The comparison of narrow and regular platform dental implants placed in posterior regions: A retrospective, longitudinal study

Comparison of narrow and regular implants

Berceste Güler1, Banu Çukurluöz Bayındır2
1Department of Periodontology, Kütahya Health Sciences University, Faculty of Dentistry, Kütahya
2Department of Prosthetic Rehabilitation, Kütahya Health Sciences University, Faculty of Dentistry, Kütahya, Turkey

Abstract

Aim: The present study aimed to evaluate the clinical measurements and radiographic marginal bone loss of narrow and regular platform dental implants with the TiUnite surface placed in the posterior jaws.

Material and Methods: The study was designed as a retrospective, parallel, longitudinal pilot trial. Twenty-eight patients (mean age: 48.34 ± 6.06) and 66 TiUnite surfaces bone level dental implants (Nobel Biocare Parallel Conical Connection) were included in the study. The implants were divided into two different groups according to the narrow platform implants (NPIs) (n=32) and regular platform implants (RPIs) (n=26). The mean implant lengths, plaque index (PI), gingival index (GI), periodontal pocket depth (PD), gingival recession (GR), keratinized gingival width (KGW) and bleeding on probing (BOP) values were recorded. Mean marginal bone level (MBL) values were evaluated, in which the distance between the bone-implant contact and the implant shoulder reference points was assessed on digital periapical radiographs via a software program (Mediadent Software). The Student’s t-test was used for between-group comparison.

Trial registration: NCT04572490. Retrospectively registered, (available at: https://clinicaltrials.gov/ct2/show/NCT04572490).

Results: The mean MBL value was 0.84±0.81 mm in the NPIs group and 0.44±0.65 mm in the RPIs group. Regarding the radiological evaluations, there was a statistically significant difference between the groups in the mean MBL (p<0.05). F(3)=6.56, p<0.001 and the GR value of 41% of the variance in the dependent variable predict mean MBL positively and significantly in the NPI group.

Discussion: Within the limitations, in this study group, narrow-platform TiUnite surface conical connection dental implants showed a higher rate of gingival recession and, consequently, marginal bone loss was observed at a higher rate in the long follow-up period.

Keywords
Dental Implants; Alveolar Bone Loss; Periodontal Pocket; Peri-Implantitis; Narrow Platform

DOI: 10.4328/ACAM.20556    Received: 2021-02-27    Accepted: 2021-05-18    Published Online: 2021-06-06    Ann Clin Anal Med 2021;12(9):1005-1010
Corresponding Author: Berceste Güler, Kütahya Health Sciences University, Faculty of Dentistry, Department of Periodontology, Kütahya, Turkey.
E-mail: bercesteg43@gmail.com    F: +90 (274) 265 20 31
Corresponding Author ORCID ID: https://orcid.org/0000-0003-2440-6884
Introduction
The increasing use of dental implants as a treatment option for edentulous areas, the option of dental implants in different diameters, lengths, and designs, which can be applied in various clinical cases [1]. Many factors, such as the implant diameter, buccolingual thickness of the residual alveolar bone, the implant platform, the occlusion type, and the mesiodistal dimension for prosthetic restoration, are important in implant design and commercial brand selection [2].

In such cases, horizontal augmentation or narrow diameter implant placement is considered two different surgical techniques [3,4]. Al-Johany et al. have shown that the diameter was classified as narrow when the implant diameter was less than 3.75 mm; however, the definition of NPIs in the studies in the literature varies according to manufacturer [1]. The use of narrow platform implants (NPIs) to avoid bone augmentation is preferable, particularly in the posterior jaws, because of its high success rate and cost-effectiveness [5]. The narrow diameter of the implant leads to a decrease in the osseointegrated surface area; therefore, the possible complications increase depending on the mechanical stress on the screw and abutment parts of the implant [6]. Because of the direct connection between dental implants and alveolar bone and the absence of a periodontal ligament, repetitive and excessive mechanical stress on the implant may cause resorption of alveolar marginal bone [7].

