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Crestal Bone Loss around Tilted or Axial Implants with Single Unit Restorations

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Abstract:
Background*: The stability of peri-implant tissues, especially the marginal bonelevel in tilted implants restoredwith single crowns has not been investigatedextensively.*
The currentstudyaims to determine the potential influence of implant inclination on peri-implant marginal bonelossafter 12 months of functionalloading.
Materials and Methods*: The study population included patients who received 96 single crowns on axial or tilted implants. Parallel radiographs made at baseline and 12 months after loading, were analyzed to evaluate the marginal bone loss at the mesial and distal side. A cumulative score was calculated, and both groups were compared using T-test.*
Results*: The measured peri-implant marginal bone loss was 0.23±0.8 mm around axial implants and 0.22±0.7 mm around the tilted implants restored with single crowns. The T-test showed no statistically significant difference between the two studied groups t(90.75)= 0.55, p = 0.58].*
Conclusion:*Within the limitations of the current study, it can be concluded that single unit constructions can be a reliable restoration technique over tilted implants regarding the peri-implant marginal bone loss. The later might bring advantages to both patients and operators.*
Key Word*:Dental implants;Peri-implant tissues;Tilted implants; Single crowns;Peri-implant marginal bone loss*

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I. Introduction

Single crowns over implants are becoming an increasingly popular option when replacing a missing tooth. However, due to the bone-implant interface, implants are more vulnerable to nonaxial forces compared to natural teeth. The lack of periodontal ligament creates a higher torsional and shear forces, which are exerted on the implant-to-bone contact surface [2].

The optimal position of implants from the biomechanical point of view would be a vertical axis perpendicular to the masticatory plane [3,4]. However, the presence of adjacent anatomical structures such as the maxillary sinus and the inferior alveolar nerve, as well as the alveolar ridge volume and inclination often limit the axial position of standard implants. The usage of tilted implants can overcome the abovementioned problems and facilitate the usage of longer implants, thus create a better load distribution, andeliminate the necessity of bone augmentation procedures [5].

The stability of peri-implant tissues, especially the marginal bone level in single tilted implants has not been investigated extensively. Several clinical and FEM studies, a few systematic reviews and meta-analyses are identified, but their focus is on implant overdentures or fixed multiple unit implant-supported prostheses rather than single-unit restorations [6,5,7,8].

The current study aims to determine the potential influence of implant inclination on peri-implant marginal bone loss after 12 months of functional loading in single-unit restorations over implants.

II. Material and Methods

Ninety-six implants (AB dental, A.B. Dental Devices Ltd., Israel) were restored with crowns between September 2018 and March 2019 at the CAD/CAM Centre of dental medicine, Faculty of Dental Medicine, Medical University of Plovdiv.

Inclusion criteria:

1. Need of single restoration over implant;
2. No history of peri-implant mucositis;
3. Satisfactory oral hygiene at the base level of investigation.

Exclusion criteria:

1. Patients with poor oral hygiene
2. History of peri-implant mucositis

Procedure methodology:

The treatment was performed by the same operator (SZ), while the assessment of the results was carried out by an experienced clinician not involved in the restorative procedures (RT). All participants provided written informed consent before inclusion in the study.

The primary outcome of the study was the analysis of marginal bone level change, depending on the inclination of the implants.

Single-unit implant restorations were fabricated using a fully digital approach (n = 64) or with conventional methods (n = 32).

The inclination of the implants was assessed in two ways depending on the way of manufacturing. In the conventional group, the definitive implant abutment, was used to determine the inclination of the implant, whereas in the digital group the calculations were performed in the Dental Designer software (3Shape, Denmark).

After fixing the restoration, a digital parallel radiograph was made, which served as the base level of the bone. Twelve months after the loading, all participants were recalled, and a second x-ray image was taken. The images were scaled using the implant length as a scale-factor. Marginal bone level was recorded as the distance between the neck of the implant and the level of the peri-implant bone on the mesial and distal side - Figure 1. The difference between the 12th month and the base x-ray images was considered marginal bone loss for the observed time period. A single previously trained operator (RT) made all the measurements. The measurement procedure was repeated after a period of two weeks in order to assess repeatability [ICC = 0.91]. The marginal bone level evaluation, as well as the scaling procedures were performed in the software FIJI [9].

