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Article

Fabrication and Rehabilitation of Edentulous Patients Using Removable Dentures

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Abstract: The rehabilitation of edentulous patients using removable denture prostheses is a crucial aspect of prosthodontics, significantly impacting both function and quality of life. This study explores the fabrication process, material selection, and patient adaptation to removable prostheses. The research follows a structured nine-step protocol, including impression-taking, occlusal rim fabrication, articulation, tooth arrangement, wax modeling, flasking, acrylic preparation, pressing, and finishing. Various prosthetic materials such as acrylic, nylon, and acetal were evaluated based on their stability, comfort, and esthetic outcomes. Findings indicate that acrylic-based prostheses provide superior load distribution and durability but require a longer adaptation period. In contrast, flexible dentures offer enhanced comfort but may accelerate alveolar ridge resorption. The use of articulators played a crucial role in achieving proper occlusion, reducing the risk of temporomandibular disorders. Additionally, acetal clasps proved advantageous in esthetics due to their natural tooth-like color. Patient adaptation varied depending on the prosthetic type, emphasizing the importance of individualized treatment planning and follow-up care. The study highlights the necessity of precision in prosthesis fabrication and patient education for optimal outcomes. Future research should focus on integrating digital technologies such as CAD/CAM and 3D printing to enhance prosthesis accuracy, stability, and patient satisfaction.

Keywords: Edentulous patients, removable dentures, prosthodontics, material selection, occlusion, patient adaptation, digital dentistry.

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1. Introduction

Scientific literature indicates that edentulous patients experience various psychological, anatomical, phonetic, and speech-related difficulties due to tooth loss[1]. Their rehabilitation with removable dentures significantly influences these factors. In this context, the relationship between the dentist and the patient plays a crucial role, as adapting to new prosthetic changes is often challenging. Therefore, patients must establish a trusting relationship with their dentist. The rehabilitation of partially edentulous patients with removable dentures is a widely used treatment method. The most commonly recommended prosthetic options include traditional removable partial dentures, prostheses attached to teeth or implants, fixed partial dentures, and implant-supported rigid or partial dentures[2].

There are various types of removable dentures, which can be categorized into two main groups:

1. The First Group includes all types of complete and partial removable dentures:

Acrylic (plastic), nylon, and acetal dentures, differing in base material, are placed on the mucous membrane of the oral cavity. Artificial teeth in plastic dentures are designed to provide high esthetic quality. Acrylic dentures have a rigid base, which positively affects the distribution of chewing forces on the jawbone. Acetal and nylon dentures

become more flexible at oral temperature, allowing for a tighter fit on the mucosa. However, a disadvantage of flexible dentures is the rapid onset of bone atrophy. Nylon dentures are preferred as temporary solutions during implant treatments[3].

2. The Second Group includes clasp-retained dentures with a metal framework. These may be secured with clasps or special attachments. Clasp-retained dentures use additional components that embrace the patient's natural teeth, ensuring stability during vertical and lateral movements. Clasps can be made of metal or acetal. Metal clasps are either cast as part of the denture framework or bent from special wire. Acetal clasps can be used in metal, acrylic, or acetal-based dentures. Their advantage lies in their ability to match the natural tooth color, making them less visible when placed on anterior teeth. Additionally, they exhibit higher elasticity at oral temperature compared to metal clasps[4].

The lifespan of complete laminar dentures is directly related to the reasons for their replacement. Functional deficiencies such as loss of fixation and stability increase the risk of alveolar ridge and mandibular bone atrophy. This also necessitates preventive measures against dystrophic changes in the mucosal area supporting the prosthesis. The Nine Stages of Fabricating Removable Dentures for Edentulous Patients[5].

The production of removable dentures follows a nine-step process:

1. Model Casting: Initial impressions of the edentulous patient's jaws are taken using special dental impression trays. The impression may require a wax border, and to eliminate air bubbles, the impression material is processed using a vibrator device[6].

2. Fabrication of the Occlusal Rim: A dental technician uses wax to create an anatomical contour of the teeth on the impression model. The occlusal rim must be properly aligned with the lips, ensuring correct incisal edge positioning, occlusal plane, vertical dimension, and midline.

3. Articulation of Models: The dentist uses an articulator to simulate the patient's jaw relationship. The primary gypsum models are indexed and positioned based on the impressions and occlusal rim measurements.

4. Tooth Arrangement: Dental laboratory technicians arrange the artificial teeth according to the required occlusal scheme, ensuring both functional and esthetic alignment.

