

## All on 4 technique assisted with computer guided surgery – A case report with 18 months follow up

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### Abstract

The All-on-4™ technique for dental implant placement has recently generated increased interest among many patients as a highly functional, aesthetic, cost-effective treatment alternative. The technique is a good option for patients who desire fixed, natural-looking dentition, yet are not willing to undergo sinus grafting or extensive bone augmentation. Computer-guided dental implantation is a revolutionary system in dentistry. The technology offers greater accuracy and precision than do free-hand techniques, and is therefore safer. The All-on-4 method combined with guided surgery does not demand high levels of surgical expertise. Furthermore, the procedure is less traumatic for the patient—the implant is placed on the best available bone—and the technique is associated with fewer post-operative complications. We present the case of a fully edentulous patient whose maxillary and mandibular dentition was restored using a fixed prosthesis and a guided, All-on-4 technique; the patient was followed up for 18 months after surgery.

**Keywords:** All-on-4, Computer guided surgery, Dental implants.

### Introduction

Implant dentistry is a boon for the restoration of missing teeth overcoming the many disadvantages of other conventional methods of restoration like removable and fixed prostheses.

Implant dentistry is now considered a prosthetic-driven treatment, and cone beam computed tomography (CBCT) plays an important role in its planning. Using a proprietary implant software, implants can now be virtually placed at a planned position also depths and surgical guides can be prepared, leading to an accurate and predictable restoration.<sup>1-2</sup> The All-on-4™ concept, which uses two axial implants in the anterior region and two tilted posterior implants, has been described in detail by Malo et al, with cumulative survival rates of 92.2%.<sup>3</sup>

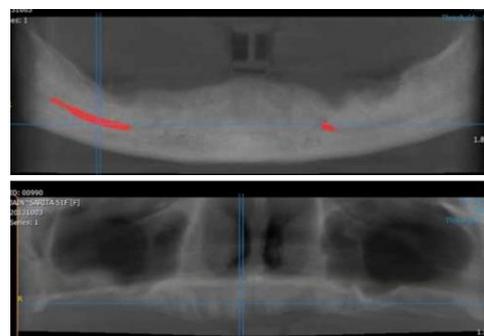
The benefits of guided implant surgery combined with the All-on-4 technique are : (1) Simplified the procedure for technician,(2) Prosthetic-driven planning and placement, (3) Ensures the exact placement of the implant in the best available bone, (4) Improved predictability, (5)Rehabilitation of completely edentulous jaws using minimal bone volume, (6) Allows for longer implants to be placed using cortical bone anchorage—on account of the angulations of the implants,(7) Greater antero-posterior (AP) spread of the implants, helps in restoring teeth up to the first molar, (8) In patients with a composite type defect , it replaces tissue as well as teeth, and restores lost vertical dimension by > 12 mm in each arch.<sup>4-9</sup>

This paper presents the case of an edentulous patient whose teeth were restored using a fixed hybrid prosthesis and a computer-guided, All-on-4 technique,

with the aim of evaluating crestal bone changes around each implant for 12 months after functional loading.

### Case Report

A healthy, 55 year-old, completely edentulous woman reported to the clinic for replacement of her missing teeth, desiring fixed restorations only. A preliminary evaluation of her dental and medical history was obtained. Initial clinical and radiographic examination revealed severely resorbed upper and lower posterior segments, as well as bilateral maxillary sinus pneumatization [Fig. 1]. The patient was not willing to undergo only grafting or sinus lift surgical procedures.



**Fig. 1: Pre-operative radiograph—Maxillary & Mandibular**

After discussion of the treatment plan, the maximum cantilever length was calculated using AP spread for 4 implants—a method proposed by English in 1990.<sup>10</sup> Upper and lower dentures were prepared for the patient, these were also used as duplicate for

radiographic template. Multiple two-mm holes were placed into the dentures, at different levels and filled with gutta percha to create radio-opaque markers. A double scan technique was used, as described in previous studies.<sup>11</sup> The CBCT data was formatted and transferred into a three-dimensional implant-planning software program (3Ddiagnostix.com). Using this software, implant positions and sizes, as they relate to both bone availability and associated vital structures, can be virtually evaluated and placed, prior to the implant procedure itself [Fig. 2 & 3]. After the plan was completed, the data were transferred to a milling centre; at which point a stereolithographic surgical guide (3DDX guide) was fabricated [Fig. 4].

