

SIMPLANT ACCADEMY: ACCURACY STUDY GROUP ABSTRACT

MA. Deflorian, A.Parenti, L.Fumagalli, T.Testori, F. Maltese,

M. Cassetta, M. Giansanti, GL. Telara, F. Valente

Introduction

In the last years, enhancements in diagnostic imaging as well as technical improvements in dental implant surgery have introduced the concept of computer aided surgery. As reported in different papers, there is not difference in implant survival rate between conventional and computer-aided treatment (Schneider 2009). The recent focus about this trend moved the research on to system evolution in order to improve safety and reliability. A consensus conference of experts in computer aided surgery has founded aiming at redact clinical indications and scientific evidence about accuracy of computer aided surgery systems.

Materials and methods

The expert panel focused on explaining this questions:

1. What does mean the accuracy? Is it possible to perform statistical tests on accuracy?
2. What is the method to gauge the accuracy?
3. Is it possible to set a mean value for the accuracy in computer aided surgery?
4. What are the clinical and technical procedures that modify the accuracy in computer aided surgery?

Results

1. What does mean the accuracy? Is it possible to perform statistical tests on accuracy?

The term “accuracy” means the difference between a recorded value and the real value. For that reason, accuracy is related to every single measure and it is a dimensionless quantity. Statistical test can't be performed to measure the accuracy of values.

2. What is the method to gauge the accuracy?

The most used method to gauge the accuracy is done by comparing preoperative and postoperative ct/cbct scans. This method had some controversial points:

- ct scans have a precision limit of 0,5 mm (Suomalainen 2010)
- ct scan have a degree of miscalculation on linear dimension , with a measure reducing of 5%.
- Accordingly to above reasons, is useless finding precision and accuracy on the tenth of a millimeter. Actually there are not methods to measure that degree of precision.

The panel confirms the lacking of reference methods to measure the accuracy and in any case this lack doesn't improve the research.

3. Is it possible to set a mean value for the accuracy in computer aided surgery?

Accordingly with previous statements, it is impossible to set a mean value of accuracy in computer aided surgery. The authors are in accord to steering the research to find out an error-free threshold value , above that the implant positioning is considered safe. Actually the authors estimate an acceptable accuracy degree of 2 mm in three dimensional space. This degree is considered inferior in comparison to classical method of implant positioning.

4. What are the clinical and technical procedures that modify the accuracy in computer aided surgery?

The Authors have analyzed the method of computer aided surgery using stereolithographic models and have reported this critical factors:

- intrinsic degree of inaccuracy are present in the manufacturing process of surgical guide starting from CT or CBCT
- 3D printers have a certain degree of inaccuracy. This degree is calculated in 0,25/0,5 mm approximately (Schneider 2002)
- dimensional stability of material used in the stereolithographic process
- exact sleeve positioning in the surgical guide

Conclusion

The authors stated:

1. At the moment it is impossible to measure the degree of accuracy of computer aided surgery
2. New method to measure the precision of CAS are needed. The scientific evidences of computer aided surgery have to be reevaluated specially in methods of investigation (Telara 2011; Telara 2012)
3. Surgical guide as Surgi Guide SAFE seems to be more accurate (Ozan 2007; Van Assche 2012)
4. CT/CBCT based surgical guides are more reliable (Farley 2013)
5. In any case, the authors recommend to maintain a distance of 2 mm from anatomical noble structures (Cassetta 2012; Testori 2012; Van Assche 2012; Valente 2009)
6. In case of immediate loading, use of prosthetic framework can compensate the misfit due to imprecise implant position. Avoid prefabricated framework. (D'Haese 2012; Testori 2012).

Bibliography

- Cassetta M, Stefanelli LV, Giansanti M, Calasso S. Accuracy of implant placement with a stereolithographic surgical template. *Int J Oral Maxillofac Implants* 2012; 27:655-663
- D'Haese J, Van de Velde T, Komiyama A, Hultin M, De Bruyn H. Accuracy and complication using computer designed stereolithographic surgical guides for oral rehabilitation by means of dental implants: a review of the literature. *Clinical Implant Dentistry and Related Research* 2012;14(3):321-335
- Farley N, Kennedy K, McGlumphy E, Clelland N. Splith mouth comparison of computer generated and conventional surgical guide. *Int J Oral Maxillofac Implants* 2013;28:563-572
- Ozan O, Turkyilmaz I, Yilmaz B. A preliminary report of patients treated with early loaded implants using computerized tomography guided surgical stents: flapless versus conventional flapped surgery. *Journal of Oral Rehabilitation* 2007;34:835–840.
- Schneider J, Decker R, Kalender WA. Accuracy in medicinal modelling. *Phidias Newsletters* 2002;8:5–14.
- Schneider D, Marquardt P, Zwahlen M, Jung RE. A systematic review on the accuracy and the clinical outcome of computer-guided template-based implant dentistry. *Clinical Oral Implants Research* 2009;20(Suppl 4): 73–86.
- Suomalainen A, Ventä I, Mattila M, Turtola L, Vehmas T, Peltola JS. Reliability of CBCT and other radiographic methods in preoperative evaluation of lower third molars. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010;109(2):276-84
- Telara GL, New concepts in computer-guided implantology (Part I): Thread timing and Implant Phase. *Implants International Magazine of Oral Implantology*, Vol. 12 - Issue 4/2011
- Telara GL, New concepts in computer-guided implantology (Part II): Thread timing and Implant Phase. *Implants International Magazine of Oral Implantology*, Vol. 13 - Issue 1/2012
- Testori T, Parenti A, Motroni A, Rinaldi M, Luongo G, Garrone R, Cocchetto R, Mandelaris G, Rosenfeld A, Robiony M. Multicenter clinical study on accuracy and precision of a new guided surgery system. *Italian Oral Surgery* 2012;5(Suppl 1):s187-s200.
- Valente F, Schirotti G, Sbrenna A. Accuracy of computer aided oral implant surgery: a clinical and radiographic study. *Int J Oral Maxillofac Implants* 2009;24:234-242

- Van Assche N, Vercruyssen M, Coucke W, Teughels W, Jacobs R, Quirynen M. Accuracy of computer-aided implant placement. *Clin Oral Implants Res.* 2012;23(Suppl. 6):112–123