

“ALL-ON-6”, “ALL-ON-4” CONCEPT IN IMPLANT-PROSTHETIC REHABILITATION: CLINICAL CASE REPORT

КОНЦЕПТОТ „ALL-ON-6“ И „ALL-ON-4“ ВО ПРОТЕТСКАТА РЕХАБИЛИТАЦИЈА СО ИМПЛАНТИ: ПРИКАЗ НА КЛИНИЧКИ СЛУЧАЈ

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Abstract

Introduction: Restoration of total edentulism in jawbones with dental implants has emerged as an advanced therapeutic solution, utilizing strategically positioned dental implants to support fixed prosthetic restoration, which closely replicates the appearance and function of natural teeth. **Aim:** The aim of the paper is to assess the clinical and radiological outcomes of the “All-on-6” and “All-on-4” concepts using three-dimensional digital planning and treatment with dental implants, emphasizing the high success rate, patient satisfaction and the functional and esthetic benefits of restoring oral function and aesthetics by using advanced technologies. **Material and methods:** This clinical case report presents the comprehensive treatment of a 60-year-old male patient with complete edentulism, with six dental implants in the maxilla and four in the mandible (Neodent Helix GM). After a six-months healing period, precise prosthetic procedures were performed, including an intraoral digital scan (Aoralscan Elite Shinning 3D) using photogrammetric technology at the multi-unit abutment level, ensuring optimal accuracy, functionality, and esthetic outcomes. **Conclusion:** The definitive prosthetic restorations resulted in significant improvements in the patient’s masticatory efficiency, speech, and overall oral health-related quality of life. This case study highlights the transformative potential of the full-arch implant rehabilitation, beginning with the 3D analysis (CBCT) analysis, meticulous planning, and implant-supported prosthetic therapy in both jaws. **Key words:** implant-prosthetic rehabilitation, “All-on-6” concept, “All-on-4” concept, 3D CBCT imaging, oral health-related quality of life.

Апстракт

Вовед: Реставрацијата со употреба на импланти при појавата наречена еден тулизам (без забост) се појавила како напредно решение, користејќи стратешки поставени денални импланти за поддршка на фиксната протетска реставрација, кои го реплицираат изгледот и функцијата на природните заби. **Цел:** Целта на трудот е да се оценат клиничкиот и ренгенолошки исход од два концепти познати како “All-on-6” и “All-on-4” користејќи тродимензионално планирање и третман со помош на денални импланти, при тоа истакнувајќи ја високата стапка на успех, задоволството на пациентите и повеќекратните придобивки од враќањето на оралната функција и естетика со употреба на напредни технологии. **Материјал и метод:** Овој клинички случај го опишува сеопфатното лекување на 60 годишен машки пациент, со целосен едентулизам, со употреба на шест денални импланти во горната и четитири во долната вилица (Neodent Helix GM). По шест месеци период на заздравување беа извршени прецизни протетски процедури, вклучувајќи скенирање со интраорален скенер (Aoralscan Elite Shinning 3D) со употреба на фотограметријата на ниво на абатменти (multi-unit), со цел да се обезбеди максимална точност, функционалност и естетика. **Заклучок:** Дефинитивните протетски реставрации резултираа во значителни подобрувања во ефикасноста на мастикацијата, говорот и целокупниот квалитет на живот поврзан со оралното здравје. Овој приказ на случај го истакнува трансформативниот потенцијал на целокупниот рехабилитациски процес, од 3D анализа (CBCT), планирање и терапија со денални импланти и протетски реставрации на двете вилици. **Клучни зборови:** импланто-протетска рехабилитација, “All-on-6” концепт, “All-on-4” концепт, 3D, CBCT, квалитет на живот поврзан со оралното здравје.

Introduction

The loss of natural teeth, known as edentulism, is a significant clinical condition that affects the functional and

aesthetic aspects of patients' lives. Edentulism not only affects the ability to chew and speak, but also negatively impacts the overall quality of life, leading to psychological, emotional, and social consequences. Traditional solutions

such as conventional complete dentures often do not meet the requirements for adequate stability and functional performance needed for optimal oral health¹. Full-mouth implant-supported rehabilitation represents a revolutionary approach to addressing this clinical limitation, involving the strategic placement of dental implants for a complete fixed reconstruction, offering a stable, long-term solution that closely resembles natural teeth, in both function and appearance. It also contributes to the restoration of masticatory efficiency and speech function, while enhancing patient self-confidence and overall well-being².

The original Branemark surgical-prosthetic protocol was based on the placement of four implants in the mandible and six implants in the maxilla in cases with minimal to moderate alveolar bone resorption³.