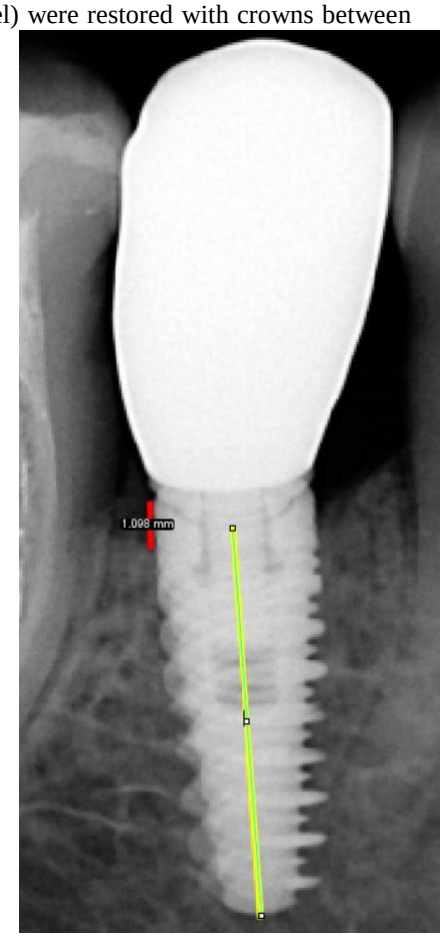

Figure 1Base MBL measurement procedure

Statistical analysis:

Descriptive statistics and graphical analysis were used to characterize the studied sample. The two established groups were compared with a T-test. Additionally, gender and age impact on marginal bone loss were investigated through multiple regression analysis. All statistical procedures were performed in R [10].

III. Result

Ninety-six patients were enrolled in the study – 52 of them were male and 44females, with equal distribution between the two proportions – Figure 2, [χ2gof = 0.67, p = 0.41].

The mean age of the participants was 40.70±11.79 years with a minimum of 21 and a maximum of 73 years – Figure 3. Forty-one of the implants constituting 43% were tilted and 55, representing 57% were axial, without a proportional difference between the two groups[χ2gof = 2.04, p = 0.15].

