

FULL ARCH REHABILITATION WITH 4 DENTAL IMPLANTS (CASE REPORT)

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Abstract

Usually, full arch reconstruction of edentulous ridges requires six to ten dental implants. However, some patients demanding fixed implant-supported prostheses are not able to medically or economically afford complex bone grafts or a greater number of implants. These clinical situations could lead the treatment plan toward the all-on-4 protocol. Four dental implant treatment concept offers a reliable solution for patients looking to escape the discomfort that so often comes from wearing a removable denture, or those with a failing dentition who do not want to spend even a day without teeth.

Designed to further help clinicians utilize a graftless approach and achieve cortical or bicortical anchorage where bone quality and quantity are limited. Costs for both the doctor and the patient are reduced because less surgical time and fewer products are used. Nevertheless, due to less implant support in this treatment option, mechanical and biological complications might arise.

This study describes the treatment of two separate cases a fully edentulous patients, one in maxilla and one in mandibula with fixed implant-supported prostheses on four dental implants.

Keywords: Full arch rehabilitation, edentulous jaw, implant-supported dental prosthesis

Introduction

Implant-supported prostheses are successful treatment modalities that can be used for single tooth replacement to full mouth rehabilitation. Depending on the number of the implants used in fully edentulous patients, the restoration can be removable or fixed [1,2].

Some of the other factors that determine the type of the prosthesis include the remaining amount of bone, the amount of inter-occlusal space, and the patient's wishes [1–5]. Fixed implant-supported prostheses usually need 6 to 9 implants in the mandible and 6 to 10 implants in the maxilla [1,2]. Generally, fixed implant-supported prostheses can be divided into screw retained and cement retained prostheses. Each treatment option has several advantages and disadvantages compared to the other [6,7].

The main advantages of cement retained prostheses are esthetics and the passive fit, while screw retained prostheses offer easy retrievability [6–9].

Another concept for restoring a fully edentulous arch with a fixed prosthesis is minimal number of dental implants at least 4, called the all-on-4 protocol. An all-on-4 prosthesis is a screw-retained hybrid prosthesis supported by four dental implants [10]. However, considering the complications of this treatment option, it is advised to choose this treatment plan only when placement of an adequate number of implants is not possible [11].

It's an approach that is less invasive and cost intensive for the patient than bone grafting, more efficient for the clinician and most importantly is clinically validated to work. Introduced more than 20 years ago, the [multi- unit abutments] all-on-4 treatment concept offers a reliable solution for patients suffering with loose removable dentures, or those with a failing dentition who do not want to spend even a day edentulous. Long term success has been shown in both the edentulous maxilla and mandible. More than 30 clinical trials provide evidence of cumulative survival rates of 94.8 – 98.0 %. These results go hand in hand with patient satisfaction. In one study, 95% of 250 patients said that they were satisfied with their new teeth, while 88% said they would definitely recommend similar treatment to friends and

colleagues. For increased flexibility, the original and widely documented implant for the all-on-4 treatment concept, is now available in more lengths and diameters for increased surgical flexibility.

Shorter, longer and wider versions have been added to an expanded range designed to further help clinicians utilize a graftless approach and achieve cortical or bicortical anchorage where bone quality and quantity are limited, thus allowing more patients to benefit from the proven advantages of the (multi-unit abutments) treatment concept. The all-on-4 treatment concept puts dental professionals at the forefront of their profession. The use of four implants reduces treatment complexity, which yields many benefits. Costs for both the doctor and the patient are reduced because less surgical time and fewer products are used.

Reduced cost, less trauma, immediate function and excellent esthetic results are all clear patient benefits, as is the prospect of a solution that feels like natural teeth. Greater chewing ability, improved speech, increased comfort, less bone resorption the list of attributes that can help drive patient acceptance goes on and on. Above all, in combination these benefits lead to a potentially life changing result: the return of a patient's self-confidence.