In 2003, the concept of full-arch prosthetic rehabilitation was introduced, based on the use of only four implants, with two implants placed axially in the anterior region of the jaws and two implants placed in the posteriorly part of the jaws, placed obliquely at an angulation⁴. The stability of the fixed prosthetic construction is further enhanced by placement of longer implants⁵. This concept avoids augmentative bone procedures, reduces surgical intervention time, and lowers the overall treatment cost⁶. In addition, a 10-year follow-up study demonstrated high success rates of fixed prosthetic restorations, reaching 99.2% of the patients⁷.

The “All-on-4” concept has been extensively investigated by numerous authors, and has been further refined to maximize the utilization of available jaw bone while reducing surgical and prosthetic complications, particularly avoiding augmentative procedures that increase treatment cost and patient morbidity^{8,9}.

Aim

The aim is to present a clinical case with “All-on-6” and “All-on-4” concept in implant-prosthetic rehabilitation with accent on three-dimensional planning and teamwork.

Material and method

The patient in this case study was 60-year-old male with complete edentulism in both jaws, and a documented history of advanced periodontitis, which results in tooth loss one year prior to presentation. The patient’s primary complaints included intolerance to previously made complete acrylic dentures, dissatisfied with his facial appearance, and impaired masticatory function. Consequently, the patient required a fixed implant-supported prosthetic solution to improve both his aesthetic outcomes and oral function.

The general medical history, arterial hypertension was noted and regulated with Covarit HCT tablets (Aplodopine/

Valsartane/Hydrochlorothiazide 5mg/160mg/12.5mg) administered once daily. The patient’s systemic condition was monitored by a specialist in internal medicine. The patient denied other systemic illnesses, was a non-smoker, and demonstrated good oral hygiene.

The preoperative orthopantomography provided a two-dimensional radiographic assessment of the jawbone structures, shown in Figure 1.

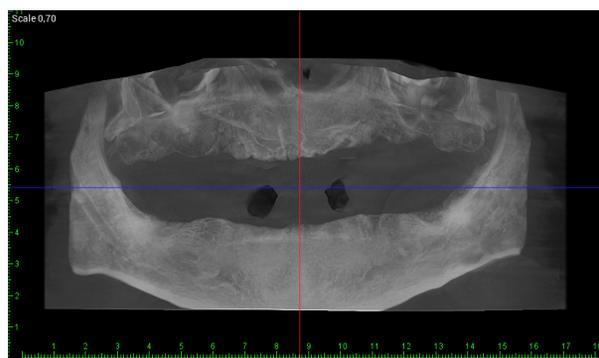


Figure 1. Orthopantomography image

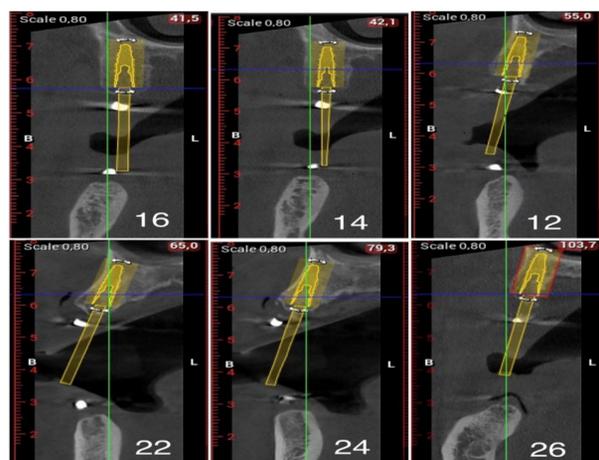


Figure 2. CBCT analyses in the maxilla

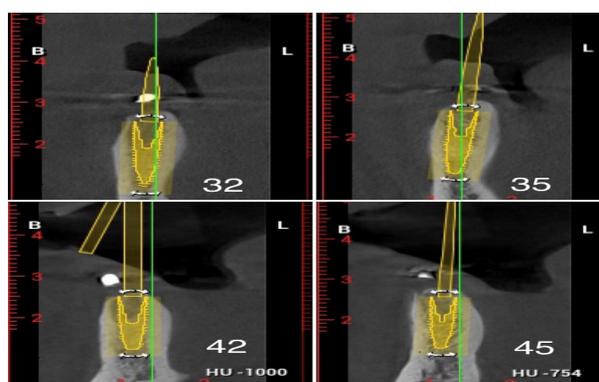


Figure 3. CBCT analyses in the mandible

Patient examination revealed a decrease in the vertical dimension of occlusion and loss of adequate lip support. Clinically, both the mandible and maxilla exhibited horizontal alveolar bone resorption accompanied by a partial reduction in vertical dimension. Analyses for precise treatment planning were performed by a CBCT scan, which confirmed the anticipated alveolar ridge bone resorption one year following tooth loss (Figures 2 and 3).

The DVT (Digital Volume Tomography) analysis was done with the existing dentures worn by the patient, and each tooth was marked with a gutta-percha markers to indicate the exact position and axial orientation (Figure 4).

