DOI: 10.21608/ADJALEXU.2021.56284.1149

EVALUATION OF CUSTOMIZED HEALING ABUTMENT IN IMMEDIATE IMPLANT PLACEMENT

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ABSTRACT

INTRODUCTION: Immediate implant placement benefits include saving time decreases the cost, and eliminating a second surgery. However, when the jumping gap between the implant and the inner surface of cavity larger than 2mm bone graft is required to avoid failure of the implant. Customized healing abutment can help in increasing the bone density and allow soft and hard tissue healing with no bone grafting leading to the success of the implant.

OBJECTIVES: To assess clinically and radiographically impersonal and radiographically the role of customized healing abutment on bone density, crestal bone loss, and osseointegration after graft less immediate implant placement in the mandibular molar region.

MATERIALS AND METHODS: The study was made out of 8 cases (20-40 years old). Implants were placed directly after extraction of an unrestorable mandibular molar without grafting, and a customized healing abutment was fabricated. Patients were assessed both clinically and radio-graphically for 6 months to assess pain, edema, probing depth, per implant-bone density, and marginal bone level.

RESULTS: Regarding clinical follow-up, all cases reported pain and edema which subsided within the first week, while the mean probing depth showed insignificant difference throughout the study period ranging from 2 to 3 mm. The radiographic follow-up showed a significant increase in mean bone density, whereas mean marginal bone level was 0.32 ± 0.23 mm at 6 months postoperatively.

CONCLUSIONS: The customized healing abutment proved successful in increasing the perimplant bone density and achieving osseointegration with immediate implants placed graftlessly in the mandibular molar region.

KEYWORDS: Immediate, Implant, Mandibular molar, customized healing abutment.

RUNNING TITLE: Customized healing abutment in immediate implant placement.

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INTRODUCTION

Immediate implant placement protocol is advised to be a reliable procedure for teeth replacement with a reported success rate of 93.4%. This procedure has many benefits over the delayed placement protocol such as avoiding residual ridge resorption, reduced visits, and greater persistent satisfaction by the patient (1).

However, Immediate implant placement poses some prejudices. One of the foremost vital issues is the crestal bone loss that still occurs in immediate implant placement, despite the ability of this technique in reducing residual bone resorption. There is a jumping peri-implant gap between the inner surface of the cavity and implant that could jeopardize the osseointegration process (2).

Many studies were conducted on the peri-implant jumping to assess the need for grafting this gap. These studies reported that a peri-implant jumping gap of more than 2mm increased the risk of crestal bone damage and jeopardized osseointegration and therefore required bone grafting to avoid implant failure(3).

Although bone grafting procedures have many advantages, it is still an expensive option and in case of autogenously grafting process causes donor site morbidity. Besides, the chance for rejection and contagion that can lead to failure; Thus, several studies have conducted the goal of avoid grafting and assessing the outcome of graftless techniques in different aspects of implant density (4, 5).

Recently, the customized healing abutment was introduced to provide a predictable biologic width and emergency profile around the implant. A variety of CAD-CAM and acrylic healing abutments have been assessed in the literature. Studies showed that CAD-CAM healing abutments are superior to acrylic healing in regards to precision and the ability to be manufactured from a variety of materials such as titanium, zirconia, and PEEK. However, acrylic customized healing abutments are lower in cost and can be fabricated directly in the patient mouth in the same visit of implant placement and still provide predictable outcomes (6).

To our knowledge, studies implicating the use of customized healing abutment in the immediately placed molar implant are scarce. A case report published recently used customized healing abutment in immediately placed mandibular molars with a jumping gap over 2 mm. In this case report, no bone grafting materials or membranes or even inducing factors like PRF were used; the report relied on crestal isolation of the implant and the socket by an

acrylic customized healing abutment to stop any interruption of the healing method and therefore permitting bone formation in the jumping gap and implant osseointegration. In that case report, the implant was evaluated before insertion of the final prosthesis, and the implant osseointegrated with a minimal amount of crestal bone loss; however, no clinical studies were conducted to judge the matter (7).

Therefore, this prospective one arm clinical trial aimed to assess clinically and radio-graphically the role of the customized healing abutment on periimplant bone density and osseointegration after graftless immediate implant positioning in the mandibular molar area .

