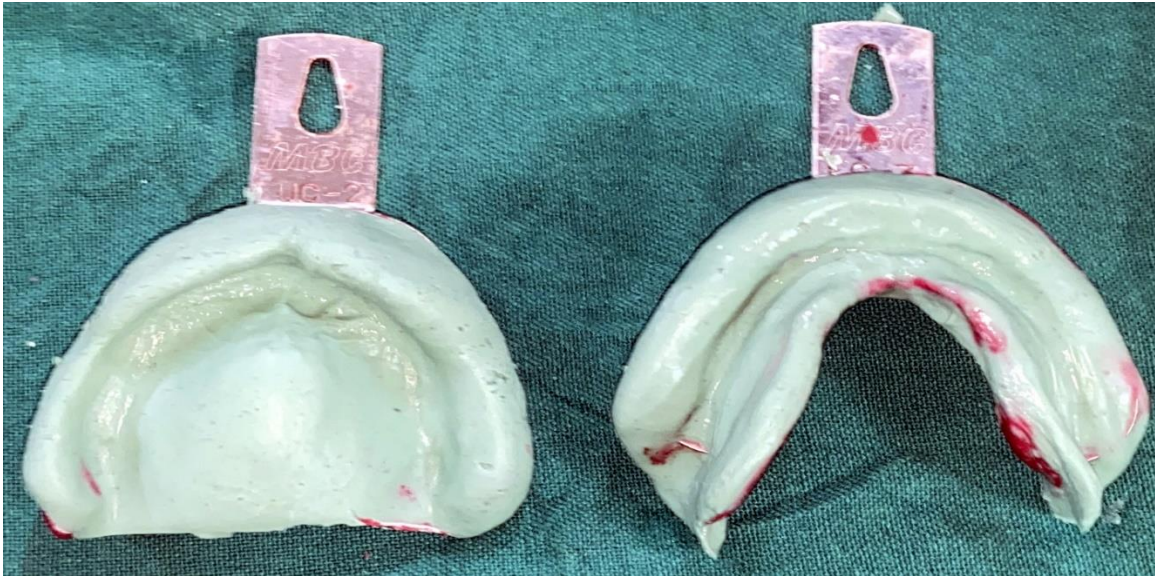


Figure 6 – Corrective primary impressions – maxillary and mandibular



Figure 7 – Custom trays – maxillary and mandibular (occlusal surface)



Figure 8 – Custom trays – maxillary and mandibular (intaglio surface)



