ORAL ABSTRACT TRACK THREE: DENTAL IMPLANT, DENTOALVEOLAR, NERVE REPAIR, OTHER

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Dynamic Navigation: Accuracy and Reproducibility in Dental Implant Placement

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Accurate depth, angulation, and crestal positioning are crucial factors during dental implant placement for long-term success. Free-hands methods for implant placement have significantly more error compared to navigation methods. This is true even when conventional laboratory-fabricated guides are used for limited guidance. The static navigation CT generated guide stent protocol has reported less than 2 mm crestal and apical deviation from the virtual plan and angulation error less than 5 degrees. Intraoperative position changes cannot be made with a static system unless the use of the stent is abandoned during the surgery. Dynamic navigation allows the surgeon to modify the predetermined plan in real-time during the surgery. The purpose of this systematic review is to assess the in vivo accuracy and reproducibility of the dynamic navigation implant virtual plan compared to the actual clinical outcome. Preoperative and postoperative CT images were superimposed (planned versus actual implant positions) to evaluate accuracy.

A systematic, computerized database search was conducted using MEDLINE (PubMed) and the Cochrane Library for studies from 2004 until the search date, January 2016, using the medical subject heading (MeSH) keywords "navigation", "dental implants", and "accuracy". A total of 37 papers were identified. Inclusion criteria were: a sample size of five or more implants, in vivo studies, and placement after ablative tumor surgery. Exclusion criteria were the following: a sample size of fewer than five implants, in vitro studies, and ex vivo studies. Four articles met aforementioned criteria and were included in this review.

Mean deviations were less than 1.4 mm in any direction and 6.5 degrees from the long axis of the implant. The table below describes the details of the selected studies.

Dynamic navigation allows the accurate real-time transfer of the virtual surgical plan to the patient even in difficult implantologic situations. Results were consistent among different surgeons with varying degrees of familiarity with the protocol operating in geographically distinct areas around the world. Dynamic navigation uses a time-efficient workflow to place implants with similar placement error to static navigation. In dynamic navigation systems, both engineering (intrinsic) and human usability factors (extrinsic) can be visualized for accuracy. Dynamic navigation is used during dental implant placement to: (1) avoid critical anatomic structures, (2) accurately place multiple implants with proper spacing and angulation, (3) place single implants in exact locations when access is limited and esthetic needs are high, and (4) minimize flap mobilization to achieve minimally invasive surgery.

References:

1. Block MS, Emery RW, Static or Dynamic Navigation for Implant Placement – Choosing the method of guidance, J Oral Maxillofac Surg 74:269-277, 2016
2. Wittwer G, Adeyemo WL, Prospective randomized clinical comparison of 2 dental implant navigation systems, Int J Oral Maxillofac Implants. 2007 Sep-Oct;22(5):785-90

Study	Implants	Navigation System	Direction	Platform Mean	Error SD	(mm) Max	Apex Mean	Error SD	(mm) Max	Angle Mean	Error SD	(degrees) Max
Elian et al (2008) New York, NY	14	DenX Advanced[1]	Global	0.89	0.53	1.96	0.96	0.50	1.99	3.78	2.76	9.86
Wittwer et al (2007) Vienna, Austria	32	VISIT[2]	Buccal	1.00	0.50	2.00	0.60	0.20	0.90			
			Lingual	0.70	0.30	1.20	0.70	0.30	1.00			
	32	Treon[3]	Buccal	1.00	0.50	2.40	0.80	0.60	2.00			
			Lingual	1.20	0.80	3.40	0.70	0.50	1.60			
Wittwer et al (2006) Vienna, Austria	78	Treon[3]	Global	1.10	0.70	3.40	0.80	0.60	2.00			
Wagner et al (2003) Vienna, Austria	32	VISIT[2]	Buccal	0.80	0.30	2.10	1.10	0.90	3.40	6.40	3.65	17.40
			Lingual	1.00	0.50	2.60	1.30	0.90	3.50			

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