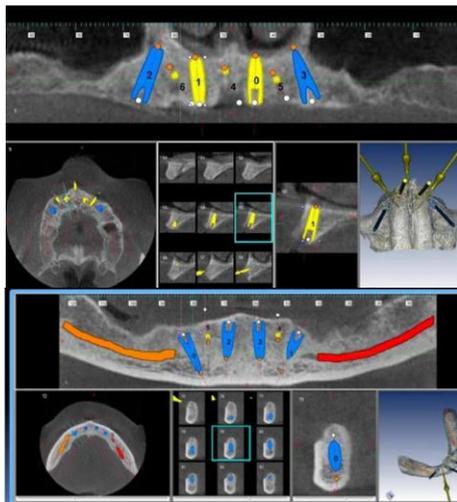


Fig. 2: Implant-planning maxillary and mandibular



Fig. 3: Surgical guide



Fig. 4: Surgical guide in place—with retention

After achieving local anaesthesia, a mid-crestal incision at the anterior edentulous space was performed, and this was extended into the second premolar area using vertical releasing incisions. The surgical guide was then stabilized using guide pins, and the first osteotomy was prepared in the anterior positions. Maxillary osteotomy was completed before the initiation of mandibular osteotomy. Finally, TS implants (Osstem, South Korea) [Fig. 5] were placed. Finally, the flap was sutured using an interrupted 4.0 vicryl suture. A post-operative OPG was then taken to evaluate implant placement [Fig. 6].

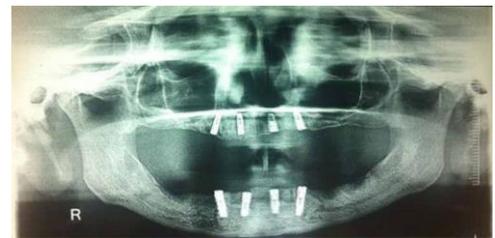


Fig. 5: Immediate post-operative OPG



Fig. 6: Final impression—with precision coping screws

The sutures were removed after two weeks, and a denture was given to the patient after four weeks. At that time, the denture was relined using soft liner (Mucoprene™ soft; Kettenbach).

The prosthetic phase was started five months after surgery. Second-stage surgery was performed and healing abutments were placed. The denture was again adjusted and relined. After a week, an alginate impression was taken to prepare a custom tray for a pick-up impression and impression was taken using open-tray impression copings and medium body impression material for both the arches, and sent to the lab [Fig. 7]. An implant-retained occlusal rim jig with bite registration was fabricated. With the help of NP cast abutments and pattern resin, a fit-verification jig was prepared; this was tried on the patients mouth to

check the fit of the abutments, and for casting of the bar [Fig. 8]. Bite rim was obtained and bite registration done. The midline was marked and lip support checked. A wax try-in denture was prepared, tried and then sent to the lab for final processing of the hybrid prosthesis. Upon delivery of the final prosthesis, torqueing of the retention screws to 30 N, and restoring the screw access holes was done. This was followed by radiographic confirmation of the fit of the prosthesis to the implant abutments, implant placement, and integration.



Fig. 7: Implant-retained occlusal rim

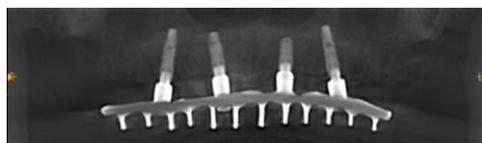


Fig. 8: Final prosthesis

**Methods**

Using the criteria suggested by Buser and Cochran et al.,<sup>12</sup> the implant survival rate was evaluated. Crestal bone changes induced by each implant were measured—taking the apex of the implant as the

reference point and measuring until the crest of the bone at the mesial, distal, buccal, and lingual aspects at baseline, 9 and 18 months. The baseline for all measurements was functional loading. An independent researcher (C.R.) not involved in actual patient treatment, performed the radiographic analyses. Bone loss was calculated as the difference between the bone level at a certain point in time (six and 12 months) and that at baseline.

