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Model of oral rehabilitation with immediate or delayed implant-supported complete dentures: Radiographic evaluation

Modelo de reabilitação oral com próteses totais implanto-suportadas submetidas à carga imediata ou convencional: avaliação radiográfica.

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ABSTRACT

Objective: The study aims were to compare the radiographic bone loss of implant-supported complete dentures submitted to immediate or delayed loading and to correlate this loss with different features of the patients involved. **Material and Methods:** Sixty protocol model implants, in 49 patients, were selected. Thirty-two protocol model implants were submitted to immediate loading, i.e., within 48 h. The remainder were submitted to delayed loading, three to six months later. Questionnaires that collected data on gender, age, location and number of implants, maintenance time and socioeconomic status were analysed. The measurements were obtained from digital panoramic radiographs (ANOVA, MANOVA; Student's t test, $p < 0.05$). **Results:** The radiographic bone loss in the models that underwent immediate and delayed loading was 2.4 mm and 2.5 mm ($p > 0.05$), respectively; regarding gender and the location and number of implants, the results did not differ ($p > 0.05$). The average ages of the immediate (62.8 ± 10.1 years old) and the delayed (54.5 ± 5.46 years old) protocol groups were significantly different ($p < 0.05$). In tests examining multivariate associations with the dependent variable of bone loss >4 mm, there was association with a greater number of sites in the maxilla, older age and female gender. The odds ratio indicated that a loss of more than 4 mm was 17 times more likely in the maxilla. **Conclusion:** 1 - Well-maintained implant-supported complete denture sunder went little bone loss; 2 - there were no differences in radiographic outcomes between different techniques of rehabilitation; and 3 - there was greater bone loss in the maxilla, compared

RESUMO

Objetivo: O objetivo deste estudo foi comparar a perda óssea radiográfica das próteses totais implanto-suportadas submetidas à carga imediata ou convencional e correlacionar este dado com diferentes características dos pacientes envolvidos. **Materiais e Métodos:** Foram selecionados 49 pacientes, que portavam 60 próteses modelo protocolo. Trinta e duas próteses foram submetidas a carga imediata, isto é, dentro de 48 horas. O restante foi submetido a carga entre três e seis meses depois da cirurgia de implante. Questionários sobre gênero, idade, localização e número de implantes, tempo de manutenção e condição socioeconômica foram analisados. As medidas das perdas ósseas foram obtidas a partir de radiografias digitais panorâmicas (ANOVA, MANOVA; teste t de Student, $p < 0,05$). **Resultados:** A perda óssea radiográfica nas próteses submetidas a carga imediata e a carga convencional foi de 2,4 mm e 2,5 mm, respectivamente ($p > 0,05$); em relação ao gênero, a localização e ao número de implantes, os resultados não diferiram ($p > 0,05$). A idade média dos pacientes submetidos a carga imediata foi de 62,8 ± 10,1 anos, e, os pacientes submetidos a carga no tempo convencional apresentaram média de idade igual a 54,5 ± 5,46 anos ($p < 0,05$). Nas análises multivariadas da variável dependente perda óssea >4 mm, houve associação com a maxila, pacientes mais idosos e do sexo feminino. A razão de risco indicou que uma perda óssea >4 mm apresentava 17 vezes mais chances de ocorrer na maxila. **Conclusão:** 1 - Próteses totais implanto-suportadas, quando submetidas a manutenções periódicas adequadas, geram pequena perda óssea; 2 - Os resultados radiográficos não demonstraram diferenças entre as

to the mandible; 4 - there were no correlations between bone loss and social class, age or gender of the patients.

KEYWORDS

Bone Loss, Dental; Dental Implants; Radiography.

técnicas de reabilitação analisadas; e 3 - Houve uma maior perda de osso na maxila, em comparação com a mandíbula.

PALAVRAS-CHAVE

Perda óssea dentária; Implantes dentários, Radiografia.

INTRODUCTION

Dental implants provide great benefits to the population compared with conventional therapies, such as fixed partial denture or total prostheses [1,2]. With sufficient planning, implant-supported complete dentures can contribute to patient quality of life, thereby addressing the serious public health problem of tooth loss that exists in many parts of the world [1].

It seems clear that the model established for surgery of implant-supported complete dentures in two stages and the placement of the prosthesis after healing is safe and well established [3]. With the evolution of dental implants and the reproduction of studies that have demonstrated satisfactory results with this technique, issues have persisted regarding maintenance, and two points can be emphasised: healthy maintenance of peri-implant tissues [4]; and specific problems such as prosthetic wear, biting of the lips, difficulty in speaking and gingival hyperplasia [5].