Dittmer et al. have conducted static load tests with the same geometry setup and reported that the load-bearing capacity was higher in TiUnite surface implants than sandblasted, large grit, acid-etched (SLA) surface implants [8]. Song et al. have mentioned that the reduced implant diameter and the implant neck showed lower fatigue strength in terms of suprastructure failure compared to the standard diameter implant [9].

Albrektsson et al. have reported that a mean 2 mm peri-implant marginal bone loss (MBL) was acceptable in the first year of implant treatment, and then 0.2 mm MBL each year would generally be within physiological limits [10]. De Souza et al. concluded that there is no statistically significant difference in terms of radiographic MBL of narrow platform implants (NPIs) and regular platform implants (RPIs) placed in posterior regions [11]. Zweers et al. evaluated NPIs for implant-supported overdenture prostheses, and reported higher MBL compared to RPIs [4]. In addition, there was more alveolar bone loss in the molar region than implants placed in the premolar region; and there is no difference in terms of MBL in splinted or single implant-supported fixed prostheses [12,13].

The hypothesis of this study is that there is no difference with regards to MBL and prosthetic complications in NPI and RPI implants with TiUnite surface in implants placed in the posterior region. This study aimed to compare the long-term radiographically peri-implant MBL, clinical measurements, and prosthetic complications of NPIs and RPIs placed in posterior jaws after functional loading.

Material and Methods
Study Design
The study was designed as a retrospective, nonequivalent control group, parallel, two-year longitudinal pilot trial and evaluated implant-supported fixed prostheses placed in the posterior jaws of patients who received implant treatment at the Faculty of Dentistry at Kütahya Health Sciences University between 2016 December and 2018 October. Non-Interventional Clinical Ethics Committee of Kütahya Health Sciences University approved the study (Decision No: 2019/07-4 Date: 27.06.2019) and it is registered at ClinicalTrials.gov ((NCT04572490) 01.10.2020). All data were collected between July 2019 and September 2019 and all patients signed informed consent.

Inclusion criteria
Inclusion criteria were as follows: the presence of a dental implant treated with fixed prosthetic restoration placed in the posterior jaw, followed for at least one year after functional loading, no active periodontal disease, no history of penicillin allergy, no radiotherapy to the head and neck region, smoking less than ten cigarettes per day, no bone augmentation surgery before or during dental implant surgery, age > 18, no mesial or distal additional crown restoration, no use of medications that affect bone metabolism, and no pregnancy or lactation.

Exclusion criteria
The implants placed in the anterior region, immediate placing and loading, or augmented before or using a graft membrane with surgery were excluded from the study.

Patient Selection and Assignment
Fifteen male and 13 female patients and 66 dental implants were included in the study. This observational retrospective study was designed according to the STROBE Statement guidelines [14]. A study flow chart of this study was shown in Figure 1.

The assignment was performed according to the dental implant diameters to include cases in the NPI and RPI which are the test and control groups. All dental implants involved are the Nobel Biocare Parallel CC brand (Nobel Biocare, Gothenburg, Sweden) with a TiUnite surface, and it defined a regular diameter of 4.3 mm and narrow diameter of 3.75 mm. Dental implants were divided into two groups according to implant diameter, the NPI group comprised 3.75 mm diameter (NP, Ø= 3.75 mm) implants, and the RPI group comprised 4.3 mm diameter (RP, Ø= 4.3 mm) implants (implant lengths: 10 mm-13 mm).