This treatment protocol has had a big impact on patient treatment. It started the trend for restoring multiple teeth using tilted implant placement that is now backed by a wealth of clinical evidence. A two decade and a more since the launch of original all-on-4, the concept is now being accepted as effective by the implant industry as a whole. Back when the first of the products were sold, dental implant engineers could only have hoped that their small piece of technology would have such a profound effect on patient care. To this day, it is still the only one of its kind with a patented handle for a supreme handling experience. It's also specifically designed for implants with regulatory clearance for immediate loading, and can be used in the treatment of both edentulous and partially edentulous patients. In that time, as a key enabler of the clinically and scientifically proven all-on-4 treatment concept, the multi-unit abutment has allowed thousands of edentulous and soon to be edentulous patients to benefit from a minimally invasive treatment process. It makes it possible to restore a full arch with a fixed restoration using just four implants, even when the bone is reduced [12].

The angled multi-unit abutments allow for the tilting of the two posterior implants, meaning longer implants can be positioned in the anterior bone, rather than in the posterior where the bone is often resorbed. This increases bone to implant contact and reduces the need for vertical bone augmentation. Anchoring the implants in better quality anterior bone also reduces cantilevers, improving support for the prostheses [13].

All-on-4 treatment concept, this allows edentulous and soon to be edentulous patients to leave the dental surgery with a full set of teeth and renewed self-confidence. Modern philosophy is that patients should live every day to the fullest, and that the months of waiting for teeth in delayed loading protocols should be avoided if the indication allows.

It is important to note that not all clinical situations provide the primary stability required for immediate loading protocols. Predictable prosthetic planning and the surgical experience are the supporting act that allows the treatment concept to play a starring role, both for patients and clinicians.

Case report 1

A 62 year old female with a history of aggressive periodontitis was referred for full maxilla rehabilitation. The patient had been wearing mobile dentures since the age of 48. Despite the considerable amount of bone loss and unwillingness to undergo any major bone graft procedures, the patient demanded fixed prostheses. The only remaining tooth in left maxilla had to be kept temporary in order to achieve support for provisional mobile prosthesis.

Considering the presented situation, the 4 dental implant protocol was selected for full arch reconstruction. The CBCT scan was then further utilized to plan the placement of the implants [Figure 1].

By analyzing the CBCT scan, the implant dimensions and positions were verified. Four regular platform, two stage dental implants were inserted. Two with the diameter of 4.5 mm and the length of 11mm were positioned distally in molar area and two with diameter 3.6 mm and length of 13 mm in first premolar area of maxilla, using the prescribed all-on-4 guide. After six months, the uncover surgery was performed. One week later, 4 regular 15° angulated abutments were directly parallelized [Figure 2], then the open tray technique with splinted impression copings was used for the impression procedure. After trying in the cemented retained metal framework and evaluating their passive fit, they were returned to the laboratory for tooth set up at the previously established vertical dimension of occlusion. Finally, the definitive restoration was delivered, porcelain fused to metal [PFM] prosthesis, which included pink porcelain for improved esthetics [Figure 3].

The new full arch suprastructure met the comfort, function and esthetic needs of the patient, by eliminated mobility and discomfort of the previous mobile prosthesis.

Case report 2

A 56 year old woman with severe alveolar ridge atrophy in mandibula, asked for a fixed prosthetic, implant supported solution. Because of her age and living style she couldn't accept removable prosthesis and at the same time she did not agree for grafting procedure or alveolar nerve transposition. Clinical and paraclinical examinations showed that the limited edentulous spaces were marginally acceptable for 4 dental implants in to the intraforaminal area [Figure 4].

The CBCT scan was afterwards evaluated for the implant dimensions and positions. Four cylindrical dental implants [diameter 3.6 mm and length 13 mm], were placed in the area of teeth 31, 41, 33 and 43. The posterior implants were slightly angulated mesially following the protocol, while the anterior implants in frontal mandibula were inserted axially. The planned position and angulation of the implants were achieved, utilizing the previously determined sites as a reference guide [Fig. 4].

Four months after osseointegration, second stage surgery, exposing the implants was performed. One week later two regular 15° and two 30° angulated abutments were parallelized directly in the patients mouth [Figure 5]. Final impressions [the open tray technique], were taken for the fabrication of the definitive porcelain fused to metal [PFM] prosthesis. The full arch construction had two free bilateral distal cantilevers. After previously established proper occlusion, final cementation was done [Figure 6]. Patient was advised to maintain oral hygiene and recalled for proper follow up.

