Case Report

# A mishap in guided surgery for All-on-4™ technique: A case report

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## ABSTRACT

A 63-year-old male patient, who had a severely resorbed edentulous maxillary arch and partially edentulous mandibular arch decided on the implant-supported fixed treatment option to replace the edentulous maxillary arch. The fully guided implant placement that utilizes the computer-generated guide is more accurate than traditional surgical guides and free-hand placements. The researchers have correlated possible implant failure risk factors with age, sex, smoking, type of edentulism, bone quality and volume, implant location, angulation, diameter, length, and various systemic factors. This case report demonstrated the failure cause of virtually planned anterior implants in All-on-4 and how to manage it by free-hand surgery without surgical guides.

**Key words:** All-on-4, Atrophic ridges, Dental implants, Guided implant surgery, Virtual planning

Implant dentistry is considered to be a prosthetically driven treatment, which requires accurate implant placement for predictable esthetic and functional outcomes [1]. With computed tomography technology and interactive software, treatment planning has become a very accurate modality for dental implant surgery. Because the optimal placement of dental implants can be challenging, special interactive software along with computer-generated templates have been developed to assist implant surgeons in accurate positioning [2]. Surgical guides allow for the ability to avoid vital structures (nerves and sinus cavity) and allow for precise placement of the implants. Virtual implant placement is based on presurgical treatment planning using software for ideal implant positioning.

This case report explains the possible intraoperative complications and early implants failure with guided surgery in the All-on-4 technique and how we managed it without a guide.

## CASE REPORT

A 63-year-old male patient presented with a chief complaint of completely missing upper teeth and requested a long-term fixed solution. Medical history revealed that the patient is a known diabetic, hypertensive, and under medication for 10 years. Past dental history revealed that the maxillary teeth were extracted 5 months back.

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On clinical examination, periodontally compromised mandibular teeth and radiographic evaluation revealed severe resorption of the posterior aspect of the maxillary arch and moderate resorption in the maxillary anterior (Fig. 1a) and mandibular posterior regions (Fig. 1b).

Several possible treatment options have been discussed with the patient. The concept of "All-on-4" therapy was proposed, where the patient would receive four implants in the maxillary arch and a removable partial denture in the mandibular arch but was reluctant to replace the mandibular teeth.

Preliminary studies requisition were orthopantomogram (OPG) (Fig. 1c), virtual planning (Fig. 2a), cone-beam computed tomography (CBCT), blood investigations (bleeding time, clotting time, $HBA_1C$, hemoglobin, and international normalized ratio), study models, and extraoral and intraoral photographs. OPG and CBCT revealed poor bone quality and quantity in the posterior maxilla. Blood investigations were found normal.

Alginate impressions were made followed by the preparation of the study models which were mounted on the semi-adjustable articulator. A maxillary complete denture was fabricated and delivered. During the surgical phase, local anesthesia (2% lignocaine and Adrenaline 1:200000) was administered in the maxillary arch. The surgical stent (Fig. 2b and c) was fabricated for guided surgery as per the virtual planning but due to the patient's large tongue and disability to open the mouth wide, there was difficulty to stabilize the surgical stent with 2 screws,

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wherein it was stabilized with the assistant's finger pressure. Surgery was proceeded by creating a punch hole (Fig. 3a) in the planned implant site (i.e., 11, 13, 21, and 23). The osteotomy site was prepared under sequential drilling and four implants were placed, in which two tilted implant placement were placed at 13 and 23 sites (4.2*13 mm) followed by two straight implants at 11 and 21 (3.75*11.5 mm) as per the advised plan through the surgical stent and radiovisiography (RVG) was taken (Fig. 3b). All the implants used here are PALTOP and they exhibited a torque value of 45N/cm. A cover screw was placed after the implant placement. Post-operative instructions and medications (Amo ×500 mg T.I.D. for 5 days and Zerodol Sp B.I.D for 3 days) were given to the patient. Postoperatively, the patient was instructed not to wear a maxillary complete denture for the first 2 weeks due to the lack of the primary stability.

