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Original Research

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

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ABSTRACT:

Background: The determination of changes in alveolar bone density around immediately loaded implants is of considerable interest. The present study was conducted to assess bone density changes around immediate functionally and nonfunctionally loaded implants using CBCT. **Materials & Methods:** 88 patients who received single tooth implants in mandible of both genders were divided equally into 2 groups. Group I was immediate non functionally loaded (INFL) and group II was immediate functionally loaded (IFL). CBCT was taken at baseline, 3 months and 6 months postimplant placement. Assessment of the bone density was performed at crestal, middle, and apical regions of implants. **Results:** Group I had 24 males and 20 females and group II had 22 males and 22 females. In group I and group II, at baseline meanbone density (HU) at crestal region was 1589.4 and 1523.4, at middle region was 1468.2 and 1423.7 and at apical region was 1326.4 and 1298.4, at 3 months at crestal region was 1357.3 and 1254.3, at middle region was 1286.4 and 1193.4 and at apical region was 1014.6 and 976.0, at 6 months at crestal region was 1480.3 and 1424.6, at middle region was 1346.5 and 1312.6 and at apical region was 1184.8 and 1124.2 respectively. The difference was significant ($P< 0.05$). **Conclusion:** Immediate non-functionally loaded dental implant showed better bone density as compared to immediate functionally loaded dental implant. CBCT proved to be beneficial in assessing bone density changes in patients receiving dental implants.

Key words: CBCT, Immediate loading, Bone density

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INTRODUCTION

Immediate loading refers to loading the implant with an interim restoration within 48 hours of implant placement. Prolonged healing durations of 3–6 months serves as the basis of success associated with conventional loading (CL) or delayed loading protocols.[1] 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.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]

The determination of changes in alveolar bone density around immediately loaded implants is of considerable interest, as it effects every aspect of implant therapy. Various factors, such as the degree of micromotion, nature of loading, primary stability, remodeling of 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.[3]

Various tools can be utilized for such an assessment.[4] One of the valid and widely used methods of assessing BMD at various skeletal sites is dual energy x-ray absorptiometry (DEXA). Three-dimensional cone beam computed tomography (CBCT) and computerized axial tomography (CT) have been utilized to measure BMD in the oral cavity.[5]The present study was conducted to assess bone density changes around immediate functionallyand nonfunctionally loaded implants using CBCT.

MATERIALS & METHODS

The present study comprised of 88 patients who received single tooth implants in mandible of both

genders. All agreed to participate in the study with their written consent.

Data such as name, age, gender etc. was recorded. Patients were divided equally into 2 groups. Group Iwasimmediate non- functionally loaded (INFL) and group II was immediate functionally loaded (IFL). Self-tapering, aggressive SLA implants were placed in the single tooth edentulous sites of mandible in both the groups. Oral hygiene maintenanceinstructions, tab. ibuprofen 400 mgBD for 5 days and cap. amoxicillin 500 mg TDSfor 5 days were prescribed.3-dimensional cone-beam computed tomography (3D CBCT) was taken at baseline, 3 months and 6 months postimplant placement. Assessment 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	immediate non- functionally loaded	immediate functionally loaded
M:F	24:20	22:22

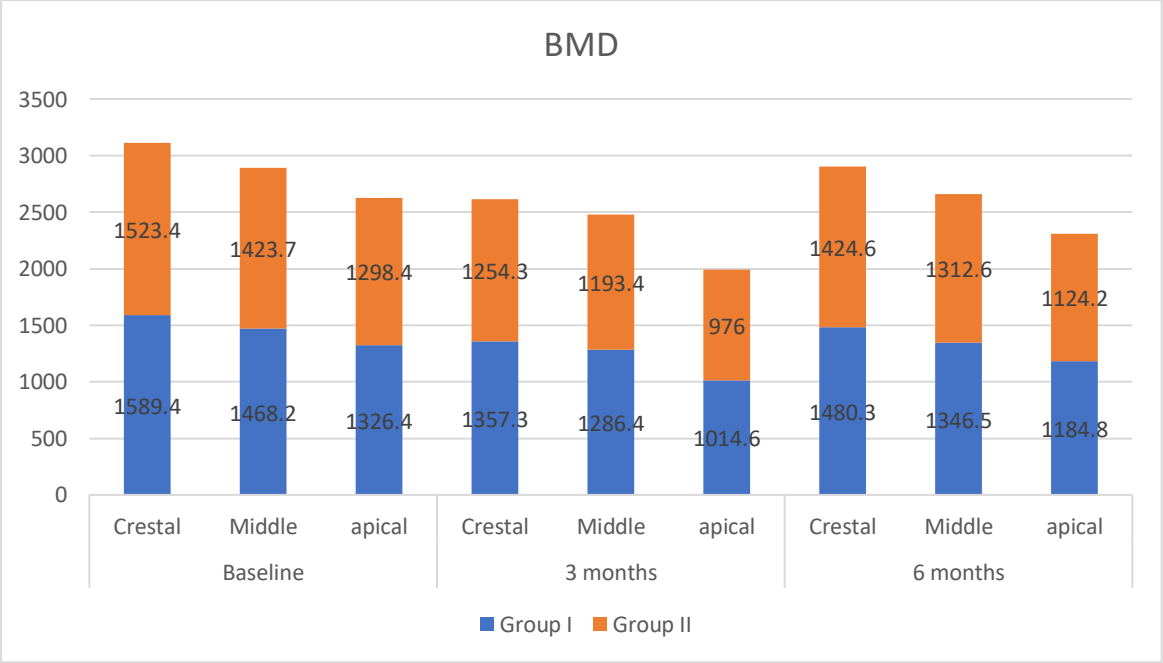
Table I shows that group I had 24 males and 20 females and group II had 22 males and 22 females.