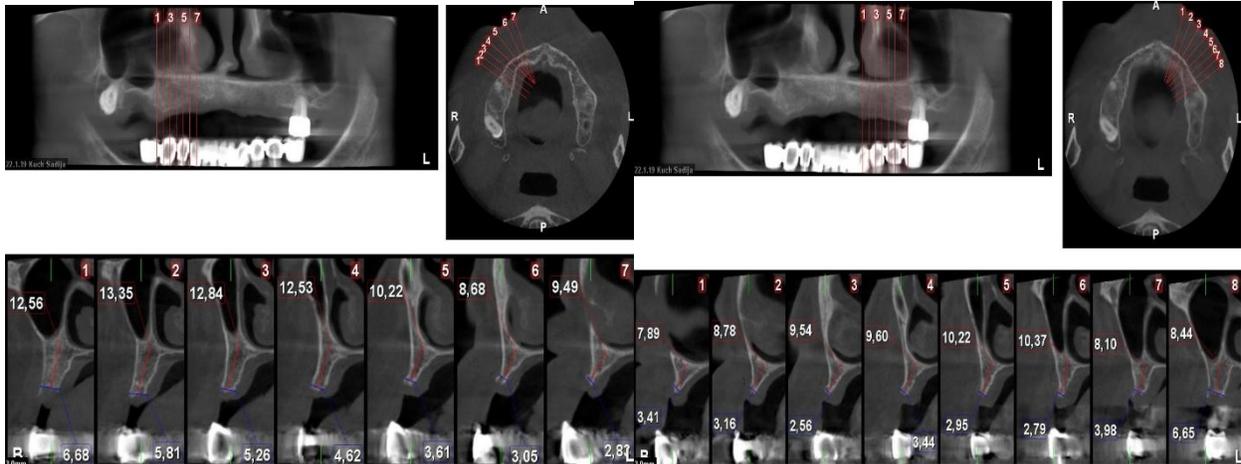


Figure 1. 3D virtual planning and measuring available bone in maxilla for 4 dental implants.



Figure 2. RTG view, six months after osseointegration and four 15° angulated abutments parallelized.