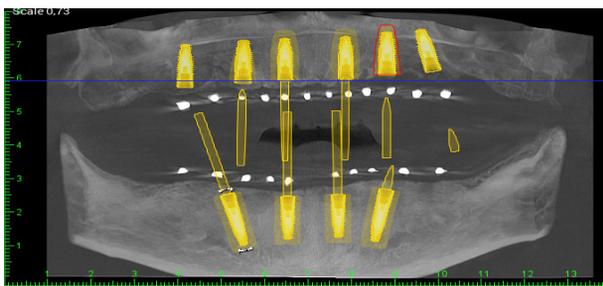


Figure 4. Digital Volume Tomography

The position of six implants in the maxilla and four implants in the mandible was planned based on radiological findings. In the posterior mandible, there was insufficient horizontal bone width for endosseous implant placement without augmentation; therefore, it was decided to use the “All-on-4” concept.

One hour prior to surgery, the patient received antibiotic prophylaxis of amoxicillin-clavulanic acid (Alkaloid Ad Skopje) and postoperative antibiotic therapy for another six days. The surgical procedure was performed under local anesthesia using articaine with epinephrine 1:100,000 (Artinibsa 4%).

For prosthetically guided implant positioning, the patient's existing acrylic dentures were utilized as a surgical reference, with pre-drilled openings corresponding to the planned implant sites.

With a classical surgical procedure, the incision was made along the crestal part of the ridge, and a full-thickness



Figure 5. Postoperative orthopantomogram

mucoperiosteal flap was elevated. A total of 10 endosseous implants (Neodent Helix GM) were placed—6 in the maxilla and 4 in the mandible (Figure 5).

The maxillary implants had the following dimensions:

- #12: 3.75x13mm;
- #14: 4.0x13mm;
- #16: 4.0x13;
- #22: 3.75x13mm;
- #24: 3.75x13mm;
- #26: 3.5x13mm.

The implants in the mandible were as follows:

- #32: 3.5x13mm;
- #35: 3.75x16mm;
- #42: 3.75 x13mm;
- #45: 4.0x16mm.

All implants were inserted with a torque value from 40 to 60 N/cm achieving adequate primary stability.

Multi-unit abutments were placed to correct implant angulation and provide optimal support for prosthetic support (Figure 6.). Straight abutments were replaced with a torque value of 32N/cm and the angulated one tightened to 25N/cm, as specified in the manufacturer's protocol.



Figure 6. Abutments installed on the inserted implants

Six months after implantation, following successful osseointegration, the prosthetic phase of the rehabilitation was initiated. The digital impression was taken using Aoralcan Elite Shinning 3D intraoral scanner photogrammetry. Diagnostic models of temporary restoration served as a reference for the occlusal relationships and aesthetic parameters achieved.

The metal framework was designed using Exocad software and was milled from a cobalt-chromic disc. It was clinically examined for its passive pressure on the abutments, through X-ray verification. Subsequently this framework was shaped with highly aesthetic ceramic materials. The definitive prosthetic restoration was screw-retained, allowing for simplified maintenance. (Figures 7 and 8)



Figure 7. Final prosthetic fixed workmanship

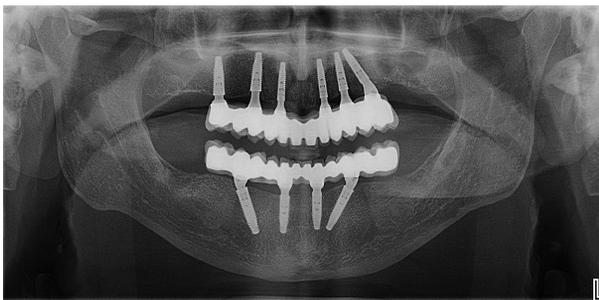


Figure 8. Orthopantomogram one year after intervention

Discussion

The rehabilitation of partial or total toothlessness in the jaw bones with dental implants is an established and widely accepted procedure in modern dentistry, offering a comprehensive therapeutic solution for individuals who have lost their natural teeth for various reasons. The technique involves surgical placement of dental implants in the bones of the jaws that act as anchors for temporary and permanent prosthetic restorations, as the implants mimic the function of the roots of natural teeth, providing a stable foundation that supports prosthetics with long-term durability and reliability¹⁰.

The benefits of implant-supported dental rehabilitation systems are well documented in the literature. Functionally, such rehabilitations restore the ability to chew and articulate, offering significantly improved masticatory performance compared to conventional removable dentures. The stability provided by the implants helps to evenly distribute occlusal forces throughout the jawbone, which not only improves chewing efficiency but reduces the risk of progressive bone resorption and subsequent facial collapse over time¹¹.

