Journal of Clinical and
Medical Images

Case Report

ISSN: 2640-9615 | Volume 7

Digital Workflow for New Extra-Short and Short Implants in Atrophic Posterior Mandible Rehabilitation. A Case Report with One-Year of Follow-Up

Thomé G[1], Bernardes SR[1], Cartelli C[2], Uhlendorf J[2] and Deliberador TM[1*]

[1]Professor at Latin American Institute of Dental Research and Education – ILAPEO, Curitiba/PR, Brazil

[2]Latin American Institute of Dental Research and Education – ILAPEO, Curitiba/PR, Brazil

[*]Corresponding author:
Tatiana Miranda Deliberador,
Latin American Institute of Dental Research and Education – ILAPEO, R. Jacarezinho, 656, Curitiba - PR, Brazil, Zip-Code: 80710-150

Received: 06 Apr 2024
Accepted: 21 May 2024
Published: 28 May 2024
J Short Name: JCMI

Citation:

Deliberador TM Thomé G, Digital Workflow for New Extra-Short and Short Implants in Atrophic Posterior Mandible Rehabilitation. A Case Report with One-Year of Follow-Up. J Clin Med Img. 2024; V7(16): 1-8

https://doi.org/10.47829/JCMI.2024.71607

Keywords:

Dental Implants; Short Implants; Computer-Aided Design; Workflow; Digital Technology; Mandible

1. Abstract

The design of short and extra-short dental implants has evolved to increase their survival rates and reduce levels of bone loss. This case report describes successful rehabilitations of atrophic posterior mandibles using digital workflow for new extra-short and short implants, with one year of follow-up. Two patients with bone height limitations were rehabilitated using extra short and short implants (4 and 5 mm in length) in the posterior mandible. After 3 months, digital workflow was used, provisional restorations were designed and processed in a CAD/CAM. After 5 months of surgical procedure, the final metal-ceramic restorations were delivered following the same digital workflow process. The patients were followed for one-year post-surgery. The new design of extra short and short dental implants used for the prosthetic rehabilitation through digital workflow represented a favorable treatment for atrophic posterior mandible.

2. Introduction

Rehabilitation of atrophic posterior mandible is considered a major surgical challenge in implant dentistry. Several treatment options have been used to vertical bone regeneration augmentation however, they can be more expensive, may have longer rehabilitation periods and higher rate of complications and failures. A relevant option is the implant-supported prosthesis, but commonly bone height is insufficient in atrophic posterior mandible for implant insertion. Short dental implants have been considered a predictable alternative for longer implants in the posterior region [1-5]. Short implant placement may reduce surgical complications, costs and patient morbidity in specific clinical situations, which vertical augmentation procedures are needed [1-3]. Even though short implant survival rates and its bone loss data are controversial in literature, short implants can be as effective as longer implants in certain clinical situations [4]. Moderate evidence exists suggesting that short implants perform as well as longer ones in the rehabilitation of edentulous sites without the need for bone augmentation[5]. In addition, short dental implants have been demonstrated to have comparable survival rates to longer implants with faster, less expensive treatment [6, 7]. An exact definition for short implants has not yet been defined in literature [1], but a classification based on several reports called "extra-short" for implants shorter than or equal to 6 mm and "short" for longer implants between 6 and 10 mm [8]. Furthermore, the use of digital workflow for prosthetic rehabilitation has been demonstrated a faster result with greater accuracy.[9] Therefore, the aim of this case report is to present two clinical cases using digital workflow for the new design of extra-short and short implants, with one-year of follow-up.

3. Case Presentation

Two patients were referred to ILAPEO College (Latin American Institute of Research and Education in Dentistry, Curitiba, Brazil) for rehabilitation in posterior mandible with implant-supported prostheses. Cone beam computed tomography (CBCT) and photographs were obtained for diagnosis and planning purposes. A 43-year-old female (patient 1) reported complaining of missing teeth #36, #37, #46 and #47 in regions with bone height limitation and measurements ranging from 5.16 mm to 8.19 mm. (Figure 1).