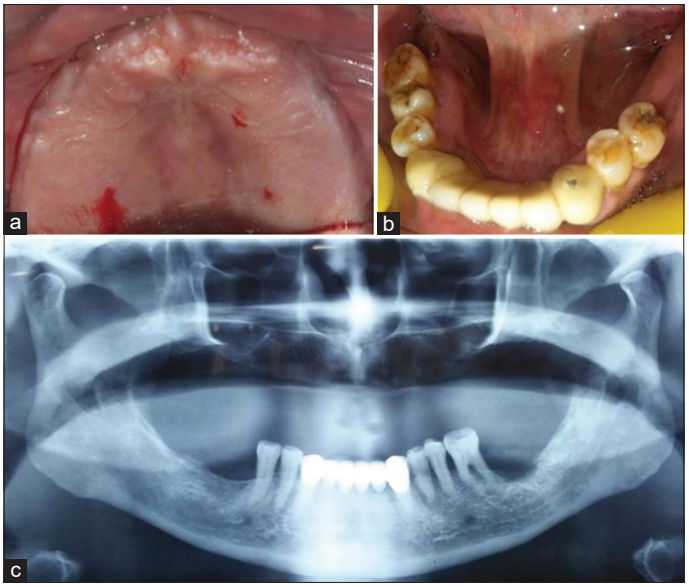


**Figure 1: (a) Pre-operative (a) maxillary and (b) mandibular arch; (c) Pre-operative orthopantomogram**

The patient was recalled after 4 months for the prosthetic procedures. On clinical examination, mobility of the implant was noticed in 11 and 21, and implant retrieval was done (Fig. 3c). Radiographic evaluation of 13 and 23 revealed satisfactory osseointegration (bone to implant contact). Hence, a cover screw was removed and the healing abutment was placed in 13 and 23 sites.

After a month, a free-hand surgical approach was attempted lateral to the failed implant site. Pre-medications were given 1 h before the surgery. Local anesthesia was administered. A crestal incision was given and a full-thickness flap was elevated. Osteotomy site preparation was done in 12 and 22 lateral to the previous implant sites 11 and 21 (Fig. 3d and e). A lancet drill was placed and parallelism was evaluated in RVG, followed by pilot drills, 2.3, 2.8, and 3.4 mm 3.75*13 mm that implant size was torqued with 35N/cm. Evaluation of the implant position was done with RVG. Sutures were placed and medications followed by post-operative instructions which were given.

After 1 week, suture removal was done and healing was in progress. After a period of 3 months, the patient was recalled for a prosthetic procedure. Radiographic examination revealed satisfactory osseointegration in 12 and 22 sites. The cover screw was removed and a healing abutment was placed in 12 and 22 (Fig. 3f). After 2 weeks, open tray coping was placed in 12, 13, 22, and 23 and the fit was checked with RVG. All the copings were splinted with dental floss and pattern resin (Fig. 4a and b) followed by an open tray impression which was made with a custom tray using putty and light body impression material (Fig. 4c). Jig trial (Fig. 4d) and