Table II Mean bone density in the crestal, middle and apicalregion

Time interval	Region	Group I	Group II	P value
Baseline	Crestal	1589.4	1523.4	0.05
	Middle	1468.2	1423.7	0.07
	apical	1326.4	1298.4	0.02
3 months	Crestal	1357.3	1254.3	0.03
	Middle	1286.4	1193.4	0.05
	apical	1014.6	976.0	0.01
6 months	Crestal	1480.3	1424.6	0.05
	Middle	1346.5	1312.6	0.04
	apical	1184.8	1124.2	0.02

Table II, graph I shows that in group I and group II, at baselinemeanbone density (HU) at crestal region was 1589.4 and 1523.4, at middle region was 1468.2 and 1423.7 and at apical region was 1326.4 and 1298.4, at 3 months at crestal region was 1357.3 and 1254.3, at middle region was 1286.4 and 1193.4 and at apical region was 1014.6 and 976.0, at 6 months at crestal region was 1480.3 and 1424.6, at middle region was 1346.5 and 1312.6 and at apical region was 1184.8 and 1124.2 respectively. The difference was significant (P< 0.05).

Graph I Mean bone density in the crestal, middle and apicalregion



DISCUSSION

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. Copious histological and histomorphometric studies have shown that the osseointegration with immediately loaded implants is comparable to that with delayed loaded implants.Radiography and computed tomography (CT) are improvements on the histologic study of bone because they enable the visualization of the bone-implant interface without the need for tissue sections.[6] While conventional intraoral periapical and panoramic radiographs find application in the preoperative evaluation and treatment planning of implant surgery and assessment of crestal bone loss after implant loading, they are of limited value in the assessment of subtle bone density changes in the healing period.[7]The present study was conducted to assess bone density changes around immediate functionallyand nonfunctionally loaded implants.

We found that Group I had 24 males and 20 females and group II had 22 males and 22 females. Ramachandran et al[8]assessed radiographic changes in alveolar bone density around immediate functionally and nonfunctionally loaded implantsin which 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 observed that in group I and group II, at baseline meanbone density (HU) at crestal region was 1589.4 and 1523.4, at middle region was 1468.2 and 1423.7 and at apical region was 1326.4 and 1298.4, at 3 months at crestal region was 1357.3 and 1254.3, at middle region was 1286.4 and 1193.4 and at apical region was 1014.6 and 976.0, at 6 months at crestal region was 1480.3 and 1424.6, at middle region was 1346.5 and 1312.6 and at apical region was 1184.8 and 1124.2 respectively. Singh et al[9]compared and assessed bone density changes around immediate functionally and nonfunctionally loaded implants. Sixty participants were given immediate functionally loaded (IFL) and immediate nonfunctionally loaded (INFL) implants.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).

Romanos et al[10] showed that following immediate loading of threaded implants, a bone-to-implant contact is established similar to that of conventionally loaded implant.Other studies have confirmed that the immediate loading protocol stimulates the formation of mature, compact, lamellar bone in response to occlusal load, increases the bone-implant contact percentage, and decreases the risk of fibrous connective tissue at the interface.[11,12]

The limitation the study is small sample size.

CONCLUSION

Authors found that immediate non- functionally loaded dental implant showed better bone density as compared to immediate functionally loaded dental implant. CBCT proved to be beneficial in assessing bone density changes in patients receiving dental implants.

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