A 40-year-old male (patient 2) reported complaining of missing teeth #37, #38, #47 and #48 in posterior region of the mandible with measurements ranging from 6.45 mm to 7.46 mm. (Figure 2). Both patients were in good general health and signed the consent form for the treatment authorization. The same surgical and prosthetic protocol were applied for both patients. After infiltration of local anesthesia and incision over the bone crest, the total flap was raised. The site preparation sequence was performed as recommended by the manufacturer and with adequate irrigation. The new extra-short and short implants (Helix Short Implant, Neodent, Brazil) were placed in patient 1 (Video 1 and 2) and patient 2 (Video 3) (Table 1). Periapical x-rays were obtained to check the correct implant positioning (Figure 3). The implants were not subjected to immediate loading, and remained non-submerged, with final abutments installation, for delayed loading. The surgery wound was closed with simple sutures that were removed 10 days thereafter. Patients were asked to use bluem mouthwash (antimicrobial agent with local release of oxygen (blue®m Europe, Netherlands) for 1 minute every 8 hours, starting 24 hours post operation for 10 days thereafter. They were also instructed to use ibuprofen 600 mg every 8 hours for 3 days. After 3 months, the abutments were removed and intraoral scanning was performed (VIRTUO VIVO® Scanner, Dental Wings™, Canada) using the compatible scan bodies (Figures 4 and 5). The abutments height (Neodent, Brazil) were checked and provisional restorations were designed within the Dental System software (3Shape, Denmark), processed in a computer-aided design and computer-aided manufacture (CAD/CAM), milling machine (DMG Sauer, Germany) and cemented, followed by occlusal adjustment. Radiographic follow-up was also performed (Figures 6 and 7). After 5 months of the surgical procedure, the final metal-ceramic restorations were delivered following the same digital workflow process. The cobalt-chromium metal infrastructures were carried out using the CAD/CAM milling machine (DMG Sauer, Germany) and tested in-mouth. They were then sent to the laboratory for preparation and application of the feldspathic ceramics. The crowns were cemented to the final abutments using RelyX U200 (3M), and they were screwed to the implants after proper occlusal adjustment (Figures 8 and 9). The patients were followed-up clinically and radiographically every 3 months, and no complications were observed or reported during the follow-up period. At the 12-month follow-up, both patients presented clinical and radiographic implant success, by not presenting any pain or tenderness upon function, absence of signs of peri-implantitis, no presence of exudate, implant stability, complete implant osseointegration and good marginal bone-level maintenance (<2 mm at the first year) [9,10] (Figure 10 and 11).

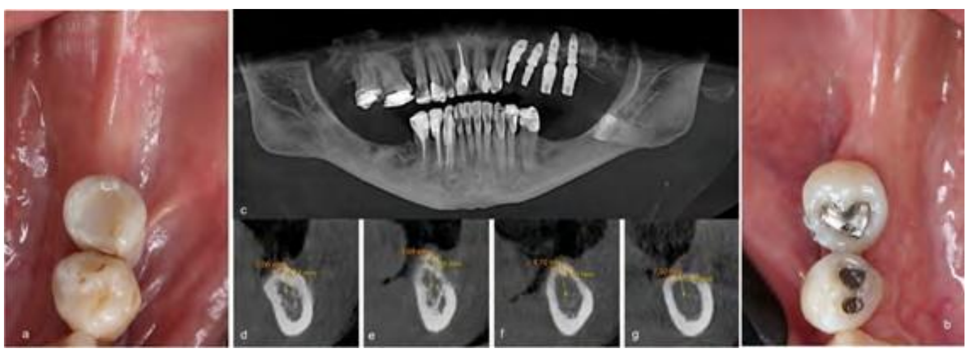

Figure 1: Patient 1. a) initial clinical occlusal image on the right side, b) initial clinical occlusal image on the left side, c) preoperative CBCT, showing absence of teeth in the posterior region of the mandible. d) transversal cross-section of #47 tooth region with 6.71 mm bone height and 5.06 mm bone thickness, e) transversal cross-section of #46 tooth region with 8.19 mm bone height and 4.08 mm bone thickness, f) transversal cross-section of #36 tooth region with 7.63 mm bone height and 4.7 mm bone thickness, g) transversal cross-section of #37 tooth region with 5.16 mm bone height and 7.92 mm bone thickness.