5. Wax Modeling of the Prosthesis: After proper tooth positioning, additional wax is applied around the teeth to gradually form the correct gingival contour. Sufficient wax is added to achieve a natural and harmonious appearance with facial muscles. After completing the wax prosthesis, the acrylic gingival base is adjusted to prevent an unnatural smooth look[7].

6. Flasking (Embedding in a Flask): Once the patient approves the trial denture, the prosthesis is prepared for processing. The first step involves embedding the model with the wax denture into the lower half of the flask and securing it with gypsum. After the gypsum sets, the upper half of the flask is placed, and additional gypsum is poured. The flask is then heated until the wax fully melts. Once opened, the flask is cleaned, leaving only the space for the denture, which is then filled with acrylic.

7. Acrylic Preparation: A technician accurately measures and mixes the polymer and monomer to create the acrylic material.

8. Acrylic Pressing: Once the acrylic mixture is ready, it is poured into the mold inside the flask. The two halves of the flask are then pressed together under controlled pressure until the acrylic fully hardens. The prosthesis is then removed, cleaned, and prepared for final adjustments.

9. Finishing and Polishing: Any excess material is trimmed using specialized rotary instruments, particularly around the edges and palatal areas. The articulation is checked and adjusted if necessary. Finally, the denture is polished using specific pastes to achieve a smooth, natural-looking finish. This structured approach ensures the fabrication of high-quality removable dentures, optimizing patient adaptation, comfort, and long-term oral health.

2. Materials and Methods

Materials:

This study analyzed the rehabilitation process of edentulous patients using removable denture prostheses. ***The following materials and tools were used during the study:***

Dental impression materials: Alginate, silicone, gypsum. Materials for prosthesis fabrication: Acrylic, nylon, acetal, metal. Measurement and articulation tools: Articulator, occlusal plates, bite registration materials. Laboratory equipment for prosthesis fabrication: Vibrator device, wax modeling materials, flask, pressing equipment. Clinical instruments for patient assessment: Oral examination tools, fixation tests[8].

Methods:

The study was based on the nine-stage rehabilitation process, with each stage carried out as follows:

1. Model Casting. Initial impressions of edentulous patients' jaws were taken. The impression material was processed using a vibrator device to eliminate air bubbles.
2. Fabrication of the Occlusal Rim.A customized wax model was prepared for the patient. The anatomical contouring was performed based on lip and jaw movements.
3. Articulation of the Models. The patient's jaw movements were analyzed using a specialized articulator. The vertical dimension and midline were determined using an occlusal plate.
4. Tooth Arrangement. Artificial teeth were placed according to the required occlusal scheme. Aesthetic and functional compatibility was verified.
5. Wax Modeling of the Prosthesis. The natural contour of the gingiva was created using wax. Facial muscle movement and natural appearance were considered.
6. Flasking (Embedding in a Flask). The patient-approved wax model was embedded in a flask. The model was covered with gypsum, and the wax was melted to create the mold.
7. Preparation of Acrylic Material. Polymer and monomer were precisely measured and mixed.
8. Acrylic Pressing. The acrylic mass was poured into the mold and pressed under controlled pressure.
9. Finishing and Polishing. Excess material was removed, and the articulation was checked. The prosthesis surface was polished and refined for a natural appearance. These methods aimed to facilitate patient adaptation to the new prosthesis, ensuring its stability and comfort[9].

3. Results

The fabrication and rehabilitation of edentulous patients with removable dentures followed a structured nine-stage protocol that contributed to consistent functional and aesthetic outcomes. Throughout this process, several key results and observations were noted regarding patient adaptation, prosthesis efficiency, and material performance[10].

Out of all the prosthetic types evaluated, acrylic-based dentures demonstrated superior load distribution and long-term stability. These dentures were particularly effective in transferring masticatory forces evenly across the alveolar ridge, thus minimizing the risk of localized mucosal trauma. However, patients reported a longer adaptation period, possibly due to the rigid base structure, which initially caused discomfort in some cases. In contrast, nylon and acetal flexible dentures showed enhanced comfort during the initial adaptation phase. Their flexibility allowed for a more intimate fit to the mucosal surface, reducing pressure points and improving speech and mastication in the short term. Nonetheless, follow-up evaluations revealed that these materials may contribute to faster alveolar bone resorption due to uneven pressure distribution over time[11].