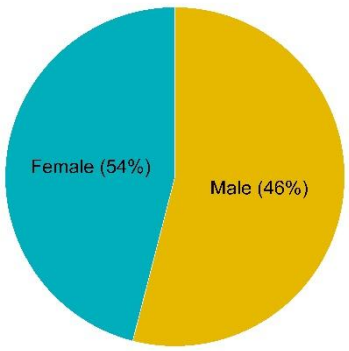

Figure 2 Gender distribution in the study sample

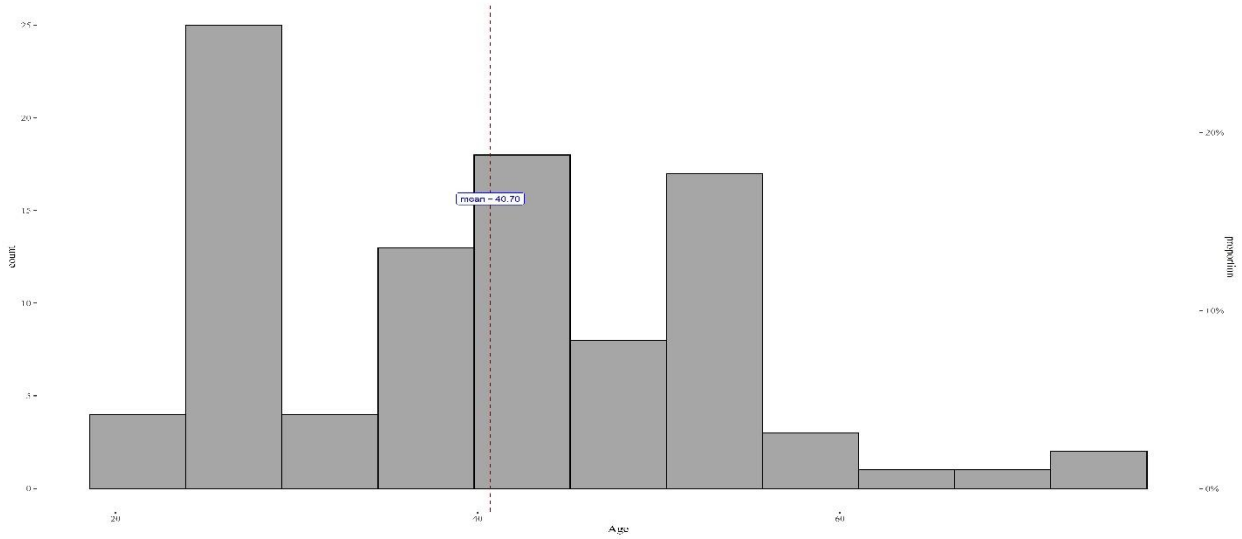

Figure 3 Age distribution in the study sample

The measured peri-implant marginal bone loss was 0.23±0.8 mm around axial implants and 0.22±0.7 mm around the tilted implants restored with single crowns. The T-test showed no statistically significant difference between the two studied groups –Figure 4 [t(90.75)= 0.55, p = 0.58].

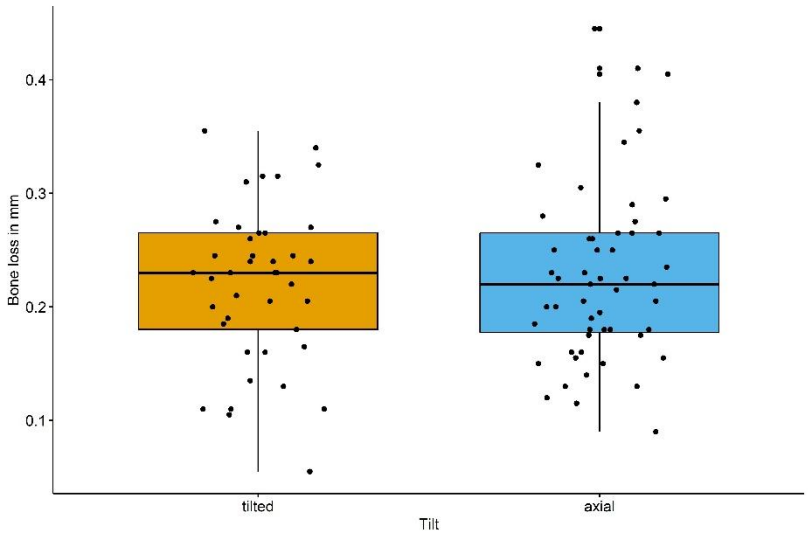

Figure 4 MBL around tilted and axial implants

IV. Discussion

It is still uncertain whether tilted implants restored with single crowns are more likely to fail over time due to peri-implant bone loss or other complications of biological or technical nature. There is limited information available in the specialized literature regarding the researched topic. Lombardi et al distinguished marginal bone loss around dental implants in two stages – early, up to 12 months and late, investigating different possible factors influencing the process (6). Galindo-Moreno et all concluded, that early MBL above 0.44 mm increases the risk of peri-implant bone loss progression (11). The use of tilted implants brings a number of advantages to both clinicians and patients, namely allowing treatment, when there are anatomic contraindications, as well as placement of longer implants compared to an axial insertion. In the current study there were no significant differences in early MBL in both study groups – axially or non-axially loaded. However, these findings are limited, due to the method used for MBL evaluation – through parallel radiographs, that only allowed assessment of medial and distal implant sites as compared to similar research that used CT scans (12). The different measurement methods for bone loss might explains the different results reported in the literature. Calanderio and Tomatis reported lesser bone resorbtion around tilted implants, where Bruschi et al

found a greater buccal resorbtion in their study (13,12) Capelli et al and Chrcanovic et al, reported results, which are in accordance with our findings (5,8).

Several authors hypothesized that factors such as implant tilt, age and gender might have an impact on early MBL. A multiple linear regression was calculated to predict the marginal bone loss based on the tilt of the implants, the gender and age of the participants in the studied sample. No significant regression equation was found for the predictor variables ($F(3,92) = 0.65, p > 0.05$), with an R2 of 0.02.

The results of the current study indicate no relationship between the abovementioned factors and early marginal bone loss, which is partially supported by other publications (14,6,15).

The success and survival rates for all constructions were 100% with no recorded complications for both axial and tilted implants. However further research on the impact of tilted implants on early and late MBL is necessary to confirm these findings.

V. Conclusion

Within the limitations of the current study, it can be concluded that single unit constructions can be a reliable restoration technique over tilted implants, regarding the peri-implant marginal bone loss irrespective of age, gender and jaw position. The later might bring advantages to both patients and operators.