Table 1: Size and length of implants installed in both patient, final torque achieved and bone type in each region.

PATIENT 1	**IMPLANT**	**FINAL TORQUE**	**BONE TYPE Lekholm & Zarb classification**
Tooth 36 (#19)	4.0 x 5.5 mm	60N	II
Tooth 37 (#18)	5.0 x 4 mm	32N	II
Tooth 46 (#30)	4.0 x 5.5 mm	60N	II
Tooth 47 (#31)	5.0 x 5.5 mm	60N	II
PATIENT 2	**IMPLANT**	**FINAL TORQUE**	
Tooth 37 (#18)	5.0 x 7.0 mm	60N	III
Tooth 38 (#17)	5.0 x 7.0 mm	20N	III
Tooth 47 (#31)	5.0 x 7.0 mm	32N	III
Tooth 48 (#32)	5.0 x 5.0 mm	32N	III

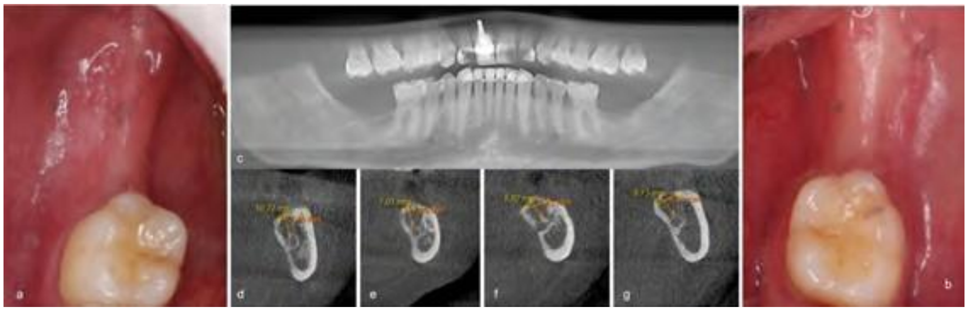

Figure 2: Patient 2. a) initial clinical occlusal image on the right side, b) initial clinical occlusal image on the left side, c) preoperative CBCT, showing absence of teeth in the posterior region of the mandible, d) transversal cross-section of #48 tooth region with 7.46 mm bone height and 10.72 mm bone thickness, e) transversal cross-section of #47 tooth region with 7.26 mm bone height and 7.01 mm bone thickness, f) transversal cross-section of #37 tooth region with 6.45 mm bone height and 8.82 mm bone thickness, g) transversal cross-section of #38 tooth region with 6.93 mm bone height and 8.73 mm bone thickness.

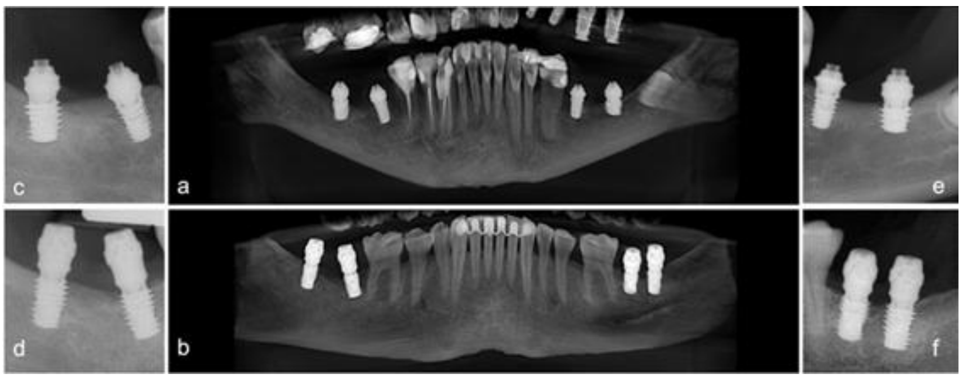

FIGURE 3: Immediate postsurgical panoramic and periapical x-rays. a) Immediate postsurgical panoramic x-ray patient 1, b) Immediate postsurgical panoramic x-ray patient 2, c) Periapical x-ray of right side of patient 1, d) Periapical x-ray of right side of patient 2, e) Periapical x-ray of left side of patient 1, f) Periapical x-ray of left side of patient 2.