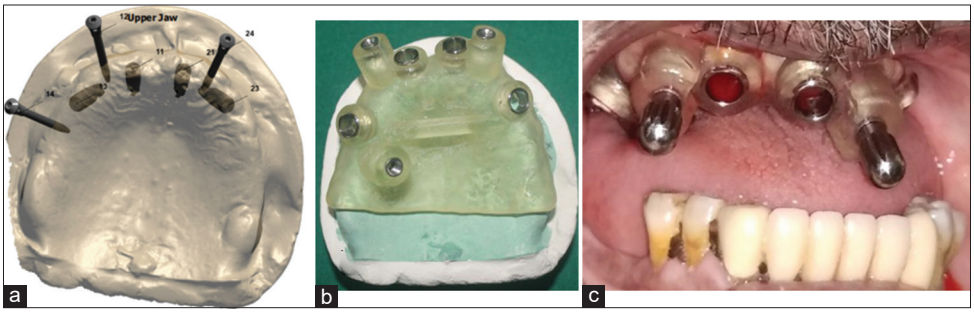


**Figure 2: (a) Virtual planning; (b and c) surgical stent**

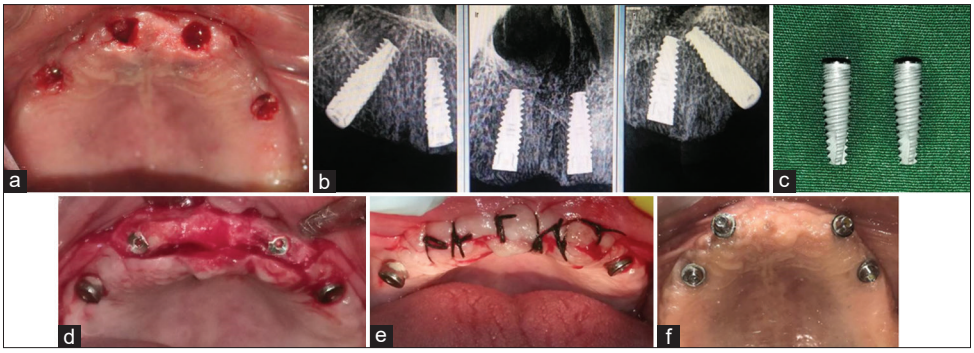


**Figure 3: (a) Punch hole created in 11, 13, 21, and 23; (b) radiovisiography irt 11, 13, 21, and 23; (c) failing implant retrieved -11 and 21; (d and e) free hand approach lateral to retrieved implant site (12, 22); and (f) multi-unit abutment placed**

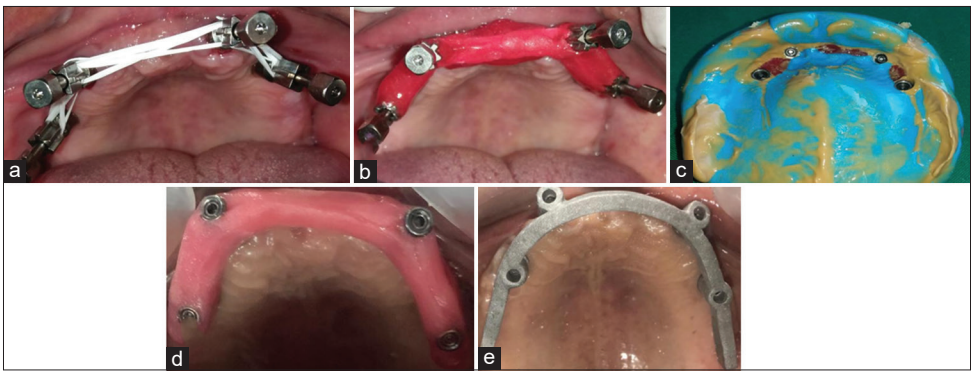


**Figure 4: (a and b) Splinted open tray coping with pattern resin; (c) open tray impression made with putty and light body; (d) jig trial; and (e) metal framework trial**