The aesthetic aspects are just as important, because the prosthetic is designed to fit and complement the patient's individual anatomical and facial characteristics. A natural smile not only increases self-esteem, it fully restores

patient's confidence, but also improves the aesthetics of the face by maintaining adequate lip support and face contour¹².

This procedure requires a sufficient volume of healthy alveolar bone to support the implants. Patients with insufficient bone volume and density require additional procedures such as bone augmentation, sinus floor elevation, and an appropriate drilling protocol for implant placement in lower density bone, in order to create an adequate osseous foundation for implant placement¹³. In addition, the treatment process itself requires precise planning and an appropriately trained multidisciplinary team consisting of implantologist, oral surgeon, prosthodontist, and dental technician.

Although the costs associated with the rehabilitation of both jaws with the help of implants are higher compared to traditional dentures, many patients consider it a worthwhile long-term investment in their oral health and quality of life. Implants are known for their exceptional durability and longevity, often lasting a lifetime with proper care and maintenance. This durability, along with the restoration of physiological chewing function and natural aesthetics, significantly improves the oral quality of life and patient satisfaction of individuals seeking a permanent solution for their tooth loss¹⁴.

The "All-on-4" therapy presents a significant advancement in dentistry, especially for patients with complete edentulism and limited bone volume. It offers several advantages including reduced treatment costs, shorter intervention times, improved treatment efficiency, and reduced patient morbidity¹⁵. This technique uses four implants to support fixed prosthetics, making it a sustainable option in restoring toothless jaws. While the All-on-4 technique has a high implant success rate of up to 99%, prosthesis survival is somewhat lower due to problems such as porcelain crown failure, prosthesis fracture, screw loosening, and distal cantilevers¹⁶. To overcome these shortcomings, the "All-on-6" technique was developed, which provides enhanced prosthetic support and more favorable stress distribution over a larger surface area¹⁷.

The "All-on-6" approach is designed to maximize the utilization of available alveolar bone to accelerate functional recovery and eliminate the need for additional augmentation procedures, which would increase the overall treatment cost¹⁸. By avoiding cantilevers, the "All-on-6" concept reduces the risk of biomechanical complications, such as prosthetic screw loosening and implant overloading.

Considering the case described here and the patient's clinical condition of severe maxillary atrophy, a combination of six implants in the upper jaw and four in the lower jaw was considered the most appropriate therapeutic approach. By placing more implants in the maxilla, the expected survival rate of maxillary prosthetic rehabilitation

is anticipated to be very high similar to that of mandibular prosthetic rehabilitation. The maxilla generally withstands lower occlusal forces than the mandible due to the relatively thin cortical bone layer and low bone density of the cancellous bone¹⁹. Thus, when the “All-on-4” concept is applied in both jaws, the failure rate is usually significantly higher for maxillary implants compared to mandibular implants²⁰. The number of implants recommended in the maxilla for a fixed prosthetic restoration is a minimum of six implants²¹.

The length of all implants exceeds 10 mm, a well-documented dimension associated with a high implant survival rate, and it corresponds to the existing bone quality, especially in the maxilla²². In addition, according to two studies, the proximity of critical anatomical structures, in cases with moderate to severe jawbone resorption, was the primary factor affecting the implant length²³. Therefore, the implant lengths in this case are 13 mm and 16 mm, respectively, according to DVT (Digital Volume Tomography) analysis, performed using advanced 3D virtual planning software. By using DVT, it is possible to assess not only bone density, but also the anticipated bone-to-implant contact, distinguishing between areas of different bone quality and thickness. This makes it possible to predict the primary implant stability prior to the surgical procedure.

Regarding distally placed implants, many authors have reported that they can be placed at different angles of 15°, 25°, 30° and 45° between the implant and the prosthetic abutment^{24,25}. These degrees of angulation are also determined by local bone quality and quantity, in terms of the length and width of the available bone for implantation, and by the surrounding anatomical structures (maxillary sinus in the maxilla and mental foramen in the mandible)²⁶. One study found that the distribution of peri-implant cortical bone pressure increases with increasing angulation between the implant and abutment and with decreasing number of implants²⁷. Other studies, however, have not found differences in cortical bone pressure between angulated and axially placed implants, as well as between connected and unconnected implants²⁸.

Despite the limitations and challenges offered by “All-on-6” and “All-on-4”, the clinical predictability of the intervention remains high if all protocols are strictly followed and the procedure is performed by a highly experienced multi-disciplinary team.

Conclusion

The rehabilitation of toothless jaws with dental implants significantly improves both oral function and facial aesthetics. Dental implants provide a stable and long-lasting foundation for prosthetic restorations, offering clear advantages over traditional total acrylic dentures.

Accurate planning with CBCT and precise surgical execution are crucial for the placement of dental implants but also for the long-term success of implant-supported fixed restorations.

The “All-on-6” and “All-on-4” concepts provide effective, and predictable implant-prosthetic treatment options in edentulous patients.

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