

An All-Inclusive Assessment of Peri-Implant Bone Loss in Mandibular Implant Supported Overdenture Therapies Using Cone Beam Computed Tomography: An Original Research Study

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ABSTRACT

Background: The prime endeavor of this study was to assess peri-implant bone loss following implant supported over dentures using cone beam computed tomography. In this study, authors had endeavored to evaluate the existing bone level around mandibular dental implants by cone beam computed tomography (CBCT).

Materials & Methods: The basic ideology and concept of this study was based on cross sectional perception. Initially, a total of 20 completely edentulous patients were selected. All selected patients had been rehabilitated by implant overdentures. Patients were precisely selected by randomized sampling procedure. For relative ease of study, the implants were divided in two groups. Group I included the implants of the right side of the mandible while Group II included implant placed on the left side of the mandible. Finally, the 40 inserted implants were analyzed comprehensively for peri-implant bone losses. The mesial, distal, buccal and lingual bone height around the dental implants was assessed by cone beam computed tomography.

Results: Statistical analysis was completed by statistical software Statistical Package for the Social Sciences (SPSS). The recorded data was subjected to appropriate statistical tests to obtain p values, mean, standard deviation, standard error and 95% CI. $P \leq 0.05$ was considered as statistically significant. All selected and studied patients were segregated into 3 age groups. 8 patients were falling in the age range of 31-35 years. Therefore we can assume that majority of the studied patients were of younger age groups. P value was found to be significant in group I & III of age range 31-35 and 41-45 years. The measured value was 0.01 and 0.00 respectively. Group I showed higher bone losses than Group II. Remarkable assumptions were outlined for all bone losses at all measured surfaced in all studied implants.

Conclusion: With the continued advancements in dental implant therapy, it is becoming increasingly easier for the clinician to provide treatment solutions that can effectively meet functional, economic and social expectations of each individual patient. Here in this study, authors concluded that the cone beam computed tomography analysis of peri-implant bone showed significant bone loss. Furthermore, these bone losses were noticed around all aspects of the studied dental implants. This kind of minute and precise detail can be expectedly presented only by cone beam computed tomography.

Keywords: Cone beam computed tomography; Bone loss, Implant, Overdenture.

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Edentulous patients are a diverse group that consists of those who are anatomically incompetent, medically compromised, economically weaker, geriatric, congenitally malformed, genetically affected. General complications of tooth loss include progressive alveolar bone loss and diminished masticatory efficiency. Since decades, complete denture has been the standard therapeutic protocol in edentulous patients.¹ However, it is a great challenge to attain acceptable results, particularly in the case of mandibular arch presenting severe resorption of the alveolar ridge. Since the introduction of the concept of osseointegration by Branemark, implant-supported overdentures have become a standard treatment option for edentulous patients. Edentulism has two major problems disability because it limits a patient's ability to perform two essential tasks in life: speaking and eating, and handicap, because significant changes are needed in order to compensate for the deficiencies.²⁻³ Treatment for edentulism includes conventional complete dentures, implant-retained overdentures and, in some cases, implant supported full arch fixed complete denture prostheses. In the past, the most common treatment for edentulism has been to restore function with complete removable dentures. Due to the fact that, edentulism causes progressive bone loss, treatment with conventional complete denture is limited and detrimental changes continue overtime. Improving the retention and the stability of mandibular complete denture using dental implants is a well known fact, documented in the literature, certified subjectively by the patients and objectively by the clinical observations.⁴⁻⁷ However, many authors are suggesting taking into account the potentially pathogenic effect of this type of treatment on the complete maxillary denture, similar to combination syndrome. Overdenture is a dental prosthesis that covers and is partially supported by natural teeth, natural tooth roots, or dental implants. Tooth-supported overdentures have various advantages over conventional complete dentures such as alveolar bone maintenance, preservation of periodontal proprioception, improved retention, stability and support, enhanced psychological comfort, and increased masticatory efficiency. Bone loss around dental implants is generally measured by monitoring changes in marginal bone level using

