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(REVIEW ARTICLE)

Prosthetics on implants

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Abstract

Dental implantation is a critical method for restoring defects in dental arches, bite, and masticatory function, involving the placement of artificial roots into the jaw. This technique, developed over the past five decades, addresses various complex dental issues and has become particularly popular due to its ability to minimize discomfort for patients with partial or complete edentulism. This article explores different types of dental implants, such as endodontic, endosseous, subperiosteal, and submucosal implants, along with the methods of prosthetics on implants, including immediate and delayed prosthetics. Indications for both one-stage and two-stage dental implantation are discussed, highlighting factors like bone density and oral hygiene. [3]A clinical case study is presented, illustrating the application of implant-supported removable prostheses with CAD/CAM technology for virtual planning and guided surgery. The article emphasizes the importance of an individualized approach to treatment, the use of advanced technologies, and preventive care for long-term implant success. Overall, dental implantation continues to be the most physiological approach for replacing missing teeth, ensuring both functional and aesthetic restoration.

Keywords: Dental implantation; Prosthodontics; Endosseous Implantation; Subperiosteal Implantation; CAD/CAM Technology; Two-Stage Implantation; Implant-Supported Dentures.

1. Introduction

Dental implantation is a method of reconstructive restoration for defects in dental arches, bite, and masticatory function. It involves the implantation of an artificial root (implant) into the upper or lower jaw. Implants serve as supports for attaching crowns (which fully replace missing teeth) or removable dentures (in this case, implants aid in the secure fixation of the prosthesis within the oral cavity). When one or more teeth are missing, dental implants are typically placed. Over time, the evolving techniques utilizing implants have addressed numerous complex issues in dentistry. It should be noted that the load on implants, as one of the treatment protocols for patients with partial or complete edentulism, has become the most popular among patients due to its ability to reduce discomfort.[1]

2. Materials and methods

Although 50 years have passed since the principles of modern dental implantology were established in Gothenburg, experimental and clinical research continues to this day.

The following types of dental implants exist:

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- Endodontic Implantation - also known as endodontic or transradicular implantation. The implant is a pin (with various elements for fixation) that passes through the tooth canal and is introduced into the jawbone through the root;
- Endosseous (Intrabony) Implantation – the implant is inserted directly into the bone tissue;
- Subperiosteal Implantation – the implant is placed on the bone surface of the alveolar process of the jaw beneath the mucoperiosteal flap;
- Endosseous-Subperiosteal Implantation combines both endosseous and subperiosteal parts;
- Intrasulcular Implantation (Insert Implantation) – the implant is placed within the mucous membrane of the jaw;
- Submucosal Implantation – the implant is placed beneath the mucous membrane of the jaw.

Methods of Prosthetics on Implants:

- Immediate Prosthetics – the fixed attachment of a pre-made dental prosthesis is carried out directly on the operating table;
- Delayed Prosthetics – this is performed in the near or distant future. Delayed prosthetics typically occur 4–6 months after implantation, as reparative processes in the initial phase of implant osseointegration occur isolated from the oral cavity environment.

Indications for One-Stage Dental Implantation: A wide alveolar ridge, dense bone with a pronounced cortical layer, a large area of gum attachment, good oral hygiene, and a stable temporary prosthesis.

Indications for Two-Stage Dental Implantation: Somatic diseases, low bone density, harmful habits (e.g., smoking), poor healing potential, the need to augment the alveolar ridge (augmentation), periodontal risk factors.

The nature of interalveolar relationships must be taken into account when designing dental prostheses supported by implants. It is important to note that when there is significant spatial divergence at the tips of the alveolar ridges, unfavorable biomechanical conditions arise for implant function. In such cases, it may be more appropriate to opt for a removable prosthesis.

For example, consider our patient, G.D., a 65-year-old with somatic diseases, who presented with complete edentulism in both the upper and lower jaws, accompanied by bone loss. Implantation was not possible without augmentation, a procedure the patient refused. As a result, we decided to create a removable prosthesis, and on the lower jaw, we installed a bar prosthesis supported by four implants. [Figures № 1, 2, 3, 4] Delayed prosthetics were carried out with the installation of conical implants. CAD/CAM technology was used for virtual planning. In this case, delayed prosthetics were performed.

3. Result and discussion

Restoring the required height of the lower facial region resulted in a significant increase in the non-alveolar part of the prosthesis. Therefore, it was better to create a removable structure, using implants only as additional supports to improve the fixation and stability of removable prostheses with a detachable locking element.

For planning orthopedic treatment supported by intrabony implants, we applied computer technologies, including computer Tomography with 3D Reconstruction Capabilities; Special Programs for Virtual Prosthesis Selection Based on Intrabony Implants; Specialized CAD-CAM Systems Coupled with Points 1 and 2, Which Allow for the Creation of Surgical Guides with Optimal Direction and Diameter Sleeves. [2]

Figure 1 X rays of the beam on dental implants

Figure 2 The beam on cast model and prosthesis

Figure 3 Patient's right profile with prosthesis on implants

Figure 4 Patients smile with prosthesis on implants

3.1. Rehabilitation and Preventive Stage

A preventive check-up is performed six months after the procedure, followed by annual consultations and professional oral hygiene every six months.

Clinical-Laboratory Stages for Prosthetics of Our Patient with Metal-Ceramic Dental Prostheses Supported by Implants:

- Stage 1: Taking a two-layer or single-layer (monophase) impression using silicone impression material. This helps to determine the central occlusion and form the prosthetic plane.
- Stage 2: The working model is fabricated using laboratory analogs of the implants and special components to transfer the implant position from the oral cavity to the technical model—impression transfers (impression heads).
- Stage 3: Casting the metal framework.
- Stage 4: Fitting the metal framework.
- Stage 5: Determining the color of the artificial teeth.
- Stage 6: Applying ceramic coating.
- Stage 7: Checking the metal-ceramic crown in the oral cavity.
- Stage 8: Staining and glazing the ceramic coating.
- Stage 9: Fixation of the metal-ceramic prosthesis.

Sequence of Clinical-Laboratory Stages:

- Choosing the Impression Method: For 1–2 implants (either open or closed), for more than two implants, the open tray method is preferable.
- Fitting the Standard Tray or Fabricating and Fitting a Custom Tray.
- Fixation of Transfers to Implants.
- Taking the Impression with Two-Component Materials.
- Screwing Laboratory Analogues of Implants to Transfers in the Impression.
- Fabrication of the Working Model.
- Choosing the Implant Head, Preparation.
- Modeling the Wax Composition. Fabrication of the prosthesis framework (metallic or all-ceramic).

4. Conclusion

In the case of the patient described above, dental implantation has effectively restored bite defects, dental arches, and masticatory dysfunctions. An individualized approach by the dentist to each patient helps address orthopedic issues for practically healthy patients, as demonstrated in the clinical example. The key factor in dental implantation is the required experience in planning orthopedic treatments and proficiency with CAD/CAM technology. This method allows for the restoration of dental arch defects without the preparation of adjacent teeth, both medially and distally. Preventing complications that arise due to tooth loss remains a crucial issue in modern dentistry. Dental implantation is still considered the most physiological method for replacing defects.

In summary, diagnosis, monitoring, and good oral hygiene ensure the longevity of the implant and extend the lifespan of the prosthetic structure.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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