References

[1]. De Rouck T, Collys K, Cosyn J. Immediate single-tooth implants in the anterior maxilla: a 1-year case cohort study on hard and soft tissue response. Journal of clinical periodontology. 2008 Jul; 35(7): 649–657.

[2]. Kim Y, Oh TJ, Misch CE, Wang HL. Occlusal considerations in implant therapy: clinical guidelines with biomechanical rationale. Clinical oral implants research. 2005 Feb; 16(1): 26–35.

[3]. Jordanov B.Single Unit restorations over implants – esthetical and functional requirements [In Bulgarian] Infodent. 2014 Jun; 22–32.

[4]. Testori T, Weinstein T, Scutellà F, Wang HL, Zucchelli G. Implant placement in the esthetic area: criteria for positioning single and multiple implants. Periodontology 2000. 2018 Jun; 77(1): 176–196.

[5]. Capelli M, Zuffetti F, Del Fabbro M, Testori T. Immediate rehabilitation of the completely edentulous jaw with fixed prostheses supported by either upright or tilted implants: a multicentre clinical study. The International journal of oral & maxillofacial implants. 2007; 22(4): 639–644.

[6]. Lombardi T, Berton F, Salgarello S, Barbalonga E, Rapani A, Piovesana F, et al. Factors Influencing Early Marginal Bone Loss around Dental Implants Positioned Subcrestally: A Multicenter Prospective Clinical Study. Journal of clinical medicine. 2019 Aug; 8(8).

[7]. Ata-Ali J, PeÃ±arrocha-Oltra D, Candel-Marti E, PeÃ±arrocha-Diago M. Oral rehabilitation with tilted dental implants: A metaanalysis. Medicina Oral, PatologÃ¬a Oral y CirugÃ¬aBucal. 2012 Jul; 17: e582–e587.

[8]. Chrcanovic BR, Albrektsson T, Wennerberg A. Tilted versus axially placed dental implants: a meta-analysis. Journal of Dentistry. 2015 Feb; 43: 149–170.

[9]. Schindelin J, Arganda-Carreras I, Frise E, Kaynig V, Longair M, Pietzsch T, et al. Fiji: an open-source platform for biological-image analysis. Nature methods. 2012 Jun; 9(7): 676–682.

[10]. R Core Team. R: A Language and Environment for Statistical Computing. Vienna; 2017.

[11]. Galindo-Moreno P, León-Cano A, Ortega-Oller I, Monje A, O Valle F, Catena A. Marginal bone loss as success criterion in implant dentistry: beyond 2 mm. Clinical Oral Implants Research. 2015 Apr; 26: e28–e34.

[12]. Bruschi E, Manicone PF, De Angelis P, Papetti L, Pastorino R, D'Addona A. Comparison of Marginal Bone Loss Around Axial and Tilted Implants: A Retrospective CBCT Analysis of Up to 24 Months. The International Journal of Periodontics & Restorative Dentistry. 2019 Oct; 39: 675–684.

[13]. Calandriello R, Tomatis M. Simplified treatment of the atrophic posterior maxilla via immediate/early function and tilted implants: A prospective 1-year clinical study. Clinical Implant Dentistry and Related Research. 2005; 7 Suppl 1: S1–12.

[14]. Negri M, Galli C, Smerieri A, Macaluso GM, Manfredi E, Ghiacci G, et al. The Effect of Age, Gender, and Insertion Site on Marginal Bone Loss around Endosseous Implants: Results from a 3-Year Trial with Premium Implant System. BioMed Research International. 2014 Aug; 2014: e369051.

[15]. Hameed MH, Khan FR, Ghafoor R, Azam SI. Marginal bone loss around cement and screw-retained fixed implant prosthesis. Journal of Clinical and Experimental Dentistry. 2018 Oct; 10: e949–e954.

[16]. Raes F, Cosyn J, Crommelinck E, Coessens P, De Bruyn H. Immediate and conventional single implant treatment in the anterior maxilla: 1-year results of a case series on hard and soft tissue response and aesthetics. Journal of clinical periodontology. 2011 Apr; 38(4): 385–394.

[17]. De Rouck T, Collys K, Cosyn J. Single-tooth replacement in the anterior maxilla by means of immediate implantation and provisionalization: a review. The International journal of oral & maxillofacial implants. 2008; 23(5): 897–904.