With the evolution of information about bone metabolism, implant surfaces, models of occlusion, tooth-implant micro-movement and systemic involvement, studies have favoured the prospect of placing implants and prosthetic devices with immediate load, and these studies have demonstrated satisfactory success rates [6,7] consistent with the results reported in the literature using the traditional model [3,6].

Given this perspective, this study sought to compare radiographic bone loss with implant-supported complete dentures submitted to immediate loading or delayed loading and to correlate the outcomes with different features of the patients involved in the study.

MATERIAL AND METHODS

The study sample consisted of 49 patients implanted with 60 implant-supported complete dentures (359 implants with the following sizes: 3.75x9 mm; 3.75x11 mm or 3.75x13 mm).

The patients were submitted to tooth extraction and placement of dental implants on the same day, being all procedures performed on fresh alveoli. The implant-supported complete dentures were produced by immediate (Immediate Group) or delayed loading (Delayed Group). Ethical committee approval was granted under number CEP/UNIC 2011-037.

In the Immediate Group, the implant-supported complete dentures were loaded within 48 hours after the surgical phase (n = 32). In the Delayed Group the implant-supported complete dentures were loaded between three and six months after the surgical phase (n = 28).

Six patients had upper and lower implant-supported complete dentures in the Immediate Group and five patients had the same condition in the Delayed Group. The remaining patients had upper or lower implant-supported complete dentures.

Panoramic radiographs were obtained, and questionnaires about socioeconomic status - designating classes A, B and C (ABEP - Brazilian Association of Population Studies) - were completed upon the return of the patients for preventive maintenance. The sample size was computed based on the findings of a pilot study, considering bone loss of 0.9 mm with a standard deviation of 0.5 mm (power and sample size).

Only patients with good general health (ASA I and II), who were not alcoholics and did

not have psychological problems that would compromise the survey information, were selected for the study, and the patients had prostheses installed for at least 180 days.

All digital panoramic radiographs included the actual proportions of the structures. The radiographs were obtained at radiological centres. If there were doubts about a diagnosis in the vicinity of the implant, periapical radiographs were obtained. The radiographs were evaluated at the implant-bone interface and along the long axis of the implant (Figure 1), and the distance between the mesial and distal alveolar crest to the edge of the implant was measured (portion of the rim of the implant). The appraiser was calibrated for this study with a Kappa of 0.81.

The data were organised and stratified, and the following statistical tests were applied: the Chi-square test; the Kappa test; Student's t test for independent samples; and univariate and multivariate analysis of variance (ANOVA and MANOVA), all at a 5% level of significance. Additionally, contingency tables were consulted to evaluate risk, using odds ratios for dependent variables between >4 mm <4 mm, and independent variables, consisting of technical implants, gender, location and number of implants and social class, were recorded.

RESULTS

The results of this study (Table 1) demonstrated that, regarding gender, in both the Delayed Group and Immediate Group, women constituted a larger proportion of the sample ($p < 0.05$). Regarding age, the Immediate Group was older (62.5±9.14 years old), compared with the Delayed Group (49±8.2 years old) ($p<0.05$).

In the observation of bone loss, the Immediate Group averaged 2.40±0.68 mm, which was not significantly different from the Delayed Group, which averaged 2.42±0.87 mm ($p > 0.05$). The distribution of protocols was well balanced regarding implant sites. The numbers were similar in the comparisons