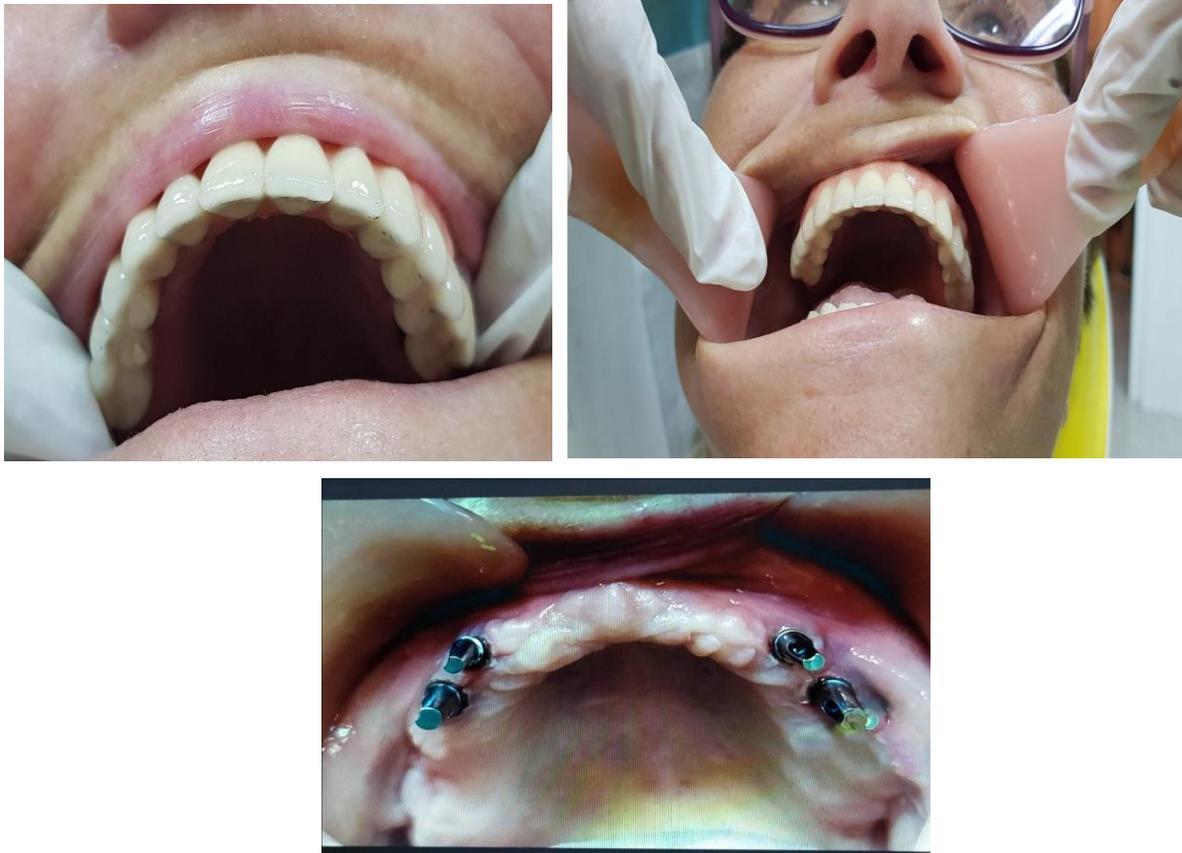


Figure 3. Definitive restoration, porcelain fused to metal [PFM] prosthesis with pink porcelain for improved esthetics.

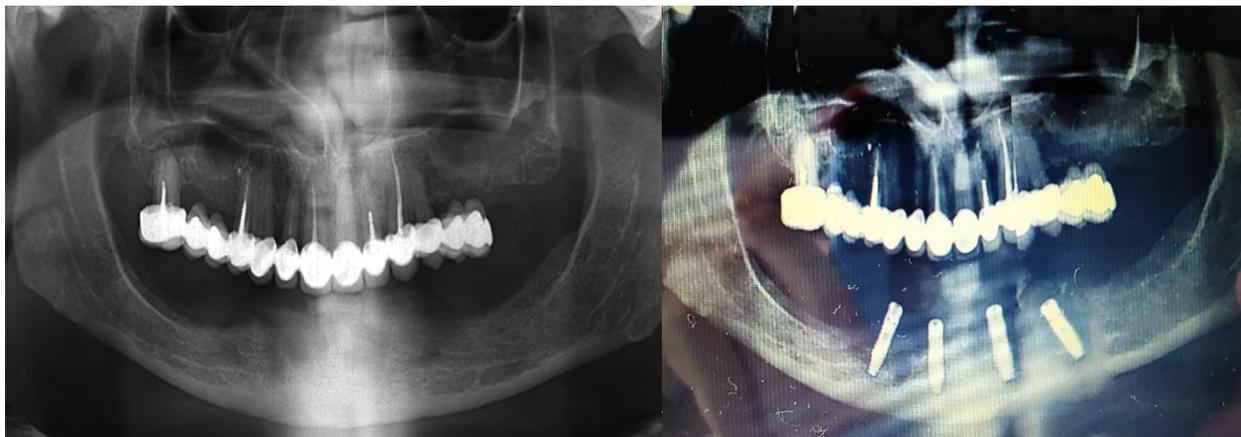


Figure 4: Preoperative RTG status and four months after implant placement and osseointegration.



Figure 5. Two regular 15° and two 30° angulated abutments positioned and parallelized manually.



Figure 6.: Definitive cemented full arch one -piece implant supported restoration.

Discussion

Implant-supported prostheses offer solutions for restoring difficult edentulous situations, which is sometimes impossible via conventional prostheses. Excessive bone loss and alveolar ridge deformities following long-term edentulism and previous periodontitis are among these situations which could restrict the number of implants to four. However, the most common biologic complication in this regard is the failure of at least one implant [15].

Fixed prostheses for the restoration of a fully edentulous arch with four implants could be either made of metal-resin [hybrid] or porcelain-metal structures. When multiple individual crowns are to be tried in the mouth, evaluating the proximal and occlusal contacts can be difficult [14], and it might be needed to use a fit checker material inside the crowns to make them more stable as it was used in case no.2. Another complication related to this type of prosthesis was achieving and maintaining the required passive fit during the laboratory procedures. Especially when a large one-piece casting framework is

considered for restoring a full arch, there is a chance for dimensional changes during the casting process [16].

