

# Assessing precision in guided implant surgery: a prospective clinical study

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## OBJECTIVES

To ensure optimal function, aesthetics, oral hygiene, and long-term clinical success, it is imperative to employ a prosthetically-driven surgical approach. This can be achieved by combining CBCT with intraoral scans in an implant-planning software that designs a surgical guide, thereafter 3D printed to be used in the surgery.

- AIM: assess the linear and angular deviations of dental implants placed in patients treated at a university dental clinic through guided surgery techniques.

## METHODS

**PROJECT:** “Application of digital technologies in oral rehabilitation” (CIIS – FMD/UCP ; Ethics Committee for Health, n.201, March 24th, 2022).

**POPULATION:** patients that placed implants with guided surgery – Postgraduation Courses in Digital Prosthodontics and Periodontology.

**VARIABLES:** type of surgical guide (tooth and/or muco-tooth-supported guides); type of guided-surgery performed (fully-guided and pilot-guided); bone location of the implants placed: maxilla or mandible.

**DATA COLLECTION**  
e-OHR software (Newsoft DS®)  
CoDiagnostix® implant planning software

- 1 Planning stage (pre-operative)
- 2 Dental impressions (post-operative)
- 3 Treatment evaluation tool



### TREATMENT EVALUATION

- Angular deviation
- 3D at apex/ crest
- MD at apex/crest
- BL at apex/crest
- Apico-coronal at apex/crest

## RESULTS

**SAMPLE**  
23 patients / 55 yo (mean age)  
13 male / 10 females

**45 IMPLANTS**  
39 implants: tooth-supported guides  
6 implants: muco-tooth-supported guides

**45 IMPLANTS**  
36 implants: fully-guided / 9 implants: pilot-guided  
35 implants: maxilla / 10 implants: mandible

Fully-guided more precise than pilot-guided. (Table 1)

Implants of **greater length** are more likely to present **3D deviations at apex** level. No correlations for implant diameter. (Table 2)

The **angular deviation, 3D at crest and MD at apex** were significantly different in the **mandible**. (Table 3)

Table 1. Linear and angular deviations.

PARAMETERS	Mean ( $\bar{x}$ ) FULLY-GUIDED	Mean ( $\bar{x}$ ) PILOT-GUIDED
Ang. Deviation (°)	4,1	4,5
3D at apex (mm)	1,8	1,9
3D at crest (mm)	1,1	1,5

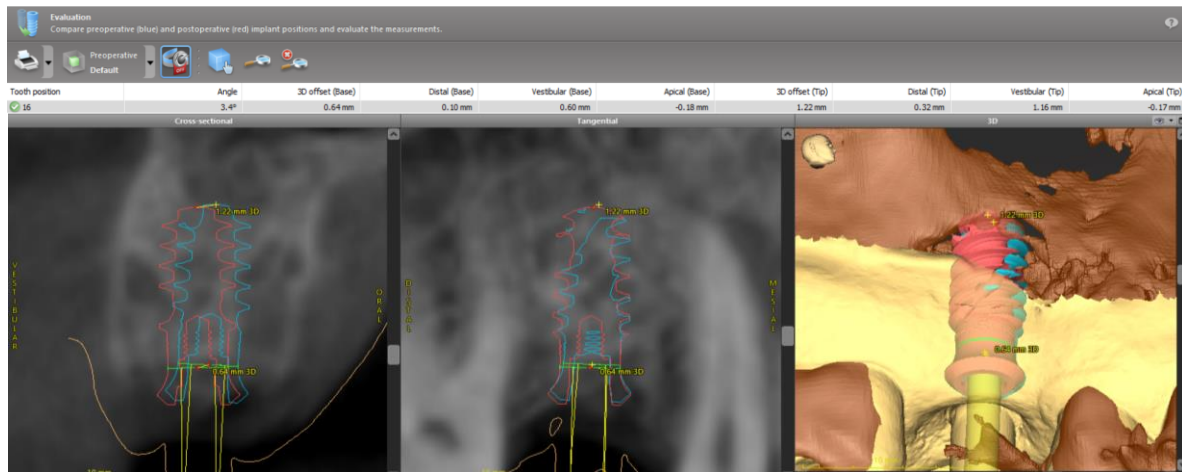


Figure 1. Treatment Evaluation tool.

Table 2. Correlation between linear / angular deviations and implant diameter / length.

Variables	Implant diameter (3.5 / 3.75 / 4.0 / 4.5 / 5)		Implant length (8 / 10 / 12 / 14)	
	$\rho$	p-value	$\rho$	p-value
Ang. Deviation	0.113	0.441	-0.064	0.663
3D at crest	0.104	0.475	-0.187	0.199
MD at crest	-0.090	0.540	0.278	0.053
BL at crest	0.155	0.289	0.005	0.975
AC at crest	-0.012	0.935	-0.005	0.975
3D at apex	0.101	0.489	-0.284	<b>0.048</b>
MD at apex	-0.146	0.316	0.279	0.053
BL at apex	0.132	0.366	-0.301	<b>0.036</b>
AC at apex	0.054	0.713	0.047	0.750

BL: Bucolingual; MD: Mesiodistal; AC: Apico-coronal;  $\rho$ : Spearman correlation coefficient

Table 3. Distribution of linear and angular deviations according to the location.

VARIABLES (mm)	LOCATIONS			p-value
	Maxilla	Mandible	Comparison statistics	
Ang. Deviation, median (IQR)	3.70 (2.90)	<b>6.00 (2.40)</b>	U=145.0	<b>0.011</b>
3D at crest, median (IQR)	1.02 (0.55)	<b>1.28 (0.72)</b>	U=169.0	<b>0.043</b>
MD at crest, median (IQR)	-0.13 (0.77)	-0.32 (0.37)	U=185.0	0.092
BL at crest, mean (SD)	0.50 (0.53)	0.30 (0.61)	t=1.174	0.246
AC at crest, mean (SD)	-0.10 (0.82)	0.07 (1.15)	t=-0.608	0.546
3D at apex, mean (SD)	1.54 (0.72)	<b>2.16 (0.66)</b>	t=-2.901	<b>0.006</b>
MD at apex, mean (SD)	-0.13 (0.95)	<b>-0.80 (1.12)</b>	t=2.183	<b>0.034</b>
BL at apex, median (IQR)	0.46 (1.09)	0.54 (1.54)	U=221.5	0.365
AC at apex, mean (SD)	0.04 (0.79)	0.16 (1.17)	t=-0.431	0.669

BL: Bucolingual; MD: Mesiodistal; AC: Apico-coronal; SD: Standard-deviation; IQR: Interquartile range; t: T-test ; U: Mann-Whitney test

## CONCLUSIONS

This research shows that:

- Fully-guided implant's surgery is more precise.
- Implants of greater length are more prone to deviations at the apex.
- Greater deviations occur in the mandible.

Future studies should increase the sample and add other guided surgery protocols.

SPEMD Grant  
to Support Scientific Dissemination



This work is financially supported by National Funds through FCT – Fundação para a Ciência e a Tecnologia, I.P., under the Project UIDB/04279/2020.