Null hypothesis is the customized healing abutment does not have any significant effect on periimplant bone density, crestal bone loss, and osseointegration. The Alternative hypothesis is the customized healing abutment has a significant effect on periimplant bone density, crestal bone 1oss, and osseointegration.

MATERIALS AND METHODS

This project was registered at Clinical Trials.gov (NCT04517968).

Patients

This study is a prospective clinical study on eight patients with badly destructed mandibular molars indicated for extraction. All patients were recruited from the oral and Maxillofacia1 Department, Faculty of Dentistry, Alexandria University.

Sample size calculation

A minimal total sample size of 8 cases selected from the outpatient clinic of the oral and Maxillofacial Surgery Department was needed to detect an assumed average difference of bone healing (about 50%) compared to the null hypothesis at 95% confidence level and 80% power using Z test (PASS program version 20). Drop out estimate is calculated to avoid sampling errors according to oxford statistical standards to be +2 added to each estimated sample group (about 25% of the overall estimated sample). (PASS program version 20). (8,9)

Patients grouping

Eight implants were inserted immediately graftlessly in the mandibular molar area and an acrylic customized healing abutment was fabricated. The patients were admitted to the study according to the inclusion and exclusion criteria and after signing informed consent.

Inclusion criteria

1-Age range: 20 – 40 years
2-Good oral hygiene .
3-Freshly extracted socket in the mandibular molar area
4-The bony defect surrounding the implant was at least 3-4 mm.

Exclusion criteria

1-Acute infection (periodontitis or mucosal infection)
2-Patients on radiotherapy or chemotherapy.
3-Alcohol or drug abuse.
4-Patients having relevant systemic.
5-Smokers.
6-Patients having parafunctional habits

Materials:-

1-Grand Mosris implant system (Straumann cop- SWEEDEN)
2-Grand Mosris Customized healing abutment for the implant (Straumann cop- SWEEDEN)
3-Physiodispenser and handpiece (NSK cop- South KOREAN)
4-Flowable Composite (3M, USA)

METHODS

I- Preoperative phase

History taking and thorough clinical examination were done for all the patients followed by radiographic examination using Cone Beam Computed Tomography (CBCT) for treatment planning and implant size selection; Furthermore, scaling was done for a1l patient.

II- Surgical phase (Figure 1, 2)

1-Chlorohexidine mouthwashes for thirty seconds before the operation.
2-1ocal Infiltration anesthesia (mepivacaine HCL and epinephrine 1:100,000)
3-Atraumatic extraction of mandibular molar remaining root or tooth was performed followed by sequential drilling up to the final drill and the implants were inserted using hand and torque wrench.
4-The healing abutment was attached to the implant and a rubber dam was adapted between the implant and the healing abutment to prevent leakage of the composite inside the socket followed by customization of the healing abutment by adding flow-able composite to its surface from bottom to make sure that we have a hard base.
5-The composite was light-cured, finished, and polished to make sure that there is no sharp ends or contact point.

III- Postsurgical phase

1-Postsurgical instruction:-

Postoperative instructions were given to the patients including oral hygiene instructions and cold fomentations for 5 min. every 3 hours, then warm mouthwashes every 6 hours for the following days.

2-Postsurgical medication:

Postoperative medications including anti-biotic and non-steroidal anti-inflammatory analgesics drugs (NSAID):
1- Chlorhexidine mouthwashes (Hexitol, Arab Drug Company, Cairo, AR).
2-Antibiotic: amoxicillin/ clavulanic acid 1g; 1 capsule every 12 hours for 6 days post-operatively (Augmentin: manufactured by GlaxoSmithKline, England).
3-NSAID: Ibuprofen 400 mg; 1 tablet every 8 hours daily after meals for 4 days (Brufen (400 mg): Abbott multinational pharmaceutical company, Cairo, A.R).

IV- Follow up phase

1-Clinical follow-up

a- Postoperative pain and infection (10)

The pain was measured using the Numeric rating scale (NRS) on the day of implant placement, the second postoperative day, and after one week. Person rated their pain on a scale 0 – 10. Zero is "no pain," and 10 is "the worst possible pain." Also, all implants were examined for infection or implant mobility throughout the 6 months follow-up period.

b- Edema (11)
Edema was measured after 24 hours and after 1-week using the edema Rating Scale; it is divided into four grades to measure the edema.

c- Periimplant probing depth (12)
Periimplant probing depth was calculated at 6 points around the implant using a periodontal probe after 1 month, 3 months, and 6 months postoperatively.