Figure 9 – Border moulding – maxillary and mandibular



Figure 10 – Wax spacer removal after completion of border moulding



Figure 11 – Final impressions – maxillary and mandibular



Figure 12 – Definitive casts – maxillary and mandibular

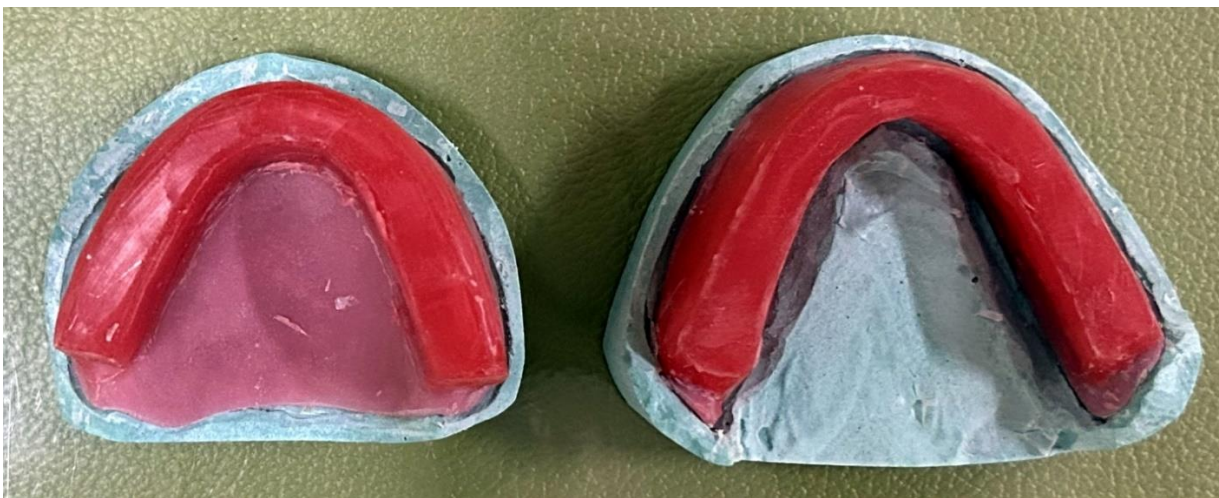


Figure 13 – Occlusal rims – maxillary and mandibular

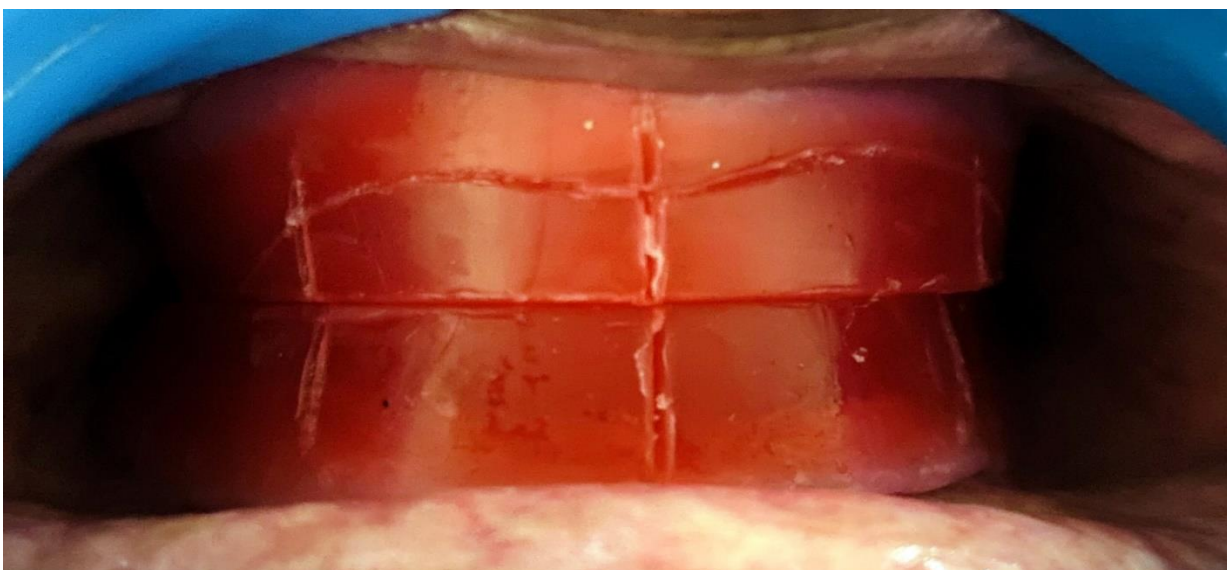


Figure 14 – Jaw relations



Figure 15 – Waxed-up try-in (left lateral view)



Figure 16 – Waxed-up try-in (frontal view)



Figure 17 – Waxed-up try-in (right lateral view)



Figure 18 – Complete dentures – in the patient’s mouth



Figure 19 – Post-operative smile (happy and satisfied patient)



Figure 20 - Happy Patient with Happy Prosthodontist (from left to right): Mr. Malkiat Singh (patient's son), Dr. Ritika Sharda (senior lecturer), happy patient, Dr. Arpit Sikri (happy prosthodontist), and Mr. Narayan Singh (dental mechanic)

To enhance facial characteristics and smile aesthetics, the dentures were characterized as follows:

1. **Characterization of denture base:** Acrylic colors were added during packing to mimic natural gingiva. Three color shades were achieved for marginal gingiva, attached gingiva, and the denture base by adding acrylic color to heat-cure acrylic monomer. Packing was done in three steps, starting with light pink acrylic around the neck of the teeth, followed by darker colors to mimic attached gingiva, and finishing with normal pink for the base. The flask was closed, and the denture was processed normally.
2. **Characterization in teeth arrangement:** Anterior teeth were arranged with slight overlapping, mild chipping, and irregularities while maintaining balanced occlusion and phonetics.

DISCUSSION

Complete dentures have strived to advance alongside dental technology, aiming to deliver results that are as lifelike as possible and tailored to each patient's unique characteristics. Unfortunately, due to a lack of information and interest in complete denture matters, many professionals provide standardized prostheses without considering options that could personalize the prostheses to the patient's needs. Broadbent points out that it's entirely feasible for a 60-year-old patient with complete dentures to have teeth resembling those of a youthful individual fresh from Disney World.¹⁶ When pursuing aesthetic satisfaction in complete dentures, the initial crucial step is understanding the patient's expectations, particularly regarding aesthetics. Artificial teeth arrangement in complete dentures should meticulously consider all aesthetic elements to ensure the patient's greater contentment and acceptance of the restoration. Aesthetic enhancement through complete dentures allows for the restoration of the lower third of the face's vertical dimension, the contour of the lips and cheeks, and the softening of pronounced grooves and wrinkles around the mouth. Tooth characterization lends naturalness to the prosthesis, restoring aesthetics, function, self-esteem, and confidence, which are pivotal goals in

stomatognathic system rehabilitation via complete dentures. In nature, there's no such thing as standardization, and in dental practice, symmetry should be avoided, with prostheses tailored to each patient's specific needs. Tooth shapes geometrically harmonize with facial contours, ranging from triangular, square, to ovoid. Some manufacturers offer innovative tooth models with varied shapes, textures, colors, and notably, translucency to enhance naturalness. Artificial teeth come in single (enamel only), double (enamel and dentin), triple (enamel, dentin, and cervical), and quadruple (enamel, dentin, cervical, and incisal) pressings. They can be customized in shape and color by simulating wear and staining on stock teeth for more precise individualization.

