Journal of Dental Sciences (2020) 15, 234–235

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Correspondence

Analysis of the relationship between a modified method for implant site preparation and primary implant stability: A pilot study

KEYWORDS
Bone density;
Dental implant;
Insertion torque;
Primary stability

Primary stability is depicted as the absence of mobility in the implant socket immediately after the implant has been inserted.[1] It depends on mechanical engagement of an implant with the surrounding bone structure.[2,3] The attainment of high primary stability, which plays an essential role in successful osseointegration, is difficult where bone quality is poor.[4,5] The goal of this human cadaver study was to analyze the primary stability of implants placed by using three different surgical techniques.

Three edentulous human cadaver mandibles were used in this study. Computerized tomography (CT) scanning (Siemens AR-SP 40, Munich, Germany) was performed after radiopaque markers (gutta-perchas in 1-mm thickness) were adhered to the alveolar crest of each mandible to mark all implant recipient sites. After establishing each implant recipient area on the cross-sectional images, the mean bone density values were recorded in Hounsfield Units (HU). For each mandible, 8 implant recipient sites (centrals, canines, second premolars and second molars) were prepared, and then all 24 implants (4 × 11.5 mm, NobelBiocare, Goteborg, Sweden) were placed.

One control (Group C) and two test groups (Groups T1 and T2) were allocated with respect to the size of implant socket preparation. For all implant site preparations, a 2 mm- and a 3 mm-diameter drill were used in full length. Then, a final twist drill with 3.4 mm diameter was used in the control group. In the test groups, the last two twist drills with 3.2 mm and 3.4 mm diameters were not used in full depth to ensure undersized implant site preparation (Fig. 1A).

The peak insertion torque (OsseoSet, NobelBiocare AB, Goteborg, Sweden) and resonance frequency analysis values were measured (Ostell, Integration Diagnostics AB, Goteborg, Sweden). For statistical evaluations, the non-parametric Mann Whitney, and the Spearman's tests were used (SPSS Inc., Chicago, IL, USA). *P*-values less than 0.05 were considered statistically significant.

The mean bone density, insertion torque, and RFA (Resonance Frequency Analysis) values were 328 ± 39 HU (Hounsfield Units), 40 ± 1 Ncm, and 70.3 ± 2 ISQ (Implant Stability Quotient) respectively for all 24 implants. No statistically significant correlations were noted between bone density and insertion torque values ($r = 0.44$, $p > 0.05$), and bone density and RFA values ($r = 0.41$, $p > 0.05$), but the difference was significant between insertion torque and RFA values ($r = 0.55$, $p < 0.05$).

The mean bone density values were 402 ± 35 HU in Group C, 320 ± 29 HU in Group T1, and 262 ± 55 HU in Group T2. These values indicated statistical significant differences between Group C and T1 ($p < 0.05$), Group T1 and T2 ($p < 0.05$), and Group C and T2 ($p < 0.01$). Higher insertion torque and resonance frequency analysis values were found in the test groups with lower bone density values when compared to the control group with greater bone density values (Fig. 1B).

https://doi.org/10.1016/j.jds.2019.11.003

Groups	2 mm-diameter	3 mm-diameter	3.2 mm-diameter	3.4 mm-diameter
Group C	11.5 mm	11.5 mm	11.5 mm	11.5 mm
Group T1	11.5 mm	11.5 mm	8 mm	5 mm
Group T2	11.5 mm	11.5 mm	5 mm	2 mm

A

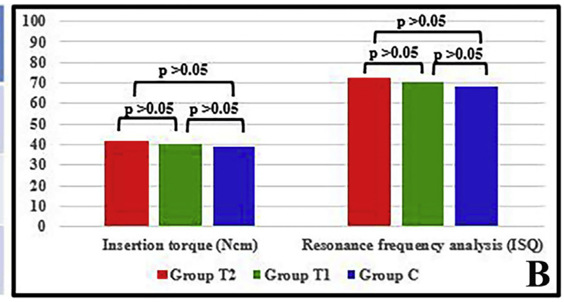

Figure 1 The diameters and lengths of the drills used in each group (A). Statistical analysis of the peak insertion torque and ISQ values among three test groups (B).

The outcomes of this study have indicated that an undersized implant site preparation may enhance primary implant stability, and also there are significant correlations between maximum insertion torque, and RFA values. Further clinical studies are needed to investigate the relationship between undersized implant site preparation and primary stability.

Declaration of Competing Interest

The authors have no conflicts of interest relevant to this article.

References

1. Turkyilmaz I, Shapiro V. Immediate provisional restoration of an implant placed in a fresh primary maxillary canine extraction socket: a case report. *Gen Dent* 2011;59:e105–9.
2. Falco A, Berardini M, Trisi P. Correlation between implant geometry, implant surface, insertion torque, and primary stability: in vitro biomechanical analysis. *Int J Oral Maxillofac Implant* 2018;33:824–30.
3. Turkyilmaz I, Tozum TF, Fuhrmann DM, Tumer C. Seven-year follow-up results of TiUnite implants supporting mandibular overdentures: early versus delayed loading. *Clin Implant Dent Relat Res* 2012;14(Suppl. 1):e83–90.
4. Degidi M, Daprile G, Piattelli A. Influence of underpreparation on primary stability of implants inserted in poor quality bone sites: an in vitro study. *J Oral Maxillofac Surg* 2015;73:1084–8.
5. Wang TM, Lee MS, Wang JS, Lin LD. The effect of implant design and bone quality on insertion torque, resonance frequency analysis, and insertion energy during implant placement in low or low- to medium-density bone. *Int J Prosthodont* 2015;28:40–7.

Gokce Soganci Unsal
Yildirim Beyazit University, Faculty of Dentistry, Department of Prosthodontics, Ankara, Turkey

Ilser Turkyilmaz*
New York University College of Dentistry, Department of Prosthodontics, New York, NY, USA

*Corresponding author. New York University College of Dentistry, Department of Prosthodontics, 380 Second Avenue, Suite 302, New York, NY, 10010, USA.
E-mail address: ilserturkyilmaz@yahoo.com (I. Turkyilmaz)

Received 13 September 2019
Final revision received 13 November 2019
Available online 24 December 2019