Clinical Measurements
The clinical measurements were recorded during subsequent sessions using a periodontal probe that was calibrated in 1 mm increments. The clinical measurements were as follows: 1) plaque index (PI); 2) gingival index (GI); 3) probing depth (PD); 4) clinical attachment level (CAL); 5) bleeding on probing (BOP); 6) keratinized gingival width (KGW); 7) gingival recession (GR). The same researcher performed all clinical measurements. The calibration protocol was applied to the reliability of the measurements. PI, GI, PD, CAL, GR, KGW measurements were assessed in five patients and ten peri-implant values. The calibration was accepted when measurements were 90% similar. All clinical measurements were recorded for four sites (mesiobuccal, distobuccal, mid buc, mesiopalatal, midpalatal, and distopalatal) per peri-implant region. PD and PI measurements are reliable in peri-implantitis diagnosis. Prosthetic complications of patients were also evaluated clinically. Veneer ceramic chipping, abutment screw loosening or fracture, implant fracture, loss of retention were recorded.
**Radiographic Measurements**

Studies have shown that periapical radiographs obtained using the parallel technique are reliable in detecting the MBL changes at different follow-ups. Digital periapical radiographs of the posterior region were obtained using a parallel method at follow-up sessions. MBL measurements were provided on periapical radiographs using a software program (Mediident Software, The Dental Imaging Company, London, England). Ten radiographic measurements of MBL around the peri-implant were performed twice with an interval of 3 weeks, and the researcher’s calibration was accepted when the measurements were similar as %90. Measurements were performed separately from the mesial and distal parts and also the average of the two measurements. The reference points for assessment are the implant shoulder and the most apical end-point of the bone-implant contact point. The vertical distance between these two points is defined as MBL (Figure 2).

**Primary and Secondary Outcome Variables**

Mean MBL and prosthetic complications were assessed as the primary outcome variables. Also, clinical measurements such as PD, GR, and KGW and those related with mean MBL, were evaluated as secondary outcome measurements.

**Surgical Treatment and Prosthetic Rehabilitation**

All surgical treatments were performed with the same surgical protocol by the same surgeon. Antimicrobial prophylaxis with amoxicillin-clavulanate (2 x 1000 mg per day) was started one day before surgery. Local anesthesia was applied to the surgical site, and the full-thickness flap was raised. Dental implants were placed with a 35 Ncm² insertion torque. All dental implants were placed crestally and the flap was closed primarily; a two-stage surgical technique was applied.

As a postoperative recommendation, the patients have been prescribed amoxicillin-clavulanate 1000 mg per day for seven days. Diclofenac potassium 50 mg as an analgesic and 0.012% chlorhexidine mouthwash were recommended for all patients until the sutures were removed one week later. All prosthetic rehabilitation was planned as veneer, and cemented fixed-suprastructures, and was delivered to the patient.

**Statistical analysis**

Data analysis was performed using a software program (SPSS Statistics for Windows, version 20.0, Chicago, IL, USA). All clinical and radiological measurements showed a normal distribution in the study; Student’s t-test was used to compare NPIs and RPIs groups. Descriptive data presented as percentages, and clinical and radiological data presented as mean±SD. A p-value of less than 0.05 was accepted as statistically significant. De Souza et al reported that the sample was determined as 22 for each group to detect MBL with 80% power and α = 0.05. [11] According to the results, the required number of implants was determined with power analysis (G Power, Brunsbüttel, Germany) to be 30 for each group. In order to evaluate the effect on mean MBL, a multivariate regression analysis test was applied for PD, GR, and KGW independent variables.

**Results**

**Demographic Data**

Twenty-eight patients (mean age: 48.34 ± 6.06 years) with 66 TiUnite surfaces dental were included in the study. The dental implant survival rate was 100%. The mean follow-up time was 2.39 ± 0.62 years in the NPI group and 2.10±0.63 years in the RPI group. The mean length of the implants was found 10.33±1.19 mm in NPI group and 10.38±1.29 mm in RPI group. Dental implant localizations, history of periodontitis, smoking and single or splinted crowns values are shown in Table 1.