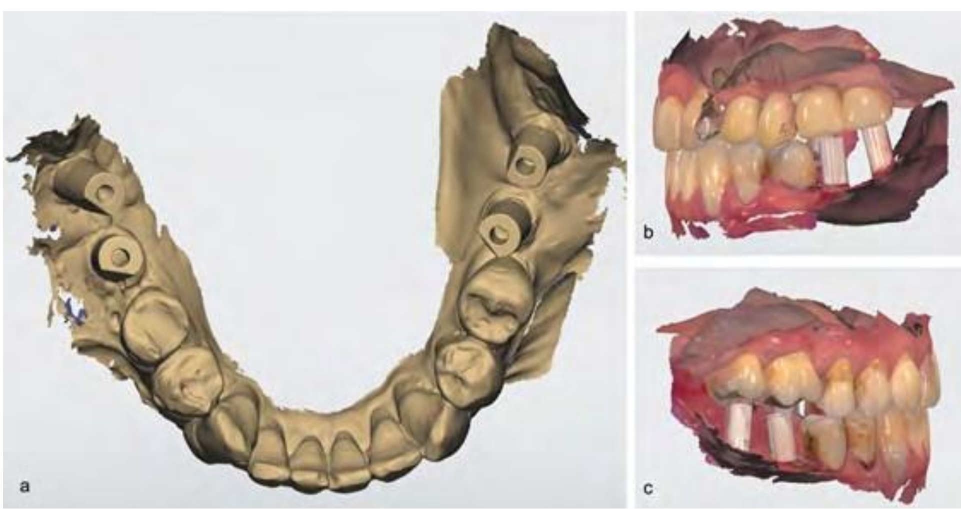

Figure 4: Intraoral scanning performed in patient 1. a) Mandible image in STL, b) PLY image of the scan of the left side of the mandible, with the scanbodies in position, c) PLY image of the scan of the right side of the mandible, with the scanbodies in position.

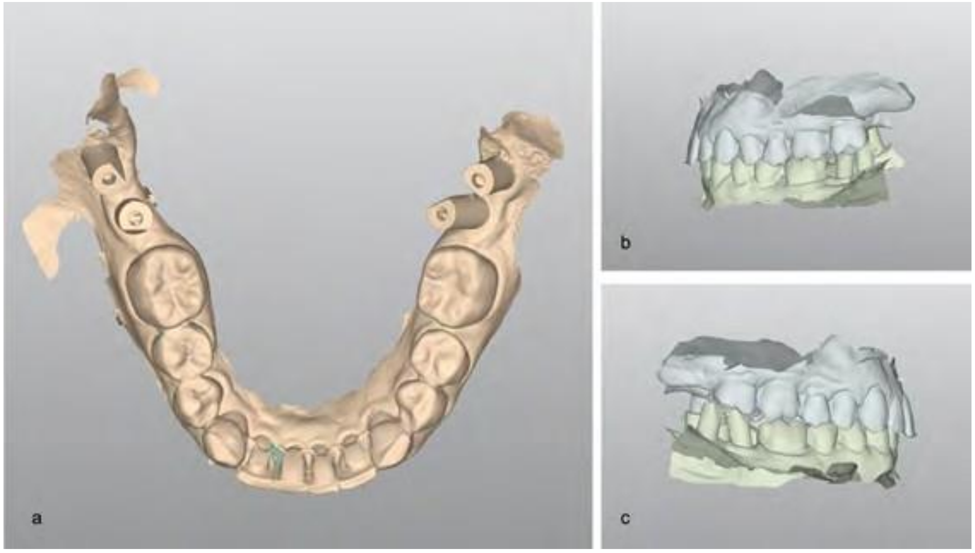

Figure 5: Intraoral scanning performed in patient 2. a) Mandible image in STL, b) STL image of the scan of the left side of the mandible, with the scanbodies in position, c) STL image of the scan of the right side of the mandible, with the scanbodies in position.

