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Original Article

Assessment of bone density changes around immediate functionally and nonfunctionally loaded implants

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ABSTRACT:
Background: Immediate and early loading of dental implants as a technique is gaining popularity gradually owing to drastically reduced treatment periods and minimal discomfort attributed to the periods of edentulism. The present study was conducted to assess bone density changes around immediate functionally and non-functionally loaded implants. **Materials & Methods:** 80 patients who received single tooth implant of both genderswere divided into 2 groups. Groups I received self-tapering, aggressive SLA implants subjected to immediate functionally loaded (IFL) (control) and group II received self-tapering, SLA implants subjected to immediate nonfunctionally loaded (INFL).Three-dimensional cone-beam computed tomography (3D CBCT) was taken at baseline, 3 and 6 months postimplant placement and the bone density was assessed around the implants at crestal, middle, and apical regions of implants. **Results:** Group I had 22 males and 18 females and group II had 19 males and 21 females. The mean bone density at baseline in group I at crestal, middle and apical region was 1534.2, 1126.2 and 1232.4, at 3 months was 1268.4, 1132.0 and 974.2 and at 6 months was 1426.8, 1364.2 and 1152.4 respectively. In group II at crestal, middle and apical region was 1542.4, 1423.2 and 1224.6, at 3 months was 1320.6, 1256.4 and 1012.4 and at 6 months was 1425.2, 1320.5 and 1156.2 respectively. The difference was significant ($P< 0.05$). **Conclusion:** Immediate non-functionally loaded(INFL)implant group showed better bone density when compared to immediate functionally loaded(IFL) implant group.
Key words: bone density, dental implant, immediate loading

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INTRODUCTION

Immediate and early loading of dental implants as a technique is gaining popularity gradually owing to drastically reduced treatment periods and minimal discomfort attributed to the periods of edentulism.[1]Immediate loading refers to loading the implant with an interim restoration within 48 hours of implant placement.The advantages include elimination of second-stage surgery, maturation of peri-implant soft tissues before fabrication of the definitive prosthesis, shortened treatment time, enhanced function, and greater patient satisfaction.[2]
Prolonged healing durations of 3–6 months serves as the basis of success associated with conventional loading (CL) or delayed loading protocols. The rationale is to keep the implant in an uninterrupted environment during the healing period. The concept of immediate loading came into existence mostly due to the increased treatment time and prolonged period of edentulousness associated with the CL protocol.[3] In addition, reduced bone density has been observed around the delayed loaded implant after the 3–6 months period due to the lack of functional stimulation during the healing period. These studies concluded that mechanical bone stimulation serves as one of the key factors in the regulation of bone remodeling.[4]
In the long-term, greater resistance to occlusal forces can be achieved with an increased bone density around the implants, more so when considering the immediately loaded implants.[5] However, there is a scarce reporting of literature concerning the quantitative assessment of bone mineral density (BMD) changes around implants, especially

immediately loaded implants.[6] The present study was conducted to assess bone density changes around immediate functionally and nonfunctionally loaded implants.

MATERIALS & METHODS

The present study consisted of 80 patients who received single tooth implant of both genders. All gave their written consent for participation in the study.

Data such as name, age gender etc. was recorded. Patients were divided into 2 groups. Groups I received self-tapering, aggressive SLA implants subjected to immediate functionally loaded (IFL) (control) and group II received self-tapering, SLA implants subjected to immediate nonfunctionally loaded (INFL). Implants were placed in the single tooth edentulous sites of mandible in both the groups. Three-dimensional cone-beam computed tomography (3D CBCT) was taken at baseline, 3 and 6 months postimplant placement. Quantitative analysis of the bone density was performed using 3D CBCT in three areas around the implants at crestal, middle, and apical regions of implants.Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I: Distribution of patients

Groups	Group I	Group II
Method	Self-tapering SLA implants subjected to IFL	Self-tapering SLA implants subjected to INFL
M:F	22:18	19:21

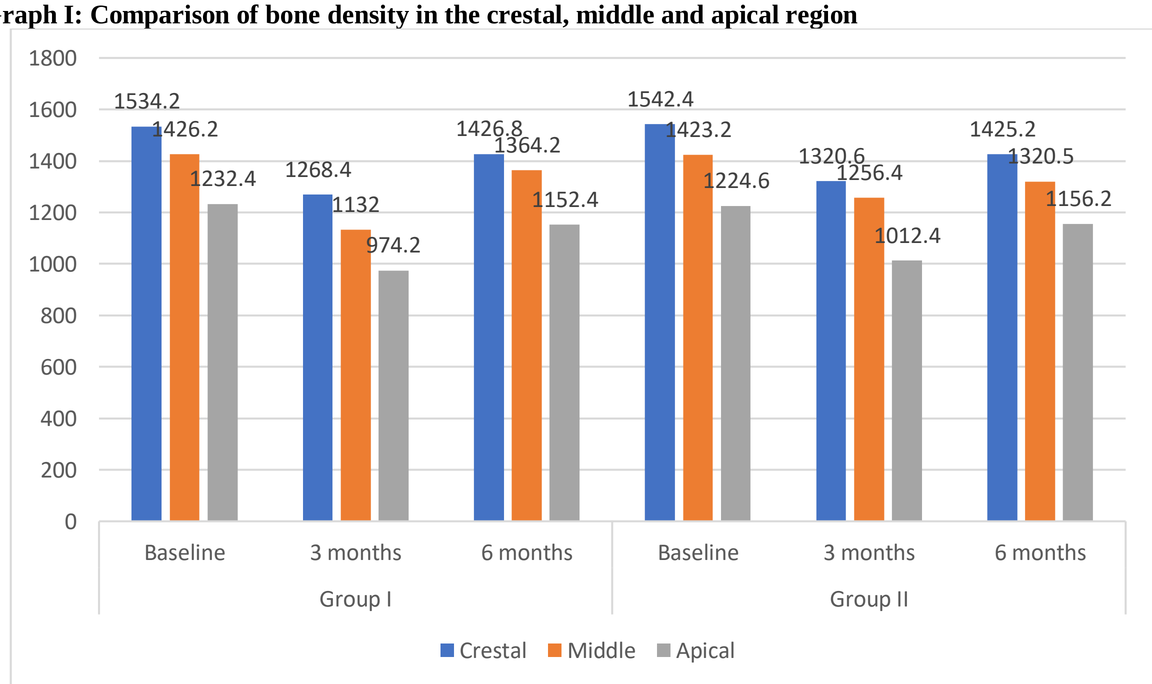
Table I shows that group I had 22 males and 18 females and group II had 19 males and 21 females.