The color of teeth correlates with the individual's age, gender, and skin tone. Typically, elderly individuals exhibit darker upper anterior teeth with incisal edge abrasion, potentially revealing dentin hue vestibularly when pigmented. Tamaki T suggests that in males, upper anterior teeth may develop a brown-orange tone, while in females, a light brown-gray tone is more common. Stained and worn teeth are indicators of older age.¹⁷

Restoring the anatomy of a lost tooth necessitates consideration of wear, abrasion, age, gender, facial pattern, and patient origin. Male dentition often features square, thick teeth with flattened vestibular surfaces, resulting in a more angular appearance. Female dentition tends to have rounded proximal surfaces and highly convex incisodistal angles in upper incisors. Lee R notes that female teeth commonly exhibit well-curved proximal surfaces in upper canines, pronounced cusps, and highly inclined mesial and distal incisal slopes. Upper premolars typically follow the shape of the canine.¹⁸

In complete dentures, acrylic resin teeth are frequently used for their wear resistance, facilitating customization of color and shape. Stock teeth are conventionally modified in shape and contour using mounted stones and sanding discs. Tooth color characterization may involve staining, restoration simulations, and decalcifications to achieve desired results.

Kuwata M suggests surface texture characterization, varying in brightness and undulations, reflecting light differently to enhance aesthetic appeal.¹⁹ Exposed roots can be simulated to convey periodontal issues and an older age appearance. Frush and Fisher emphasize the importance of tooth arrangement and alignment in achieving naturalness in complete dentures, aligning with age, gender, and personality.²⁰

For a youthful appearance, slight visibility of the incisal edge in upper anterior teeth is recommended, while tooth wear may obscure the incisal edge in cases of a senile appearance. Diastema, or tooth gaps, contribute to natural and harmonious aesthetics in complete dentures. Characterization techniques, such as simulations of decalcifications, amalgam graying, dentin pigmentation, and crack replication, enhance the natural appearance of teeth.

There's a notable contrast between complete dentures with characterized teeth and conventional ones. Tamaki T advocates for highlighting diastemas, incisal wear, cervical abrasions, enamel stains, and restorations to mimic natural dentition, reducing the artificial appearance of complete dentures.²¹

Managing completely edentulous patients with characterized denture prostheses requires a comprehensive understanding to achieve a more natural appearance compared to conventional dentures, which often result in an artificial look. This case report outlines a method for fabricating a characterized complete denture prosthesis for a completely edentulous female patient. Frush and Fischer emphasized the use of gender, personality, and age as guidelines for tooth selection, arrangement, and characterization to enhance the individual's natural appearance.²² The primary aim is to achieve dynamic unity, where the entire dental composition complements the face and itself, avoiding a mechanical or uniform appearance. Principles such as proportion, line, dominance, balance, and color are specifically applied to achieve this goal. This article is significant due to its scientific approach to the artistic aspect of denture construction.

The primary objectives of complete denture prostheses in edentulous patients are to enhance aesthetics, phonetics, and masticatory function. Characterized dentures were chosen for this patient to fulfill these objectives, as well as the patient's preference for a natural appearance. Patient involvement in treatment decisions is crucial for the success of complete denture therapy. Literature confirms that tooth loss often leads to heightened awareness of dental appearance, emphasizing the importance of characterizing the denture base to mimic natural oral tissues, including rugae areas, gingival sulcus, and interdental papillae.

Esthetics has gained significant importance in dentistry, with treatment planning now beginning with clear esthetic objectives. Neglecting esthetics in treatment planning can lead to unfavorable outcomes. Today, treatment planning prioritizes esthetics while considering its impact on function, structure, and biology. Incorporating the dynesthetic and dentogenic concepts, along with unity with variety, results in a more natural and harmonious prosthesis desired by patients and reflective of the quality of care they deserve. Simple guidelines, such as using gender-specific tooth molds, arranging prosthetic teeth according to sex, personality, and age, and sculpting the visible denture base with natural contours, can help achieve outstanding esthetics.

CONCLUSION

Throughout the historical evolution of artificial teeth, and with an ongoing commitment to replicating nature's designs as faithfully as possible, establishing a strong relationship between patient, professional, and technician in prosthodontics is crucial for successful treatment outcomes. All dental professionals and associated technicians should meticulously document, mold, and analyze the shape, color, arrangement, and alignment of natural teeth, while also delving into relevant literature on the subject.

Characterization of teeth in complete dentures should be prioritized as it mirrors natural teeth, offering patients the closest approximation to their original dentition. This characterization not only enhances aesthetics but also contributes to the patient's psychological well-being and confidence, which significantly impacts their social interactions.

The use of characterized complete denture prostheses in prosthodontic therapy presents the potential to provide edentulous patients with a more natural or lifelike appearance compared to conventional dentures, which often have a distinctly artificial look. Treatment with characterized complete denture prostheses can lead to improved speech, enhanced aesthetics, and significant social and psychological benefits over traditional dentures.

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