2-Radiographic follow-up:-
CBCT was done immediately postoperative and at 6 months to evaluate:

a- Peri-implant bone density: (13)
Peri-implant bone density was measured at eight fixed points around the implant in the Hounsfield unit (HU) using the ON DEMAND software (Cybermed Inc, Korea) and the mean was calculated.

b- Crestal bone loss (14)
The space between inner surface 0f cavity and implant t was measured on the mesial, distal, and buccal aspect of the implant using the ruler tool of the ON DEMAND software and the mean was calculated; this was done at 6 months postoperatively.

V- PROSTHETIC PHASE:-
The porcelain fused metal crown was inserted at 6 months postoperatively. **(Figure (1,2))**

Statistical analysis
Data were documented, tabulated, and statistically analyzed utilizing the IBM SPSS package version 20.0 (Armonk, NY: IBM Corp). The info was given by exploitation vary (minimum and maximum), mean, variance, and median. The ANOVA with perennial measures check was used for unremarkably distributed quantitative variables, to check between over 2 periods or stages, and also the Friedman test for the abnormally distributed quantitative variables. The significance of the obtained results was judged at the 5% level (P<0.05).

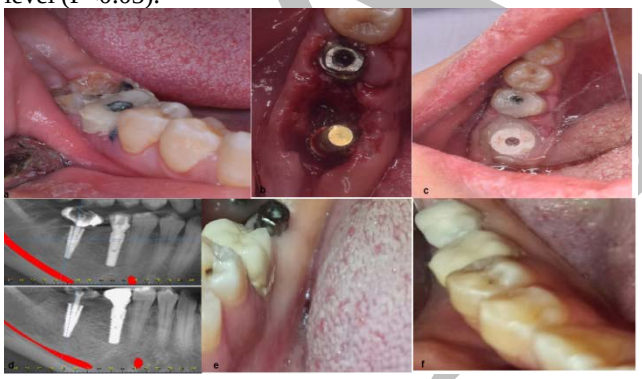

Figure (1): Showing a-clinical preoperative picture, b-implants after insertion, c- customized healing abutment, d-CBCT immediate postoperative and at 6 months e- final abutment in place and f- final prosthesis.

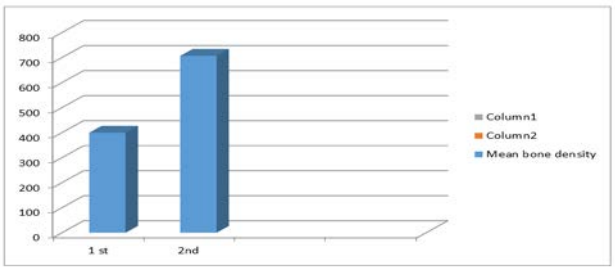

Figure (2): Comparison between the two studied periods according to bone density (n=8)

Table (1): Showing the crestal bone loss at 6 months (n= 8).

		%
Crestal bone loss Min. – Max. Mean ± SD. Median (IQR)	 0.59 – 0.13 0.32 ± 0.23 0.30(0.29-0.31)	

Table (2): Comparison of the various studied periods showing the Periodontal probing depth (n= 8).

	No.	%
Periodontal probing depth 2 3	 6 2	 75.0 25.0
Min. – Max. Mean ± SD. Median (IQR)	2.0 – 3.0 2.25 ± 0.46 2.0 (2.0 – 2.5)	

RESULTS

The present study was conducted on eight patients. Eight implants were placed in a freshly extracted mandibular molars socket from which four cases were first mandibular molars and four cases were second mandibular molars. Patients were chosen from the outpatient Clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University. All subjects were free from any systemic disease that can concession implant success. Patients' ages ranged from 20 to 40 years old with a mean of 27.50 ± 4.99years 0ld and were 5 females and 3 males. All patients were followed up, and the results were registered as regards both clinical and radiographic evaluations**.**

1-Clinical evaluation

A. Pain: - Table (3):
Immediate postoperative, the mean postoperative pain was 5.5 with a minimum of 4 and a maximum of 7. Whereas, after 24 hours, the mean after 24 hours was 2.87 with a minimum of 1 and a maximum of 5. Furthermore, after 1 week, no pain was recorded in any of the patients, and throughout the rest of the follow-up period.