**Table 1. Demographic data related to implant and patient characteristics**

|                      | NPI (n=32) | RPI (n=26) |
|----------------------|------------|------------|
| Age (mean±SD)        | 46.97±6.98 | 50.86±5.28 |
| Dental Implant localizations |            |            |
| Right Maxilla        | 6          | 3          |
| Left Maxilla         | 7          | 8          |
| Right Mandibula      | 9          | 4          |
| Left Mandibula       | 10         | 11         |
| Implant Length (mm)  |            |            |
| (mean±SD)            | 10.38±1.29 | 10.38±1.29 |
| (8.5-13.0 mm)        | (8.5-13.0 mm) |
| Follow-up year (mean±SD) (min-max) |            |            |
| 2.39±0.62 (1.3-3.2) | 2.10±0.63 (1.3-3.2) |
| Number of implants exposed to smoking | 5 (15.62%) | 12 (46.15%) |
| History of Periodontitis (implant number) | 2 (6.25%) | 2 (7.69%) |
| Single Crown (%)     | 17 (53.12%) | 14 (53.84%) |
| Splinted Restoration | 15 (46.87%) | 12 (46.15%) |
| Occlusal Trauma      | 5 (15.62%) | 3 (11.53%) |

NPIs: Narrow Platform Implants; RPIs: Regular Platform Implants

**Table 2. Comparison of radiographic and peri-implant clinical measurements between the NPIs and RPIs**

|                      | NPI (n=32) (mean±SD) | RPI (n=26) (mean±SD) | p- values |
|----------------------|----------------------|----------------------|-----------|
| Mesial-MBL           | 0.80±0.85            | 0.40±0.75            | 0.070     |
| Distal-MBL           | 0.87±0.84            | 0.48±0.68            | 0.055     |
| Mean-MBL             | 0.84±0.81            | 0.44±0.65            | 0.046**   |
| PI                   | 0.94±0.59            | 1.01±0.96            | 0.727     |
| CI                   | 0.98±0.76            | 0.96±0.71            | 0.881     |
| PD                   | 2.26±0.48            | 2.27±0.57            | 0.972     |
| GR                   | 0.09±0.37            | 0.02±0.13            | 0.363     |
| KGW                  | 1.91±1.39            | 2.52±1.51            | 0.121     |
| BOP                  | 58.33%±58.68%        | 56.08%±45.29%        | 0.842     |

NPIs: Narrow Platform Implants; RPIs: Regular Platform Implants; MBL: Marginal Bone Loss; PI: Plaque Index; CI: Gingival Index; PD: Periodontal Pocket Depth; GR: Gingival Recession; KGW: Keratinized Gingival Width; BOP: Bleeding on Probing. Student-T Test was used for statistical analysis. Statistical significance was p <0.05.

**Table 3. Multiple regression analysis of mean marginal bone loss and related clinical factors**

|      | B     | SE    | β     | t    | p- value |
|------|-------|-------|-------|------|----------|
| PD   | 0.83  | 0.247 | 0.05  | 0.536| 0.74     |
| GR   | 1.38  | 0.516 | 0.63  | 4.35 | 0.00     |
| KGW  | -0.41 | 0.087 | -0.7  | -0.4  | 0.64     |
| PD   | 0.05  | 0.25  | 0.047 | 0.214| 0.83     |
| GR   | -0.016| 1.05  | -0.003| -0.015| 0.98     |
| KGW  | 0.04  | 0.095 | 0.094 | 0.429| 0.67     |

F=6.536, R=0.642 R²=0.412; ** F=0.102 R=0.117 R²=0.014 B: Partial regression coefficient; β: Standart regression coefficient; SE: Standart error
Primary Outcomes
The mean MBL value was 0.84±0.81 mm in the NPIs group and 0.44±0.65 mm in the RPIs group. Regarding the radiological evaluations, there was a statistically significant difference between the groups in the mean MBL (p<0.05) (Table 2). When prosthetic complications were examined, abutment screw loosening occurred in solely one RPIs single-crown fixed prosthetic restoration.

