

Accuracy Assessment of Dynamic Vs. static navigation implant placement protocols

(Randomized controlled trial with radiographic assessment)

A protocol submitted to Department of Oral Medicine, Periodontology, Oral Diagnosis and Radiology, Faculty of Dentistry, Ain Shams University, in partial fulfilment of the requirements of the Doctoral's Degree in Oral Periodontology.

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Introduction

Restoration of missing teeth with dental implants has been widely recognized as one of the treatment options (1). Proper surgical diagnosis is essential, to prevent any complications or injury to vital anatomic structures, to help in the prosthetic driven approach and to formerly evaluate the available bone quality and quantity.

The concept of ‘Dynamic navigation’ implantology was born after the use of ‘Static navigation’ or ‘Guided implant surgery’, offering remarkable changes in the treatment plan and aiding clinicians in proper implant rehabilitation (2).

In static navigation, the full digital workflow has been shown to lead to many inaccuracies, starting from the intraoral position of the template and it’s fixation. Some claimed the inaccuracy of tooth supported templates was less than mucosa supported ones showing greater deviations than the proposed plan, but these were refuted by Raico Gallardo et al. in their meta-analysis.

One of the main drawbacks of fully-guided static navigation is the fact that there’s no intraoperative evaluation and change in treatment plan.

Implant surgeons can evaluate a patient, plan the implant position after scanning and perform the implant surgery all in the

same day. Without the need for a static surgical guide, thus reducing both time and cost of fabrication (3).

While both dynamic and static image navigation systems are quite efficient, dynamic navigation technologies offer the following advantages:

1. The patient can be scanned, scheduled for, and operated on the same day.
2. Plans can be changed during surgery if clinical circumstances necessitate it.
3. The full field is easily visible.
4. The accuracy may be evaluated at any time (4).

One of the main advantages of Dynamic Navigation (DN) is that it aids the surgeon to confirm accuracy at all times, unlike the Static Navigation using guide (SN), which may include errors if the stent was not properly seated over the teeth (3).

The present (DN) approach necessitates getting a 3D scan using a consistently repeatable fiducial marking system, virtual planning of the implant, alignment and identification of fiducial markers and implant drills, last is implant osteotomy preparation and implant placement in line with the 3D constructed image present on the navigation screen (3).

The workflow may be entirely digital. Dependency on the system employed maybe anticipated when assessing the accuracy

reached here. Because of the difficult surgical implementation, the success of the dynamically guided insertion necessitated extensive training. More clinical research is needed to compare dynamic navigation approaches to static navigation (5).

Aim of the study

Primary objective:

Deviations in :

- Platform position
- Apical position
- Angular deviation

Of the placed implant when compared with the planned one.

Secondary objective:

Patient satisfaction questionnaire and operating time for each technique.

Study Methodology

The proposal will be reviewed by the Faculty's research ethics committee.

❖ Patient Selection:

- Selection of 20 patients will be made in the outpatient clinic of the Oral Medicine, Periodontology, Diagnosis and Radiology Department at the faculty of dentistry, Ain Shams University.
- The procedure will be explained to all patients and an informed consent will be signed before their inclusion in the study.

❖ Inclusion Criteria:

- Healthy patients at least 22 years old.
- At least one missing tooth to be restored using an implant in the upper jaw from the maxillary right 2nd premolar to the maxillary left 2nd premolar.
- At least six residual teeth in the affected jaw (5).
- Minimum of 5 mm available bone.

❖ Exclusion Criteria:

- Medical condition or medication that would impair bone healing.
- Poor oral hygiene
- Inadequate bone width or height that may need bone augmentation.

- Alcohol users.
- Smoking more than 10 cigarettes per day.
- History of head and neck radiotherapy.
- Pregnant females.
- Uncontrolled hypertensive or diabetic patient.
- Vulnerable group; prisoners, pregnant women, orphans...etc

❖ **Groups:**

- Group 1 : 10 patients Static Navigation
- Group 2 : 10 patients Dynamic Navigation

❖ **Patient Preparation:**

Static Guidance:

- CBCT is taken prior to implant surgery to allow for proper planning of the prosthetic driven implant placement and an impression is taken to allow for proper guide design and fabrication.

Dynamic Guidance:

- Thermoplastic stent preparation to fix the radiopaque fiducial marker on the arch that needs to be treated.

- Cone Beam Computed Tomography taken with a stent in the mouth.
- Implant planning using prosthetic driven approach.
- Guided placement of implant, with the stent holding an optical marker mounted on the arch to provide a coordinate reference frame during surgery.

❖ **Surgical Procedure:**

Static Guidance:

- Infiltration anesthesia will be administered to the missing area to be restored.
- Placement of the guide with it's proper orientation on the teeth.
- Guided implant drilling and placement is achieved.
- Placement of healing abutment of the proper size.

Dynamic Guidance:

- Infiltration anesthesia will be administered to the missing area to be restored.
- Calibration using the fiducial marker for accuracy.
- When looking in a screen, implant drilling and placement is performed.
- Placement of healing abutment of the proper size.

❖ **Post-operative instructions:**

1. Antibiotics will be prescribed for each patient; Amoxicillin and clavulanic acid (1gm every 12 hours

for 5 days) or Clindamycin (600 mg every 8 hours for 5 days).

2. Non-steroidal anti-inflammatory drug (300 mg twice daily for 3-5 days).
3. Chlorhexidine solution 0.12% twice daily.
4. Following a soft diet for three days.
5. Stopping mechanical removal of plaque at the surgical site for two weeks.

❖ **Follow up visits:**

- A CBCT will be taken on the day of the surgery after implant placement.
- A patient's expectations questionnaire is filled a week after implant placement in terms of pain and expectations from the treatment.

❖ **Accuracy assessment:**

Superimposition of the planned CBCT and the immediately post-operative CBCT will be done to assess the

accuracy of implant placement according to the technique used, in terms of :

- Angular Deviation
- Deviation of the Implant Platform : Mesiodistal, Buccolingual and Apicocoronal.
- Deviation of the Implant Apex: Mesiodistal, Buccolingual and Apicocoronal.

❖ Operating time

- Operating time will be recorded for each procedure to be compared.

❖ Patient satisfaction

- Patient will fill a survey to compare the patient's satisfaction between the surgical guide and the dynamic navigation.

Statistical analysis

All data will be collected, tabulated and statistically analyzed.