Figure 6: Provisional restorations cemented after 3 months of the surgery in patient 1. a) Right side occlusal view, b) Left side occlusal view, c) Right side frontal view, d) Left side frontal view, e) Radiographic follow-up of left side, f) Radiographic follow-up of right side.

Figure 7: Provisional restorations cemented after 3 months of the surgery in patient 2. a) Right side occlusal view, b) Left side occlusal view, c) Right side frontal view, d) Left side frontal view, e) Radiographic follow-up of left side, f) Radiographic follow-up of right side.

Figure 8: Final metal-ceramic restorations after 5 months of the surgery in patient 1. a) Right side occlusal view, with abutments, b) Right side occlusal view, with final metal-ceramic, c) Right side frontal view, with final metal-ceramic, d) Radiographic follow-up of right side, e) Left side occlusal view, with the abutments, f) Left side occlusal view, with final metal-ceramic, g) Left side frontal view, with final metal-ceramic, h) Radiographic follow-up of left side.

Figure 9: Final metal-ceramic restorations after 5 months of the surgery in patient 2. a) Right side occlusal view, with the abutments, b) Right side occlusal view, with final metal-ceramic, c) Right side frontal view, with final metal-ceramic, d) Radiographic follow-up of right side, e) Left side occlusal view, with the abutments, f) Left side occlusal view, with final metal-ceramic, g) Left side frontal view, with final metal-ceramic, h) Radiographic follow-up of left side.

Figure 10: Twelve months of clinical and radiographic follow-up in patient 1 (a-h).

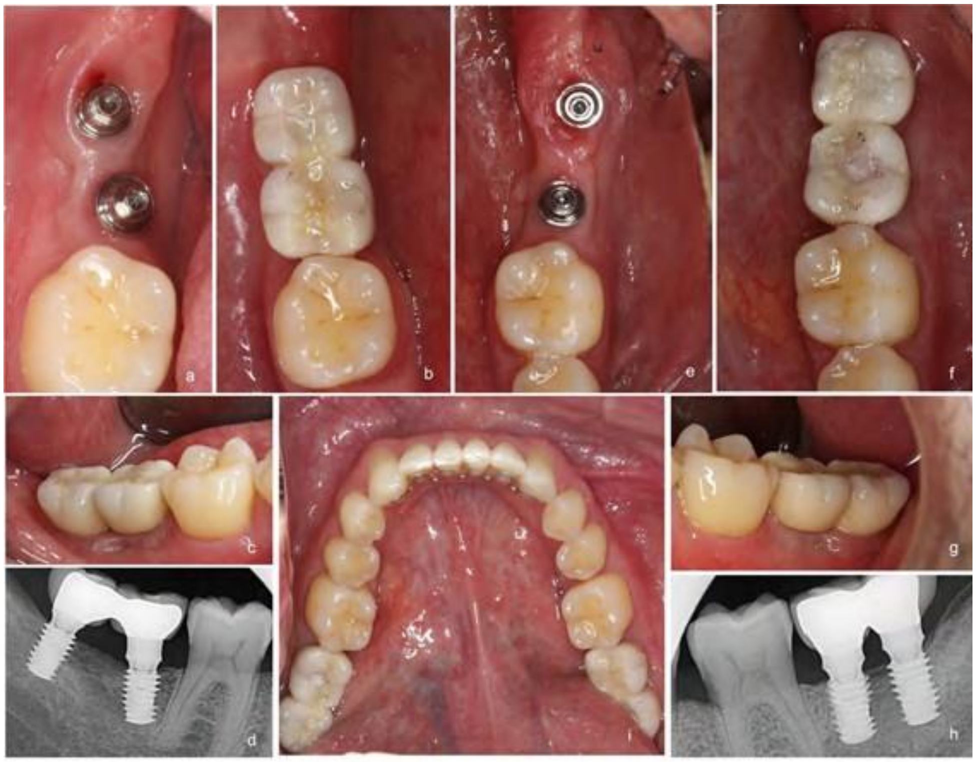

Figure 11: Twelve months of clinical and radiographic follow-up in patient 2 (a-h).