Secondary Outcomes
There was no statistically significant difference between the NPIs and RPIs groups in terms of all clinical measurements. KGW values were 2.46 ± 1.62 mm and 2.60 ± 1.5 mm in the NPIs and RPIs groups, respectively. PD levels were 2.25 ± 0.57 mm in the NPIs group and 2.29 ± 0.48 mm in the RPIs, and the GR values were 0.08 ± 0.35 mm in the NPIs group and 0.02 ± 0.12 mm in the RPIs group, respectively (Table 2).
Comparison of narrow and regular implants

As a result of the multivariate regression analysis, a significant regression model was obtained in the NPI group, but no significant model was obtained in the RPI group. F (3) +6.56, p <0.001 and the GR value of 41% of the variance in the dependent variable predict the mean MBL positively and significantly in the NPI group. As a result of the analysis, it was found that the effect of PD and KGW on mean MBL was not found in both study groups (Table 3).

Discussion

Recently, studies comparing the placed NPIs and RPIs in the posterior region on variable patient populations have increased. [11,15] The hypothesis that “there is no difference with regards to MBL and prosthetic complications in NPI and RPI implants with TiUnite surface in implants placed in the posterior region” is rejected for MBL and prosthetic complications in this study population. This study has shown that radiographically MBL changes were increased in the NPI group comparing to the RPI group in the long-term, and gingival recession was related to increased mean MBL.

Galindo-Moreno et al. have concluded that MBL rates were significantly affected by connection type, bone substratum, and smoking. [16] However, Hingsammer et al. reported that age, gender, insertion torque, implant surface area, location, position, bone quality, and insertion torque did not influence peri-implant bone loss after one year of loading for short-splinted dental implants [17]. The mean peri-implant MBL would be higher with narrow implants due to decreased implant surface area exposed to excessive occlusal force and the accumulation of mechanical stress on the implant shoulder [7]. However, De Souza et al. have mentioned that no statistically significant difference was found in terms of MBL in SLA surface NPIs and RPIs in posterior jaws in a randomized controlled clinical study [11]. Grandi et al. have shown that one-year follow-up clinical and radiological evaluations were performed after splinted fixed NPIs supported fixed prosthetic restorations in the posterior mandible, and the mean MBL was reported 0.48 mm in the first year [15]. The mean 10-year follow-up of NPIs placed in the posterior region revealed that the mesial MBL was 1.16 mm, and the distal MBL was 1.21 mm; 1.10 mm in single crowns and 1.22 mm in splinted restorations. Also, it has been mentioned that SLA surface implants placed in the premolar region to NPIs have higher MBL than those placed in the molar region [18]. Hingsammer et al. reported that factors affecting MBL in short and NPIs were evaluated. Thus, the mean MBL around short implants measured 0.71 mm ± 0.74 mm and has been found to have a strong correlation with the calculated crown-to-implant ratio [17]. In our study, the lengths of the dental implants were recorded, but crown-implant ratios were not evaluated. The assessment of the effect of dental implants on crown-to implant ratio and MBL by calibrating on radiographs may be necessary for clarifying the factors that will affect MBL in NPIs.

Shi et al. have shown that the risk of prosthetic complications with SLA surface NPIs was significantly higher than with splinted restorations of single crowns [18]. In a review, the most common complications in single crown restorations are loss of retention, screw loosening, or veneer chipping [19]. De Souza et al. reported that two RPIs and one NPI had screw loosening, and one RPI had veneer chipping [11]. Also, Al-Aali et al. evaluated technical complications on NPIs splinted and a single crown fixed prosthetic restoration, they reported that significantly more complications were observed in single crowns [12]. Controversial results in the studies may be due to different implant systems, different abutment torque application force, different implant placement techniques, the bone structure of the implant placing region, or the experience of the dentist who performed the prosthetic restoration. In this study, abutment screw loosening was found solely in one single-crown RPI implant placed in the maxilla.