A significant result observed was the role of occlusal articulation using an articulator. The use of this device led to a better simulation of jaw relationships and improved the alignment of the artificial dentition. It helped prevent occlusal errors that could lead to temporomandibular joint discomfort or inefficient mastication. Most patients who received prostheses fabricated with proper articulation experienced fewer post-insertion complications and reported improved chewing efficiency[16]. From an esthetic perspective, acetal clasps proved to be highly effective. Due to their tooth-colored appearance, they were less noticeable in anterior regions, leading to increased patient satisfaction, especially among individuals with high esthetic demands. Additionally, the durability and elasticity of acetal at intraoral temperature contributed to better retention without compromising gingival health[12].

The study also highlighted the importance of wax modeling and finishing stages, where careful anatomical contouring resulted in prostheses that closely matched the patient's gingival architecture and facial muscle harmony. This attention to detail was instrumental in achieving a natural look and functional comfort. Another key result was related to patient adaptation and satisfaction. While most patients adapted to their new prostheses within a two-week period, those fitted with rigid acrylic dentures required up to a month to fully accommodate the changes. Regular follow-ups and patient education significantly reduced complaints of soreness, instability, and speech difficulty. Finally, the introduction of modern techniques such as CAD/CAM and digital articulators was suggested for future practice. These technologies have the potential to improve the precision of prosthesis fabrication, reduce chairside adjustment time, and further enhance patient outcomes[13].

4. Discussion

The rehabilitation of edentulous patients using removable denture prostheses is a complex process that involves both functional and psychological adaptation. The findings of this study highlight the importance of precise prosthetic fabrication, patient-centered approaches, and the role of different materials in achieving optimal outcomes[14].

One of the key challenges in removable prosthodontics is ensuring proper retention, stability, and comfort for the patient. A well-fitted prosthesis must distribute occlusal forces evenly, prevent excessive pressure on the soft tissues, and allow for natural speech and mastication. The study demonstrated that acrylic-based prostheses provide a rigid and stable foundation, which is particularly beneficial in load distribution to the underlying bone[15]. However, their rigidity may cause discomfort in some patients, leading to a preference for flexible materials such as nylon and acetal. While flexible dentures offer better adaptation to the oral mucosa, they may accelerate alveolar ridge resorption due to their less uniform force distribution. The articulation process plays a crucial role in determining the final occlusal relationship, ensuring that the prosthesis aligns properly with the patient's natural jaw movements. Errors in this stage can lead to occlusal discrepancies, discomfort, and even temporomandibular joint (TMJ) disorders. The use of an articulator in this study helped in achieving an anatomically accurate setup, thereby enhancing the functional efficiency of the prostheses[16].

Another significant factor in patient satisfaction is the esthetic outcome of the prosthesis. Acetal clasps were found to be particularly advantageous due to their ability to blend with natural tooth color, making them less noticeable compared to traditional metal clasps. This feature is essential for patients who are concerned about the visual impact of their prostheses, particularly in anterior regions.

Furthermore, the adaptation period for patients varied depending on the type of prosthesis used. Traditional acrylic dentures required a longer adaptation period, whereas flexible and implant-supported prostheses allowed for a more immediate adjustment. Patient education and follow-up care were found to be essential in minimizing discomfort and improving long-term compliance with prosthesis use. Overall, the study underscores the importance of material selection, fabrication techniques, and individualized treatment planning in the successful rehabilitation of edentulous patients. Future research should focus on advancements in digital dentistry,

such as CAD/CAM technology and 3D printing, to further improve the precision and comfort of removable dentures.

5. Conclusion

The rehabilitation of edentulous patients using removable denture prostheses is a multifaceted process that requires a combination of precise fabrication techniques, appropriate material selection, and patient-centered care. This study highlights the importance of each step in the prosthesis manufacturing process, from impression-taking to final polishing, in ensuring optimal functionality, comfort, and esthetics.

Acrylic-based prostheses were found to provide better load distribution and long-term durability, while flexible dentures offered greater initial comfort but posed a higher risk of alveolar ridge resorption. The use of articulators played a vital role in achieving proper occlusion, minimizing complications such as occlusal discrepancies and temporomandibular disorders. Additionally, esthetic considerations, particularly the use of acetal clasps, proved beneficial in improving patient confidence and satisfaction. Patient adaptation to removable prostheses varied, reinforcing the need for individualized treatment planning, patient education, and regular follow-ups. The findings suggest that advancements in digital dentistry, such as CAD/CAM technology and 3D printing, have the potential to further enhance precision and patient outcomes.

In conclusion, successful rehabilitation with removable dentures depends on a meticulous approach to prosthesis design and patient management. Future research should focus on integrating modern digital techniques to improve prosthetic accuracy, longevity, and overall patient experience.

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