B-Infection
None of the patients showed any sign of infection or mobility throughout the follow-up period

C- Edema
After 24 hours, 5 patients had mild edema, while the other 3 patients showed moderate edema. Moreover, there were no

signs of edema after 1 week for all the patients, and throughout the study period.

D- Probing depth Table (2):

The mean probing depth was 2.25 mm± 0.46 mm throughout the study period with no change in the probing depth values for 1 to 6 months

2- Radiographic evaluation:

A- Peri-implant bone density: Table (3), Figure (2)

Immediately postoperatively, the mean peri-implant bone density value was 360 ± 40.49 HU with a minimum recorded value of 311.12 HU and a maximum recorded value of 489.87 HU.

At 6 months postoperatively, the mean peri-implant bone density value was 643 ± 65.4 with a minimum recorded value of 578.46 HU and a maximum recorded value of 787.23 HU.

The differences between bone density immediately post-operative and 6 months post-operative were statistically significant ($p < 0.05$)

B-The Crestal Bone Loss: - **Table (1):**

After 6 months, the mean post-operative crestal bone loss was 0.32 ± 0.23 mm with a minimum of 0.13 and a maximum of 0.59.

Table (3): Comparison of the various studied periods regarding peri-implant bone density (n=8).

Bone density	1st	2nd	t	p
Min. – Max.	311.12 – 489.87	578.46 – 787.23		
Mean ± SD.	360 ± 40.49	562 ± 120.84	7.619*	<0.001*
Median (IQR)	330.7(460.4 – 630.2)	601.0(179.8 – 273.0)		
Increase	227.1 ± 84.30			

DISCUSSION

The immediate placement of dental implants is a commonly recognized technique, achieving survival rates equivalent to implants inserted according to traditional treatment protocols. Although this technique is represented in the aesthetic zone by structured protocols and many studies, there is less knowledge on placing immediate implants in the posterior area where the aesthetic impact is lower, which is often tougher. For example anatomical landmark, length and size of root , mandibular nerve, the shape of socket, and canal to the lingual pouch. Also taking into consideration the state of the gingiva and its healing process, and how to restore its original shape giving a good emergency profile further complicates the situation(16-18).

In this study, the success rate was 100%. This agreed with Tolstunov (2006)(20) and Krump, John L who found that the success of the immediate implant placement was 92.7%; while that of the delayed placement was 98.1%. Besides, most of the studies found that no huge difference found placement protocols concerning the survival rate and that the only important thing is the proper patient selection for the operation. This is the most important criteria in determining the method for implant placement, whether the patient is suitable for immediate implant placement or delayed placement (19-21).

Extraction was achieved atraumatically for all the patients, followed by wound debridement and irrigation. Davarpanah and Szmukler-Moncler in (2009) (21) reported on 5 patients; consistent with the results, that dental waste didn't seem to interfere with implant osseointegration, however, there was On this latter reason, very little scientific evidence, so caution is generally advised, with stress on meticulous irrigation and surgical improvement. (22).

Regarding postoperative pain and edema, all patients showed postoperative pain and edema which subsided within a few days after implant placement. This goes with Urban and Thomas who stated in 2010 in their study on 94 patients regarding the postoperative pain and swelling In addition to marginally extreme swelling and gentle oozing. Patients encountered little to moderate discomfort during immediate implant placement in molar regions involving techniques (23).

In this study, the mean probing depth was 2.25 mm± 0.46 mm throughout the study period. There was no change in probing depth value from 1 month to 6 months postoperative. In 2008 Tomas Linkevicius made a literature review on 75 articles from 1980 till 2007 to evaluate the periodontal probing depth around the implant. The author concluded that a probing depth exceeding 4 mm is associated with implant failure (24, 25).

Moreover, Roos-Jansaker AM and Lindahl C in 2008 researched 113 patients who received 347 dental implants. In this study, 37% of the implant was considered failed since they had a probing depth of ≥3 mm with bone resorption of 4 mm (26).