The studies have reported that smoking is a risk factor for peri-implantitis and causes a higher rate of both periodontal and peri-implant destruction [20, 21]. Alasqah et al. showed that MBL was higher in smokers, however, no differences were found between the NPI and RPI groups in a 3-year retrospective study of SLA surface NPIs and RPIs [22]. Arisan et al. found that 81 Friedent Plus surface implants with 3.4 diameters and sandblasted, large-grit, acid-etched (SLA) surface implants were evaluated clinically and radiographically in a 5-year follow-up study; in terms of MBL, there was more bone destruction in the posterior jaws compared to the anterior region and in smokers compared to non-smokers [23]. In our study, although there were a higher number of implants exposed to smoke in the RPI group, a lower rate of MBL was confirmed in the RPI group than the NPI group.

Gingival recession was evaluated in a single study comparing NPIs and RPIs. Ghazal et al. reported that there was no statistically significant difference regarding gingival recession between the NPI and RPI groups [24]. In this study, there were no statistically significant differences between the groups in GR values, however, in regression analysis, an increased gingival recession affected mean MBL in NPI groups.

De Souza et al. reported that MBL was 0.58 ± 0.39 mm for NPIs and 0.53 ± 0.46 mm for RPIs, however, there is no information on implant placement in bone level crestally or subcrestally [11]. In a long-term study of subcrestally and crestally placed dental implants, the mean MBL value was 1.2 ± 0.2 mm for the 2 mm subcrestally placed implant and 1.4 ± 0.2 mm for the crestally placed implant [25]. In this study, all dental implants were placed crestally according to the manufacturer’s recommendations. One of the limitations of this study is the evaluation of splinted and single crowns in a pool. The present study did not evaluate whether the opposite occlusion was tooth-supported or removable prosthesis-supported. Since this study was evaluated prospectively, however, patient-related operational data could not be assessed. An important limitation in this study is that the implant placement area, the amount of buccal alveolar bone remaining after implant placement, and the biological width, which are factors that will affect the peri-implant MBL, are not evaluated.

Conclusion: In terms of clinical peri-implant measurements and prosthetic complications, there was significant difference was found between the NPI and RPI groups at the 2-year follow-up. Within the limitations, in this study group, narrow-platform implants showed a higher rate of gingival recession and, consequently, marginal bone loss was observed at a higher rate in the long follow-up period. Studies with a larger data set are needed.
Scientific Responsibility Statement
The authors declare that they are responsible for the scientific content
including study design, data collection, analysis and interpretation, writing, some
of the main line, or all of the preparation and scientific review of the contents and
approval of the final version of the article.

Animal and human rights statement
All procedures performed in this study were in accordance with the ethical
standards of the institution and/or national research committee and with
the 1964 Helsinki declaration and its later amendments or comparable ethical
standards. No animal or human studies were carried out by the authors for this
article.

Funding: None
Conflict of interest
None of the authors received any type of financial support that could be considered
potential conflict of interest regarding the manuscript or its submission.