Table II: Comparison of bone density in the crestal, middle and apical region

Groups	Time interval	Crestal	Middle	Apical	P value
Group I	Baseline	1534.2	1426.2	1232.4	0.05
	3 months	1268.4	1132.0	974.2	
	6 months	1426.8	1364.2	1152.4	
Group II	Baseline	1542.4	1423.2	1224.6	0.01
	3 months	1320.6	1256.4	1012.4	
	6 months	1425.2	1320.5	1156.2	

Table II, graph I shows that mean bone density at baseline in group I at crestal, middle and apical region was 1534.2, 1126.2 and 1232.4, at 3 months was 1268.4, 1132.0 and 974.2 and at 6 months was 1426.8, 1364.2 and 1152.4 respectively. In group II at crestal, middle and apical region was 1542.4, 1423.2 and 1224.6, at 3 months was 1320.6, 1256.4 and 1012.4 and at 6 months was 1425.2, 1320.5 and 1156.2 respectively. The difference was significant (P< 0.05).

Graph I: Comparison of bone density in the crestal, middle and apical region



DISCUSSION

The assessment of changes in alveolar bone density around immediately loaded implants is of considerable interest to the clinician, as it influences every aspect of implant therapy.[7,8] Various factors, such as the degree of micromotion, nature of loading,6 primary stability, remodelingof woven bone formed after implant osteotomy, and the stress-strain contours that develop at the implant-bone interface, influence the ultimate internal architecture of alveolar bone after implant loading.[9,10] Most studies to date have been histologic and histomorphometric analyses of bone reaction to implant loading in animal biomodels and have indicated that the immediate loading of implants stimulates ossification around implants, resulting in an improved bony foundation for the definitive prosthesis.[11,12]The present study was conducted to assess bone density changes around immediate functionally and nonfunctionally loaded implants.

We found that group I had 22 males and 18 females and group II had 19 males and 21 females. Ramachandran et al[13]assessed radiographic changes in alveolar bone density around immediate functionally and nonfunctionally loaded implants. 20 participants with partially edentulous mandibles received implants that were immediately loaded either functionally (IFL) or nonfunctionally (INFL). Standardized intraoral periapical radiographs were made at baseline, 3, and 6 months. These were digitized and analyzed using the histogram tool of the GNU Image Modulation Program for changes in alveolar bone density at crestal and lateral apical levels around the implant. An increase in the mean lateral apical pixel grayscale values of 4.68 ±0.80 at 3 months and 4.15 ±0.29 at 6 months was observed with IFL, while INFL demonstrated an increase of 5.66 ±0.53 at 3 months and 6.07 ±0.59 at 6 months. A decrease in the mean crestal pixel grayscale values of -24.40 ±7.41 with IFL and -16.86 ±5.14 with INFL was found from baseline to 3 months.

We found that mean bone density at baseline in group I at crestal, middle and apical region was 1534.2, 1126.2 and 1232.4, at 3 months was 1268.4, 1132.0 and 974.2 and at 6 months was 1426.8, 1364.2 and 1152.4 respectively. In group II at crestal, middle and apical region was 1542.4, 1423.2 and 1224.6, at 3 months was 1320.6, 1256.4 and 1012.4 and at 6 months was 1425.2, 1320.5 and 1156.2 respectively. Singh et al[14]compared and assessed bone density changes around immediate functionally and nonfunctionally loaded implants.Sixty participants selected based on the predetermined inclusion and exclusion criteria received single tooth implants in mandible under two implant loading protocols: Immediate functionally loaded (IFL) and immediate nonfunctionally loaded (INFL). Randomization was done by computer-aided simple randomization procedure. Self-tapering, aggressive SLA implants were placed in the single tooth edentulous sites of mandible in both the groups. Three-dimensional cone-beam computed tomography (3D CBCT) was taken at baseline, 3 and 6 months postimplant placement. Quantitative analysis of the bone density was performed using 3D CBCT in three areas around the implants at crestal, middle, and apical regions of implants.Bone density changes after implant placement in IFL group from baseline to 3 months were; crestal region (314.18 ± 71.69), middle (278.23 ± 70.17), apical (274.70 ± 59.79) and changes from 3 to 6 months were; crestal (−105.55 ± 39.60), middle (−114.80 ± 41.46), apical (−141.88 ± 69.58). Bone density changes after implant placement in INFL group from baseline to 3 months were crestal region (199.42 ± 47.97), middle (56.91 ± 10.39), apical (200.98 ± 67.43) and changes from 3 to 6 months were; crestal (−194.38 ± 75.30), middle (−204.40 ± 63.75), apical (−191.28 ± 62.33).

The limitation the study is small sample size.

CONCLUSION

Authors found that immediate nonfunctionally loaded(INFL)implant group showed better bone density when compared to immediate functionally loaded(IFL) implant group.

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