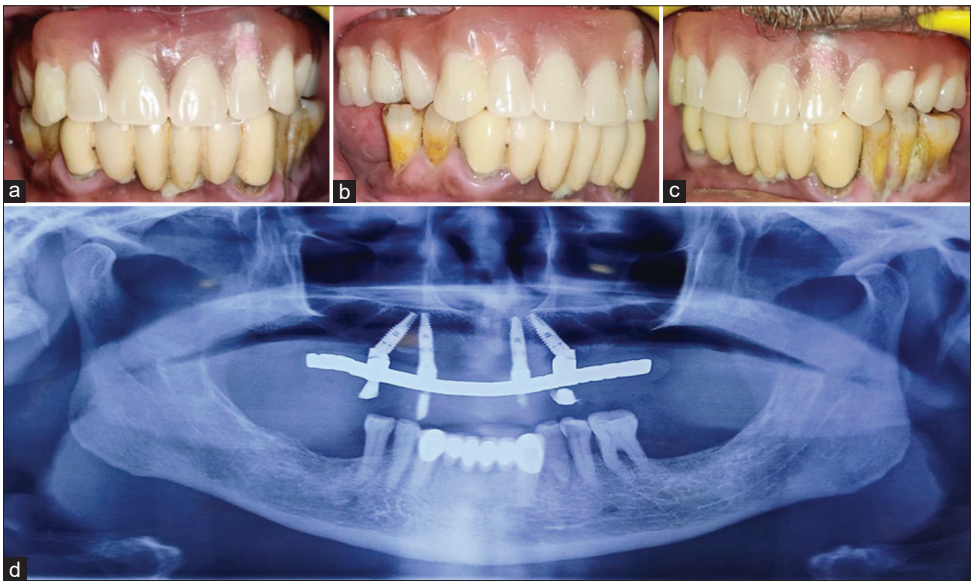


**Figure 5: (a) Hybrid denture insertion of maxillary arch done; (b) 1-year follow-up orthopantomogram**

metal framework fit were done (Fig. 4e). Jaw relation was recorded and try-in of maxillary teeth was done. Maxillary hybrid denture insertion was done (Fig. 5a-c) and the access hole was covered with cotton and composite. OPG was taken. Post-insertion instructions were given to the patient. After 1 year of follow-up, OPG (Fig. 5d) revealed good osseointegration and the patient was satisfied with the esthetics, form, and function of the denture.

## DISCUSSION

Implant dentistry is rapidly evolving and constantly challenging the practitioner to be aware of recent advances. The success of full mouth rehabilitation with dental implants directly depends on pre-operative planning [3].

The benefits of guided-implant surgery combined with the All-on-4 technique are (a) simplified procedure for the technician, (b) prosthetic-driven planning and placement, (c) ensures the exact placement of the implant in the best available bone, (d) improved predictability, (e) rehabilitation of completely edentulous jaws using minimal bone volume, (f) allows for longer implants to be placed using cortical bone anchorage on account of the angulations of the implants, (g) greater anteroposterior (AP) spread of the implants that help in restoring teeth up to the first molar, and (h) replaces tissue as well as teeth and restores lost vertical dimension by >12 mm in each arch in patients with a composite type defect [4]. On the other hand, there are some limiting factors involving CAD/CAM surgical guides such as sufficient mouth opening and tongue size, which must be evaluated before ordering the guide. The patient must have adequate opening depending on the guide, length of implant, and drill system used. Otherwise, even if the surgical guide is accurately fabricated, it may not be inserted in the mouth properly and eventually, the surgery cannot be performed [5].

Three different surgical guide designs depending on their supporting surfaces have been described; (a) tooth-supported surgical guide is placed on the remaining natural teeth; (b) mucosa-supported surgical guide is directly placed on the mucosa, allowing flapless implant placement; and (c) bone-supported surgical guide is placed on the bone following a full-thickness mucoperiosteal flap elevation. However, this technique has some disadvantages, including potential damage to the bone due to insufficient irrigation and the inability to visualize the surgical anatomical landmarks, with an increased risk of error in implant positioning with increasing degrees of maxillary bone atrophy.

The first crucial factor affecting clinical result accuracy is the stability of the surgical template during the CBCT analysis and during surgical procedures with respect to surgical template positioning on the bone with pins to avoid damaging noble anatomic structures such as nerves and vessels, because any small deviations may cause surgical errors and iatrogenic anatomical lesions, which are reported in the literature to occur in 9.1% of all cases [5]. The second crucial factor affecting computer-aided surgery accuracy for the correct angle of insertion of the implant drill is related to the area of surgery and the mouth-opening capacity, because, in 2.3% of cases in the posterior maxillary area, there is a limited interocclusal distance. The third crucial factor that affects accuracy is related to the bone volume and bone architecture in atrophic bone areas of the jaws, together with potential micromovements of the surgical mucosa-supported template due to the typical resilience of the oral mucosa [6,7].

In the present case report, there are many factors that lead to the failure of two anterior implants: mistakes would have occurred during CBCT and virtual planning, data transfer, and in the processing of surgical template, inadequate mouth opening, enlarged tongue, inability to place fixation screws to stabilize the surgical stent, internal irrigation difficulty, and D3-D4 bone volume.

All the above factors are the reasons which made the mucosal-supported surgical stent placement and stabilization with the fixation screws also difficult. Wherein stabilization of the surgical stent was done with the assistant's finger which may be the major cause for the failure of the anterior implants by placing it more palatally, where the bone quality was poor. The case selection for the guided surgery is a very important factor to be considered to avoid the above possible complications and failures.

## CONCLUSION

Modern techniques such as virtual planning and advanced surgical procedures like guided implant placement have substantially contributed to surgical practice and enhanced the outcomes. However thorough pre-operative planning, errors during data transfer of virtual planning and intraoperative skills of the surgeon are still the key factors in minimizing potential complications.

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