4. Discussion

Short implants are considered a predictable treatment for posterior mandible, by reason of reduction of treatment complexity, especially in cases that require complementary surgical procedures [1,12]. However showed that short implants with length lower than 8 mm had lower survival rates than standard implants (higher than 8 mm length), due to reduced contact between the bone and implant compared to longer implants [1]. To overcome these limitations, dental implant industry has been developing new short and extra short implants to enhance their survival rate and reduce complications. In the present cases, both patients used short and extra short implants with new designs (Helix Short Implant, Neodent, Curitiba, Brazil), with a follow-up of one-year, presented no biological or mechanical complications being observed in this period. These findings agree with the current literature [10-13]. These new implants have cylindrical bodies, conical apexes and internal hexagon platforms. They have an unique design with different heights (4 to 8.5 mm) and diameters (3.75, 4, 5, 6 e 7 mm), suitable for the maxilla and mandible (for all types of bone) with indication to place at the gingival level. When short implant is compared to WS Titamax implant (Neodent), short implant presents advantages, such as high resistance, transmucosal collar abutment height of 1.8 mm with smooth surface. Short implant can be indicated for single and multiple prostheses [13], used with conventional or digital workflow. Since it does not contain an implant driver, its placement is easier. The operator (G.T.), who has extensive clinical experience with short implants, confirmed the easy placement and design of short implant, due to its sharp characteristic. It was also observed that the marginal bone level remained stable during the follow-up period. This result corroborated with the literature, which showed that short implants did not influence marginal bone loss when compared to standard implants [1].

Another advantage of short implants was hydrophilic surface treatments, physicochemical technology of Acqua (blasting + acid etching + immersion in isotonic solution) enhance osseointegration, favoring successful rehabilitation. Recent research shows that implants with a hydrophilic surface exhibited acceleration in the process of osseointegration, culminating in greater secondary stability in low-density bone than in implants with a control surface [14]. Final prosthetic rehabilitation with adequate occlusal adjustment was performed with the splinting of crowns for both cases. This procedure was more favorable for reducing stress and it allowed the stress to be shared between the implants [10]. Another important factor was the distribution of occlusal contacts made by the prosthesis in the absence of a masticatory overload. The option to use digital workflow in these cases was to reduce treatment time and optimize the workflow. Recent report showed that the digital workflow was a reality that can be integrated into daily dental practice, resulting in greater safety, predictability of results, and easy use in all clinical stages [15]. CAD/CAM provides an alternative methodology to fabricate dental prostheses, which may minimize the misfit of the conventional laboratory work [16]. In addition, digital workflow proved to be a favorable procedure in rehabilitation of the posterior region of the mandible, resulting in increased predictability of the result and patient satisfaction with the treatment [9].

5. Conclusion

The new design of extra short and short dental implants used for the prosthetic rehabilitation through digital workflow presented a successful treatment alternative for atrophic posterior mandible. This advance in dental implant technology can allow benefits for patients with limited bone height in their posterior regions of the mandible. However, more data with longer follow-up are required to provide a broad performance of the new short and extra implants in atrophic posterior mandible.

6. Clinical Significance

Short implant placement may reduce surgical complications, costs, and patient morbidity in specific clinical situations, in which vertical augmentation procedures are needed. It is the first clinical case report of implant rehabilitation in the posterior mandible with new extra short and short implants. Use of implants with new design that allows a better locking, greater resistance, easy placement, and stability of the cervical bone in this follow-up period. However, the use of short implants requires clinical experience and adequate training.