Implant success was defined according to criteria given by Adell et al., they determined that the mean bone loss for Branemark osseointegrated implants was 1.5 mm for the first year, followed 0.1 mm/year.<sup>13</sup> The overall mean crestal bone level at the different intervals was compared using the repeated measure ANOVA test. Intervals were compared using the post-hoc Bonferroni test.

**Results**

The length of all eight implants was 11.5 mm; the diameter of four out of the eight implants was 3.5 mm, and that of the rest was 4.0 mm. The two distal implants were tilted at between 35° and 40°, depending on the anatomical conditions; the two mesial implants were oriented axially. The mean crestal bone loss values induced by all implants at 9 and 18 months were 0.75 ± 0.23 mm and 0.89 ± 0.31 mm, respectively. This difference was not statistically significant (p > 0.05) at six months, but was at 12 months (p < 0.05). Crestal bone loss induced by maxillary implants did not differ significantly from that induced by mandibular implants (p = 0.487) after 18 months. Comparing the straight and tilted implants, a significant (p < 0.05) difference was observed after 18 months, with slight bone loss among the tilted implants [Table 1, Fig. 9].

**Table 1: Mean crestal bone level and bone loss at 6- and 12-month follow-up visits**

Crestal bone level	Baseline mean±SD	9 months mean±SD	18 months mean±SD	p-value	Difference between baseline and 9 months	Difference between baseline and 18 months	Difference between 9 and 18 months
Overall	12.17±1.27	11.58±1.41	11.38±1.40	0.049*	0.75±0.23	0.89±0.31	0.20±0.08
Maxilla	11.79±1.52	11.09±1.67	10.87±1.72	0.068*	0.69±0.19	0.91±0.37	0.23±0.09
Mandible	12.55±1.04	12.07±1.11	11.89±0.96	0.080*	0.48±0.17	0.66±0.29	0.18±0.11
Tilted	11.69±1.51	10.85±1.59	10.72±1.67	0.041*	0.84±0.28	0.98±0.38	0.13±0.05
Straight	12.64±0.94	12.31±0.84	12.04±0.80	0.081*	0.33±0.99	0.61±0.21	0.28±0.13

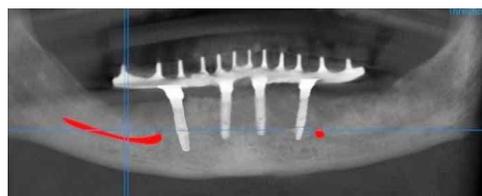


Fig. 9: Post-operative maxilla and Mandible after 18 months (Radiographic view)

**Discussion**

Technological advancements continue to revolutionize our ability to treat patients in a more efficient manner. Using CBCT imaging of available bone, anatomical issues that may be encountered during surgery can be revealed, and prosthetic tooth positioning can be planned. Computer-guided, template-based implant placement yields high implant survival rates—ranging from 91% to 100%.<sup>5</sup>

According to a recent review, the accuracy of guided implant surgery in vivo ranges from 0.95 to 4.5 mm at the apex of the implant. Consequently, a small deviation in the positioning of the implants can alter the thickness of the buccal or lingual cortical bone and result in additional bone loss. However, as the implants were placed without raising a flap in the same review, this was difficult to check.<sup>14</sup> In our case, a flap was raised to remove this error.

In the present report, the mean marginal bone level after one year of functional loading (0.89 mm) was comparable with that found in previous studies involving the same type of implant.<sup>16</sup> Tilted implants induced slightly more bone loss than straight, although the loss was still within the limits of the proposed criteria for implant success.<sup>13</sup>

Thus, All-on-4 combined with guided surgery can be called a successful amalgamation of the two techniques, with the possibility of improved outcomes for patients.

### Conclusion

Considering the advantages and benefits of All-on-4 combined with guided implant placement and restoration, we recommend this as a viable treatment alternative for rehabilitation of edentulous jaws.

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**Conflict of interest:** None declared.

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