Effects of implant Placement Depth (4 mm versus 6 mm) on crestal bone stability in Immediate Implant Placement: A Clinical Study with 1-Year Post-Restorative results

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Participants in this study were scheduled for tooth extraction followed by immediate implant placement. One hour prior to the procedure, patients were administered 1 g of amoxicillin orally, which was continued at a dosage of twice daily for one week after the procedure. Teeth were extracted under local anesthesia using 4% articain with epi-nephrine 1:100000 (Ubistesin forte, 3M ESPE, USA), with an emphasis on minimizing trauma and avoiding flap elevation, employing root sectioning if necessary. Care was taken to preserve the marginal gingiva and papillae. Following extraction, the socket was cleaned and assessed. Osteotomies were created using the original drills in a sequence specified by the implant manufacturer. The implant was placed centrally in the me-sio-distal aspect and more towards the lingual/palatal side of the socket. According to the group allocation, control group implants were positioned 4 mm below the mid-facial gingival margin, while test group implants were placed 6 mm below the gingiva. The insertion torque was recorded with manual torque wrench [13]. Anatomical or individual healing abutments were used after implant placement. Individual healing abutments were crafted chairside using original titanium temporary abutments and flowable composite (3M Supreme Filtek Flow, 3M ESPE, USA), creating critical and subcritical contours. The composite was pol-ished meticulously). All immediate implant sites were grafted with allogenic cortical/cancellous particulate (1000-1700 micron) bone material (Rocky Mountain Tissue Bank, RMTB, USA), up to the gingival margin (Figure 3B) and healing abutments were secured on the implants with 15 Ncm torque. Postoperative instructions were provided both verbally and, in a booklet, advising patients to rinse their mouths twice daily for 2 weeks with a commercially available mouth rinse containing 0.12% chlorhexidine di-gluconate. After 4 months, the osseointegration of implants was evaluated for presence or absence of following symptoms: pain, recurrent peri-implant infections, mobility on manual palpation and continuous peri-implant radiolucency. If those symptoms were absent, implant was deemed successfully integrated and silicone impressions for final restorations were taken. Screw-retained full-contour zirconia crowns with ultra-polished subgingival areas, were delivered. The access holes were filled with Teflon tape, and while the top 1 mm was sealed with flowable composite. Individual oral hygiene instructions were provided both verbally and in booklet form. Scheduling of follow-up visits were carried out after 1 year of last dental visit.

The primary outcome was the radiologic evaluation of peri-implant MBL. Secondary outcomes implant stability in terms of primary and secondary stability measured in implant stability quotient (ISQ). Parallel intraoral radiographs with a radiovisiography (RVG) sensor (Carestream RVG 5200, Carestream Health, USA) and standard holder (Dexis IXS Digital Sensor Holder, USA) were taken after implant placement (T0), just

after delivering final resto-ration (T1) and at 1- year follow-up visit (T2). The alignment of the radiographs was verified by the image of the implant neck, which appeared as an un-distorted straight line. If the image was not in a parallel orientation, the angulation of the holder position was changed, and another radiograph was taken. ImageJ (v 1.54p, NIH, USA) software was used to analyze radiographs at T0, T1 and T2 time points. Original obtained image was enlarged 20 times for more precise calculation. The diameter of the implant was utilized to calibrate the dimensions of all radiographic images. MBL around the implant was assessed by measuring the distance from the implant-abutment junction to the initial point of bone contact on both the mesial and distal sides, and an average was determined for each implant. MBL change was calculated by subtracting the T2 values from the T1 measurements. Negative values showed bone loss, while positive values indicated bone gain. To establish intra-examiner reliability, the second and third measurements were compared, as they were taken with a one-month interval between them. The final data point used was the average of all three measurements, and the standard deviation (SD) was controlled to not exceed 0.1 mm. All radiograms were in-dependently analyzed by an experienced dentist who was blinded to the study's purpose and was not involved in the execution of the research. Primary implant stability was determined using resonance frequency analyzer (MEGA ISQ II, Megagen, S. Korea) in the buccolingual and mesiodistal direction and an average value was noted down. ISQ value was measured for each implant at the baseline followed by before the final restoration.

Statistical analysis

Sample size calculation was based on primary outcome variable crestal bone loss. G*Power was used to calculate sample size. Effect size was calculated based on the data of De Siqueira and colleagues (mean and SD of two groups: 1.03 ± 0.6 and 0.66 ± 0.38). To achieve power of 90% with and α level 0.05, minimum sample size came out to be 29 patients. To compensate for attrition rate and to accommodate possible dropouts, a total of 36 patients were enrolled, 18 in each group. The normality of the collected data was determined using the Shapiro-Wilk test. Based on normality, parametric (the t-test and paired samples t-test) or non-parametric (the Mann-Whitney U test and Wilcoxon matched-pairs signed rank test) statistical tests were employed to compare dependent variables between groups and within groups at different time points, respectively. SPSS v24 (IBM Corp., USA) was used for statistical analysis, and the significance level was set at $p<0.05$.