Also, following firing the gingival pink porcelain to the metal substrate, the passive fit of a previously tested framework could be compromised [17]. Therefore, in order to achieve the passive fit, the framework had to be cut and soldered. Using non-engaging multiple unit screw-retained abutments for a one-piece structure or dividing a full arch framework into three segments, particularly when the implant axes hinder a single path of placement, could be considered as the alternative solutions [4].

However, since the bone volume was not sufficient to place the adequate number of implants, as it was shown in described cases, it was not possible to divide the mesostructure into three segments. Furthermore, such segmentation could compromise the final esthetic result due to improper implant number or position.

Acrylic fracture has been reported to be the most common complication in an all-on-4 prosthesis [15]. This could also be the case when using full ceramic zirconia bridge. In both prostheses, this complication could be prevented by regular occlusal adjustments and by using a night guard [18].

The possible reason of acrylic fracture was the tension created in the bulky pink porcelain which was used to camouflage the defective and reduced soft/hard tissue structures in some areas in conjunction with using a long span one-piece full arch framework [19]. Also, the lack of proprioception capacity of the normal dentition plays a role in the higher incidence of porcelain fracture in implant-supported restorations. Pink laboratory composites are also another choice in these situations. However, their drawbacks, in comparison with pink porcelain, are weaker bonding to the metal substrate and water resorption over time. Furthermore, the gingival porcelain might inhibit accessibility for complete removal of excess cement, like it was used in case no.1.

Therefore, it is recommended to fabricate duplicated abutments using a putty material or acrylic resin and to cement the crowns on them. After removing the excess cement, the crown can be cemented in the mouth [7].

Cementing the crowns near the abutment access holes with an appropriate temporary luting agent is advisable for their easier future removal.

First degree of advantages of the all-on-4 concept: angled posterior implants avoid anatomical structures, angled posterior implants allow longer implants anchored in better quality bone, reduces posterior cantilever, eliminates bone grafts in the edentulous maxilla and mandible in majority of cases, which correspond with our study.

Second degree of advantages are: high success rates, implants well-spaced, good biomechanics, easier to clean, immediate function and aesthetics, final restoration can be fixed or removable, reduced cost due to less number of implants and avoidance of grafting in the majority of cases.

Disadvantages: free hand arbitrary surgical placement of implant is not always possible as implant placement is completely prosthetically driven, length of cantilever in the prosthesis cannot be extended beyond the limit, and it is very sensitive technique and usually requires elaborate pre-surgical preparation such as CAD/CAM, surgical splint.

There is a big confrontation between the prosthetic experts on cantilevers number, size, occlusal plate and force reduction in one-piece, full arch rehabilitation with only 4 implants. Rangert provides simple guidelines for controlling occlusal loads on implants and prosthetic reconstruction an anterior-posterior spread [distribution distance between the most anterior and most posterior implants] of 10 mm was proposed for a cantilever of 20 mm [2 x anterior-posterior spread] for mandibular implant supported fixed prosthesis. English proposed anecdotally that a very reasonable rule of thumb for determining posterior cantilever in mandibular implant supported fixed prosthesis, should be 1.5 x anterior-posterior spread. According to English, this would allow a 10-12 mm posterior cantilever for the mandible, whereas maxillary implant supported fixed prosthesis, posterior cantilever should be reduced to 6-8 mm due low bone density [18, 19].

Conclusion

In situations where only four implants are used in the same arch, utilizing multi-unit abutments in posterior part of the jaws, means of creating a uniform prosthetic platform for ease of reconstruction.

At the same time they provide surgical flexibility by allowing the posterior implants to be tilted avoiding sinus cavity, foramen mentale, mandibular canal and eliminating the need for grafting.

This saves considerable time and expenses for the patient. But the rehabilitation of completely edentulous, atrophied maxilla and mandible by the placement of implants using the all-on-four protocol gives new hope for a perceivable success, while becoming a promising treatment method of choice and standard in the care for severely compromised patients

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