radiographs. After the first year of implantation, an implant should have <0.2 mm annual loss of marginal bone level to satisfy the criteria of success.⁸⁻¹¹ However, the process of measuring marginal bone level on radiographs has a precision of 0.2 mm owing to variations in exposure geometry, exposure time and observer perception. The etiology of the implant infection is conditioned by the status of the tissue surrounding the implant, implant design, degree of roughness, external morphology, and excessive mechanical load. Regenerative treatment of bone loss and peri-implantitis also is a growing problem.¹²⁻¹³ Therefore; the proposed study was designed to evaluate the existing bone level around mandibular dental implants by cone beam computed tomography. The underlying endeavor was to figure out the peri-implant bone loss.

MATERIALS & METHODS

The fundamental ideology and concept of this study was based on cross sectional perception. At first, a total of 20 completely edentulous patients were selected from the department of prosthodontics of the institute. We studied total 10 male and 10 female patients. Patients were accurately selected by randomized sampling procedure. In this technique, each member of the population has an equal chance of being selected as subject. The entire process of sampling is done in a single step with each subject selected independently of the other members of the population. These selected completely edentulous patients were already wearing complete dentures made from standard clinical and laboratory techniques. All selected patients had also been rehabilitated by implant supported overdentures by standard osteotomy and prosthodontic procedures. We had selected the cases in which only two implants were placed for supporting mandibular overdenture. These were mostly placed on bilateral canine regions. For relative ease of doing study, the implants were divided in two groups. Group I included the implants of the right side of the mandible while Group II included implant placed on the left side of the mandible. Finally, the 40 inserted implants were analyzed comprehensively for peri-implant bone losses at 6 months follow up period. The mesial, distal, buccal and lingual bone height around the

dental implants was assessed by cone beam computed tomography. Informed consent was taken from the patients those were willingly ready for involvement. Immediately before the implementation of the study, author had explained the relative importance of this study to all participating patients. The privacy and other interrelated rights of the patients along with their freedom of expression were kept completely confidential. Results thus received was compiled in table and subjected to basic statistical analysis. P value less than 0.05 was considered significant ($p < 0.05$).

RESULTS

In the current century, dental implant companies have estimated that more than two million implants are placed each year and this number will increase annually. Implant treatment is now considered a common method of rehabilitation of edentulous jaws by implant supported over-dentures. However, peri-implant bone loss is one of the greatest dilemmas that lead to implant failure. In this study, all obvious findings and data were sent for statistical analysis using statistical software Statistical Package for the Social Sciences version 21 (IBM Inc., Armonk, New York, USA). The finalized data was subjected to appropriate statistical tests to obtain p values, mean, standard deviation, chi-

square test, standard error and 95% CI. Table 1 and Graph I showed that out of 20 patients, males were 10 and females were 10. All selected and studied patients were segregated into 3 age groups. 8 patients were falling in the age range of 31-35 years. Therefore we can assume that majority of the studied patients were of younger age groups. P value was found to be significant in group I & III of age range 31-35 and 41-45 years. The measured value was 0.01 and 0.00 respectively. Table 2, 3 and Graph II demonstrates fundamental statistical description with level of significance evaluation using Pearson chi-square test [for Group I and II]. Group I showed higher bone losses than Group II. Graph III demonstrating Pearson chi-square value on all measured surfaces in Group I & Group II. Noteworthy presumptions were outlined for all bone losses at all measured surfaced in all studied implants. ($p < 0.05$ significant) Mean bone loss on mesial surface of Group I was 0.65 while in Group II it was 0.21. Mean bone loss on distal surface of Group I was 0.81 while in Group II it was 0.27 Mean bone loss on buccal surface of Group I was 0.28 while in Group II it was 0.23. Mean bone loss on lingual surface of Group I was 0.82 while in Group II it was 0.31. P value was found to be significant for bone loss observed on all implant surfaces in both the groups. Figure 1 showing measurement of available crestal cortical bone thickness in mandibular arch by CBCT.

Table 1: Age & gender wise distribution of patients.