Furthermore, Roos-Jansaker AM and Lindahl C made a study in 2006 (31).on 249 patients who received 999 implants and were recalled for reevaluation. Although 20.4% of the patient had a 3.1 mm probing depth and over 48% of the cases had ≥4 mm probing depth, they considered these implants to be successful. Moreover, Systematic review papers have also associated probing depth as a factor influencing implant survival, among other periimplant soft-tissue parameters. (27, 28)

Regarding the mean per implant-bone density, there was an increase since the operation to 6 months postoperative. This improvement was significant, although no bone graft was placed in the peri-implant gap which exceeded 2mm in width. This can be attributed to the good emergence profile and soft tissue healing around the customized healing abutment which enhanced the healing ability of the bone and formation of bone in the extraction sockets and around the implants (28).

Our results agreed with Tarnow associated Chu WHO clinically and histologically evaluated the horizontal and vertical defect in immediately placed implants and whether these implant will at the implant-socket interface, osseointegrate coronally, though there is no main flap closure, bone graft, or barrier membrane was placed; only a straight-profile healing abutment was placed. In their

study. The residual horizontal defect was 4.2 mm oral and allowed to heal by secondary purpose, and the implants were loaded and biopsied after 5 months and 10 months of placement. The histological section showed intimate implant-bone contact at the coronal threads. There was also a restoration of implant coronal biological width to bone interaction with connective tissue and junctional epithelium (29).

In the study, the mean post-operative crestal-bone loss was 0.32 ± 0.23 mm with a minimum 0f 0.13 and a maximum of 0.59. This result mismatches with Tewari, Nishant Kumar in 2020 who reported in their study, that the crestal bone loss in immediately placed mandibular molar had a mean of 1.02 mm after 6 months of implant placement (30).

Moreover, UPPSALA, Sravani, et al. in 2020 concluded in their study, that crestal bone loss around immediately placed dental implants 6 months after implant insertion was 1.68 mm. This result was much higher than the results found in this research (31).

The lower crestal bone loss values found in our study may be attributed to the customized healing abutment which provided a good emergence profile and isolated the socket coronally leading to lower crestal bone loss values (32).

CONCLUSION

The customized healing abutment proved successful in increasing the periimplant bone density and achieving osseointegration with immediate implants placed graftlessly in the mandibular molar region.

CONFLICT OF INTEREST

All the writers note that no conflicts of interest have occurred.

FUNDING BODIES

Authors declare that this project was not funded by any foundation. And nothing has neither influenced the results nor the independence of the author to publish the results or own the data.

ACKNOWLEDGMENTS

I acknowledge all the effort done in helping in this project from all the doctors, medical staff, and the patients.

REFERENCES

1. Schwartz-Arad D, Chaushu G. Placement of implants into fresh extraction sites: 4 to 7 years retrospective evaluation of 95 immediate implants. J Periodontol. 1997;68:1110-6.
2. Schropp L, Isidor F. Timing of implant placement relative to tooth extraction. J Oral Rehabil. 2008;35:33-43.
3. Chrcanovic BR, Albrektsson T, Wennerberg A. Reasons for failures of oral implants. J Oral Rehabil. 2014;41:443-76.
4. Adell R, Lekholm U, Rockler BR, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg. 1981;10:387-416.
5. Seibert JS. Treatment of moderate localized alveolar ridge defect Prevention and reconstruction in therapy. Dent Clin North Am. 1993;37:80-256.
6. Akin R. A new concept in maintaining the emergence profile in immediate posterior implant placement: the anatomic harmony abutment. J Oral Maxillofac Surg. 2016;74:2385-92.
7. Coscas G, Cunha-Vaz J, Soubrane G. Macular edema: definition and basic concepts. In: Macular Edema. Ch 1. Basel: Karger Publishers; 2010. pp. 1-9.
8. Gorman BS, Primavera LH, Allison BD. PASS: A program for estimating effect sizes, statistical power, and sample size. Educational and psychological measurement.1995 Oct; 773-6.
9. Alshhrani WM, Al Amri MD. Customized CAD-CAM healing abutment for delayed loaded implants.The Journal of prosthetic dentistry.2016 Aug 1; 116(2):176-9.
10. BREIVIK, Else Kristine; BJÖRNSSON, Gudmundur A.; SKOVLUND, Eva. A comparison of pain rating scales by sampling from clinical trial data. The Clinical journal of pain, 2000: 22-28
11. PATTERSON, Joanne M.; HILDRETH, Anthony; WILSON, Janet A. Measuring edema in irradiated head and neck cancer patients. Annals of Otology, Rhinology & Laryngology, 2007: 559-564.
12. MOMBELLI, Andrea, et al. Comparison of periodontal and peri-implant probing by depth-force pattern analysis. Clinical oral implants research, 1997: 448-454
13. IEZZI, Giovanna, et al. A site-specific intraoperative measurement of bone-to-implant contact during implant insertion: A study on bovine ribs using a computerized implant motor. Journal of Dental Sciences, 2015: 21-27.
14. SESMA, Newton, et al. Assessment of Marginal Bone Loss around Platform-Matched and Platform-Switched Implants-A Prospective Study. Brazilian dental journal, 2016: 712-716.
15. Barone A, Toti P, Quaranta A, Derchi G, Covani U. The Clinical Outcomes of Immediate Versus Delayed Restoration Procedures on Immediate Implants: A Comparative Cohort Study for Single-Tooth Replacement. Clin Implant Dent Relat Res. 2015;17:1114-26.
16. Scarano A. Traditional Postextractive Implant Site Preparation Compared with Pre-extractive Interradicular Implant Bed Preparation in the Mandibular Molar Region, Using an Ultrasonic Device: A Randomized Pilot Study. Int J Oral Maxillofac Implants. 2017;32:655-60.
17. Atieh MA, Payne AG, Duncan WJ, de Silva RK, Cullinan MP. Immediate placement or immediate restoration/loading of single implants for molar tooth replacement: a systematic review and meta-analysis. Int J Oral Maxillofac Implants. 2010;25:401-15.
18. Peñarrocha M, Uribe R, Balaguer J. Immediate implants after extraction. A review of the current situation. Med Oral. 2004;9:234-42.