References

1. Lemos CAA, Ferro-Alves ML, Okamoto R, Mendonaca MR, Pellizzer EP. Short dental implants versus standard dental implants placed in the posterior jaws: a systematic review and meta-analysis. J Dent. 2016; 47: 8-17.
2. Lee SA, Lee CT, Fu MM, Elmisalati W, Chuang SK. Systematic review and meta-analysis of randomized controlled trials for the management of limited vertical height in the posterior region: short implants (5 to 8 mm) vs longer implants (> 8 mm) in vertically augmented sites. Int J Oral Maxillofac Implants. 2014; 29(5): 1085-1097.
3. Das Neves FD, Fones D, Bernardes SR, do Prado CJ, Neto AJ. Short implants an analysis of longitudinal studies. Int J Oral Maxillofac Implants. 2006; 21(1): 86-93.
4. Torres-Alemany A, Fernández-Estevan L, Agustín-Panadero R, Montiel-Company JM, Labaig-Rueda C, Mañes-Ferrer JF. Clinical Behavior of Short Dental Implants: Systematic Review and Meta-Analysis. J Clin Med. 2020; 9(10): 3271.
5. Guida L, Bressan E, Cecoro G, Volpe AD, Del Fabbro M, Annunziata M. Short versus Longer Implants in Sites without the Need for Bone Augmentation: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Materials (Basel). 2022; 15(9): 3138.
6. Ravidà A, Wang IC, Barootchi S, Askar H, Tavelli L, Gargallo-Albiol J, et al. Meta-analysis of randomized clinical trials comparing clinical and patient-reported outcomes between extra-short (≤6 mm) and longer (≥10 mm) implants. J Clin Periodontol. 2019; 46(1): 118-142.
7. Schwartz SR. Short Implants: An Answer to a Challenging Dilemma? Dent Clin North Am. 2020; 64(2): 279-290.
8. Al-Johany SS, Al Amri MD, Alsaeed S, Alalola B. Dental implant length and diameter: A proposed classification scheme. J Prosthodont. 2017; 26: 252-260.
9. Souza G, Comparin LL, Tatim T, Deliberador T and Garcia VG. “Digital Workflow Rehabilitation in Short Implants Associated with Gingival Grafts”. EC Dental Science. 2021; 69-81.
10. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. Int J Oral Maxillofac Implants. 1986; 1(1): 11-25.
11. Misch CE, Perel ML, Wang HL, Sammartino G, Galindo-Moreno P, Trisi P, et al. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. Implant Dent. 2008; 17(1): 5-15.
12. Lezzi G, Perrotti V, Felice P, Barausse C, Piattelli A, Del Fabbro M. Are <7-mm long implants in native bone as effective as longer implants in augmented bone for the rehabilitation of posterior atrophic jaws? A systematic review and meta-analysis. Clin Implant Dent Relat Res. 2020; 22(5): 552-566.
13. Pellizzer EP, De Mello CC, Santiago Junior JF, De Souza Batista VE, De Faria Almeida DA, Verri FR. Analysis of the biomechanical behavior of short implants: The photo-elasticity method. Mater Sci Eng C Mater Biol Appl. 2015; 55: 187-192.
14. Pinto GDCS, Reis IARD, Leocádio ACS, Silva M Jr, Faeda RS, Oliveira GJPL, et al. Evaluation of hydrophilic surface osseointegration in low-density bone: Preclinical study in rabbits. Braz Dent J. 2023; 34(3): 66-72.
15. Da Silva Salomão GV, Chun EP, Panegaci RDS, Santos FT. Analysis of Digital Workflow in Implantology. Case Rep Dent. 2021; 2021: 6655908.
16. Jiang X, Lin Y, Cui HY, Di P. Immediate loading of multiple splinted implants via complete digital workflow: A pilot clinical study with 1-year follow-up. Clin Implant Dent Relat Res. 2019; 21(3): 446-453.