Age Group (Yrs)	Male	Female	Total	P value
31-35	4	4	8	0.01*
36-40	2	4	6	0.30
41-45	4	2	6	0.00*
Total	10	10	20	*Significant

* $p < 0.05$ significant

Table 2: Fundamental statistical depiction with level of significance assessment using pearson chi-square test [for group I]

Parameters	Mean Bone Loss	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Mesial [For 20 surfaces]	0.65	0.456	0.897	1.96	2.343	1.0	0.01*
Distal [For 20 surfaces]	0.81	0.675	0.344	1.96	2.786	2.0	0.00*
Buccal [For 20 surfaces]	0.28	0.456	0.865	1.51	2.249	1.0	0.00*
Lingual [For 20 surfaces]	0.82	0.245	0.234	1.54	1.852	1.0	0.00*

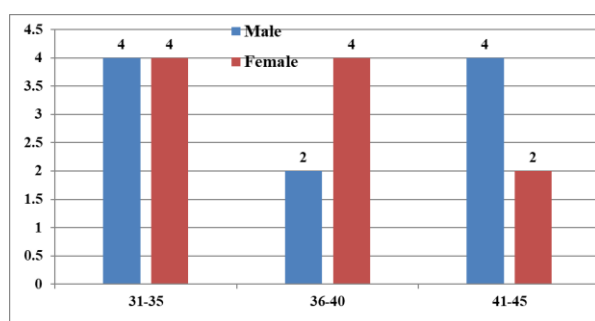
* $p < 0.05$ significant

Table 3: Fundamental Statistical Depiction With Level Of Significance Assessment Using Pearson Chi-Square Test [For Group Ii].

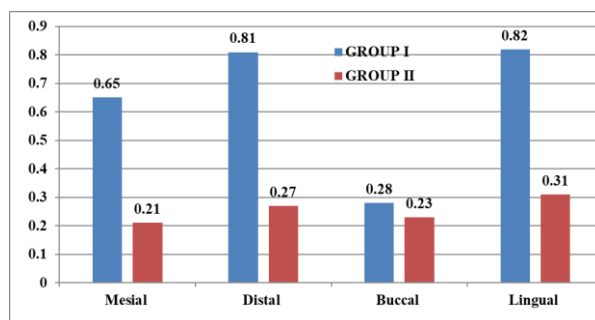
Parameters	Mean Bone Loss	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Mesial [For 20 surfaces]	0.21	0.349	0.234	1.54	1.674	1.0	0.02*
Distal [For 20 surfaces]	0.27	0.642	0.653	1.59	21.346	2.0	0.01*
Buccal [For 20 surfaces]	0.23	0.752	0.457	1.56	2.121	1.0	0.00*
Lingual [For 20 surfaces]	0.31	0.789	0.989	1.86	1.245	2.0	0.00*

*p<0.05 significant

Graph 1: Age & gender wise distribution of patients.



Graph ii: mean bone loss on all measured surfaces in group i & group ii.



Graph iii: Pearson chi-square value on all measured surfaces in group i & group ii.

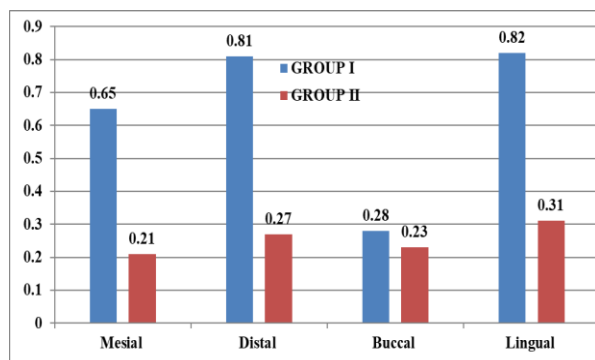
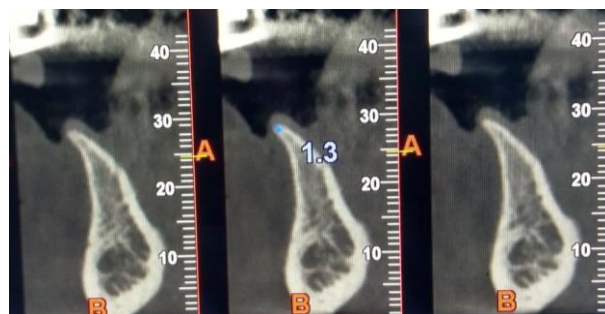


Fig 1: Measurement of crestal cortical bone thickness in mandibular arch by CBCT.