19. Moy PK, Medina D, Shetty V, Aghaloo TL. Dental implant failure rates and associated risk factors. Int J Oral Maxillofac Implants. 2005;20:569-77.
20. Tolstunov L. Dental implant success-failure analysis: a concept of implant vulnerability. Implant Dent. 2006;15:341-6.
21. Fugazzotto PA. Immediate implant placement following a modified trephine/osteotome approach: success rates of 116 implants to 4 years in function. *Int J Oral Maxillofac Implants.* 2002;17:113-20.
22. Davarpanah M, Szmukler-Moncler S. Unconventional implant treatment: I. Implant placement in contact with ankylosed root fragments. A series of five case reports. Clin Oral Implants Res. 2009;20:851-6.
23. Douglass GL, Merin RL. The immediate dental implant. J Calif Dent Assoc. 2002;30:362-74.
24. Lindhe J, Berglundh T. The interface between the mucosa and the implant. Periodontol. 2000; 1998 (17):47-54.
25. Zigdon H, Machtei EE. The dimensions of keratinized mucosa around implants affect clinical and immunological parameters. Clin Oral Implants Res. 2008;19:387-92
26. Roos-Jansaker AM, Lindahl C, Renvert H. Nine- to fourteen-year follow-up of implant treatment. Part II: the presence of peri-implant lesions. J Clin Periodontol. 2006;33:290-5.
27. Zigdon H, Machtei EE. The dimensions of keratinized mucosa around implants affect clinical and immunological parameters. Clin Oral Implants Res. 2008;19(4):387-392
28. Acocella A, Bertolai R, Sacco R. Modified insertion technique for immediate implant placement into fresh extraction socket in the first maxillary molar sites: a 3-year prospective study. Implant Dent. 2010;19:220-8.
29. TARNOW, Dennis P.; CHU, Stephen J. Human histologic verification of osseointegration of an immediate implant placed into a fresh extraction socket with excessive gap distance without primary flap closure, graft, or membrane: a case report. International Journal of Periodontics & Restorative Dentistry, 2011;31.5.
30. Keshk AM, Alqutaibi AY, Algebra RS, Sweden MS, Kaddah A. Prosthodontic maintenance and peri-implant tissue conditions for telescopic attachment-retained mandibular implant overdenture: systematic review and meta-analysis of randomized clinical trials. Eur J Dent. 2017;11:559-68.
31. Najafi H, Siadat H, Akbari S, Rokn A. Effects of Immediate and Delayed Loading on the Outcomes of All-on-4 Treatment: A Prospective Study. J Dent (Tehran). 2016;13:415-22.
32. Prasad DK, Shetty M, Bansal N, Hegde C. Crestal bone preservation: a review of different approaches for successful implant therapy. Indian J Dent Res. 2011;22:317-23.