References
1. Al-Johany SS, Al Amri MD, Alsaedi S, Alaloda B. Dental Implant Length and Diameter: A Proposed Classification Scheme. J Prosthodont. 2017;26(3):252-60. DOI:10.1111/jopr.12517
2. Esposito M, Murray-Curtis L, Grusovin MG, Coulthard P, Worthington HV. Interventions for replacing missing teeth. Different types of dental implants. Cochrane Database Syst Rev. 2007;4(4):CD003815. DOI:10.1002/14651858.CD003815
3. Berlitum I, Seboua N, Nemcovsky CE, Slutzkey S. Lateral bone augmentation in narrow posterior mandibles, description of a novel approach, and analysis of results. Clin Implant Dent Relat Res. 2018;20(2):96-101. DOI:10.1111/cid.12580
4. Zeevers J, van Donkum A, Hogendoorn EA, Quirynen M, Van der Weijden GA. Clinical and radiographic evaluation of narrow- vs. regular-diameter dental implants: 3-year follow-up. A retrospective study. Clin Oral Implants Res. 2015;26(2):149-56. DOI:10.1111/cid.12309
5. Maiorana C, King P, Quass S, Sandell K, Worsaae N, Galindo-Moreno P. Clinical and radiographic evaluation of early loaded narrow-diameter implants: 3 years follow-up. Clin Oral Implants Res. 2015;26(7):77-82. DOI:10.1111/cid.12281
6. Petrie CS, Williams JL. Comparative evaluation of implant designs: Influence of diameter, length, and taper on strains in the alveolar crest. A three-dimensional finite-element analysis. Clin Oral Implants Res. 2005;16(4):486-94. DOI:10.1111/j.1600-0501.2005.01132.x
7. Chow WF, Mištů S, Bakotić D. Combined effects of implant insertion depth and alveolar bone quality on perimplant bone strain induced by a wide-diameter, short implant and a narrow-diameter, long implant. J Prosthet Dent. 2010;104(5):293-300. DOI:10.1016/j.prosdent.2010.04.012
8. Dittmer S, Dittmer MP, Kohorst P, Jendras M, Borchers L, Stiesch M. Effect of implant-abutment connection design on load bearing capacity and failure mode of implants. J Prosthodont. 2011;20(7):510-16. DOI:10.1532-849X.2011.00758.x
9. Song SY, Lee JY, Shin SW. Effect of Implant Diameter on Fatigue Strength. Implant Dent. 2017;26(1):59-65. DOI:10.1097/ID.0000000000001502
10. Albrektsson T, Buser D, Sennerby L. On crestal/marginal bone loss around dental implants. Int J Periodontics Restorative Dent. 2013;33(1):9-11.
11. de Souza AB, Sukekava F, Tolentino L, César-Neto JB, Garcez-Filho J, Araújo AG. Narrow- and regular-diameter implants in the posterior region of the jaws to support single crowns: A 3-year split-mouth randomized clinical trial. Clin Oral Implants Res. 2018;29(1):100-7. DOI:10.1111/cid.13076
12. Al-Aali KA, Alrehbah AS, Alrahlah A, AlFawaz YF, Abduljabbar T, Vohra F. Clinical and radiographic peri-implant health status around narrow diameter implant-supported single and splinted crowns. Clin Implant Dent Relat Res. 2019;21(2):386-90. DOI:10.1111/cid.12718
13. Alghamdi O, Alrahiah M, Al-Hamoud N, Alkindi M, Vohra F, Abduljabbar T. Peri-implant soft tissue status and crestal bone loss around immediately-loaded narrow-diameter implants placed in cigarette-smokers: 6-year follow-up results. Clin Implant Dent Relat Res. 2020;22(2):220-5. DOI:10.1111/cid.12893
14. van Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. Int J Surg. 2014;12(12):1485-9. DOI:10.1016/j.ijsu.2014.07.013
15. Grandi T, Svezia L, Grandi G. Narrow implants (2.75 and 3.25 mm diameter) supporting a fixed splinted prostheses in posterior regions of mandible: beyond 2 mm. Clin Oral Implants Res. 2015;26(6):e28-e34. DOI:10.1111/cid.12324
16. Ringhammer L, Watzek G, Pommer B. The influence of crown-to-implant ratio on marginal bone levels around splinted short dental implants: A radiological and clinical short term analysis. Clin Implant Dent Relat Res. 2017;19(6):1090-8. DOI:10.1111/cid.12546
17. Shi JX, Xu F, Zhang LF, Gu YX, Gao SC, Lai WC. Long-term outcomes of narrow diameter implants in posterior jaws: A retrospective study with at least 8-year follow-up. Clin Oral Implants Res. 2018;29(1):76-81. DOI:10.1111/cid.12751.

How to cite this article: Berceste Güler, Baru Çakurkuluzı Bayındır. The comparison of narrow and regular platform dental implants placed in posterior regions: A retrospective, longitudinal study. Ann Clin Med 2021;12(9):1005-1010.