DISCUSSION

According to recent UN data, the increasing number of elderly patients in the population, especially in Western countries, is a certain reality for the future. In Portugal, it has been predicted that the percentage of the population over 60 years old could rise from 24% in 2011 to 40% by 2050. Edentulous patients are a diverse group comprised of those who are anatomically deficient, medically compromised, economically depressed, geriatric, congenitally deformed, genetically affected as well as general population for a number of other reasons have been rendered edentulous. An implant-supported overdenture may be practically advantages over conventional complete denture and removable partial denture; these reduce bone resorption, greater prosthesis stability, improved maintenance and better esthetics. Implant supported overdenture may reduce the amount of soft-tissue coverage and extension of the prosthesis. Hygiene condition and home maintenance procedures are improved with the overdenture compared with fixed prosthesis. Implant supported overdenture limits lateral movements and consequently minimize soft-tissue trauma. Greater

stability of implant-supported overdenture drives from mechanical attachment of the implant support system retaining the restoration.¹⁴⁻¹⁶ In general, mandibular implant-supported overdentures may be a preferable option due to several advantages such as; possible decrease resorption of the residual ridges, may improve stability and retention, and possible additional improvement in the patient's quality of life and satisfaction. The use of implants has dramatically improved treatment choices for most edentulous patients, but it may not be suitable for all patients particularly in less prosperous countries or for patients who are unable to afford costs associated with this treatment option. Evidence of biomechanical success and psychosocial satisfaction has led to an emerging consensus that a two implant overdenture should be recommended treatment in the management of an edentulous mandible. The McGill and York consensus statement have come out strongly in favor of the two-implant supported overdenture.¹⁷⁻¹⁸ The minimum number of implants needed for the implant restoration is still debatable. The success of this treatment modality, while excellent, is unfortunately outside the financial scope of many edentulous patients. A cost comparison study between an unsplinted two-implant retained mandibular overdenture and a conventional complete mandibular denture showed the direct cost of the overdenture to be 2.7 times the cost of the conventional complete denture. Conventionally, the anterior mandible has been considered a safe, preferred site for implant placement for overdentures even with severe residual ridge resorption and the anticipation of a relatively less challenging surgical procedure. In the last two decades, the use of prosthetic retention systems in dental implants has achieved good results in edentulous patients, significantly increasing their satisfaction and prosthetic rehabilitation results. The criteria proposed by many pioneer researchers included immobility, absence of peri-implant radiolucencies, absence of pain, absence of infections and <0.2 mm vertical bone loss per year (except the first year).¹⁹ In the past five decades, titanium dental implant systems have been widely used to support dentures and improve eating and speech. In spite of their popularity, implants do not solve all problems related with bone loss. Success of dental implants is a concern for patients, dentists, industries, insurance companies and healthcare systems.

CONCLUSION

Edentulism is a chronic condition for which the palliative therapy is a set of removable complete dentures. Given the global increase in the life expectancy, and the increase in the elderly population, the seekers for this treatment among the elderly edentulous population will be increased. With the advance of the dental implants, the retention and stability of mandibular complete denture have been improved to a large extent. Here in this study, authors concluded that the cone beam computed tomography analysis of peri-implant bone showed significant bone loss. Furthermore, these bone losses were noticed around all aspects of the studied dental implants. Group I showed higher bone losses than Group II. This kind of minute and precise detail can be expectedly presented only by cone beam computed tomography. Our study results must be considered as suggestive for presuming prognosis for similar clinical conditions. However, we expect some other large scale studies to be performed that might further establish certain standard and concrete guidelines in these perspectives.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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