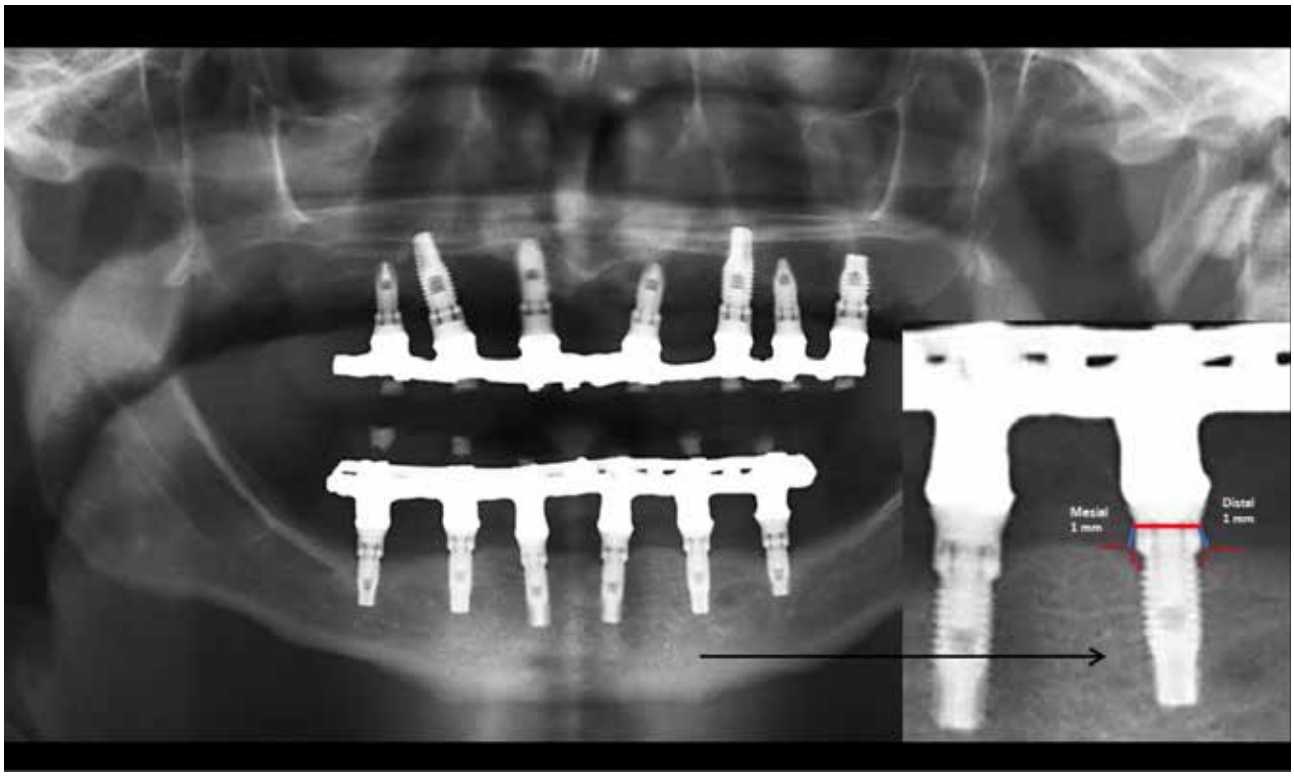

Figure 1 - Demonstration of bone loss measurement between the mesial and distal alveolar crest to the edge of dental implant performed in digital panoramic radiograph.

between the maxilla and mandible ($p > 0.05$). The maxilla represented 32 protocols, and the mandible represented 28 protocols.

Bone loss greater than four millimetres was significantly different in the comparison between the two groups involved in the study ($p > 0.05$); however, regarding the location of implant placement, a larger number of sites with bone loss greater than four millimetres were in the maxilla, compared to the mandible ($p < 0.05$). It is emphasised that, compared to the number of implants placed, there were no significant differences between the groups ($p > 0.05$) regarding the location: maxilla or mandible ($p > 0.05$).

The service time of the Immediate Group was shorter (11.6±8.57 months) compared to the Delayed Group (18.32±11.78 months), and statistical analysis demonstrated a significant difference ($p < 0.05$). Regarding social class, most of the patients in the Immediate Group were in class C ($p < 0.05$), but the predominant social class in the Delayed Group was class A ($p < 0.05$). Overall, across both groups (60 protocols), the least prevalent social class was class B ($p < 0.05$).

In analysis of variance, with the dependent variable of bone loss, there were no significant correlations ($p > 0.05$) with the independent variables of gender, age, time of service, site of insertion of the implants, or social class.

Modifying the statistical model for the dependent variable of bone loss greater than four millimetres, there were a greater number of sites with bone loss greater than four millimetres in the maxilla ($p < 0.05$). Furthermore, women ($p < 0.05$) and older patients involved in the study ($p < 0.05$) were more likely to have bone loss greater than four millimetres. Social class was not associated with bone loss greater than four millimetres. Multivariate linear regression models with two dependent variables were applied, but no relationships were found ($p > 0.05$).

Table 1 - Data relative to a study performed of 60 protocols using an immediate or delayed technique

	Immediate Group			**Delayed Group**			**Total**			**P-value**
	32 (53.3%)			**28 (46.7%)**			**60 (100%)**			**P>0.05**
Gender	Male	Female		Male	Female		Male	Female		P<0.05
	9 (28.1%)	23 (71.9%)		11 (39.2%)	17 (60.7%)		20 (33.3%)	40 (66.6%)		
Years old	62.5±9.14			54.92±8.2						P<0.05
Bone loss	2.40±0.68			2.42±0.87						P>0.05
Location	Maxilla	Mandible		Maxilla	Mandible		Maxilla	Mandible		P>0.05
	15 (46.9%)	17 (53.1%)		14 (50%)	14 (50%)		29 (48.33%)	31 (51.66%)		
Sites >4 mm	<4	>4		<4	>4		<4	>4		
	342	30		310	36		556	66		P<0.05
Number of sites							55	11		P<0.05
Mean of rank	28.69			32.57						P>0.05
Number of implants	186			173						P>0.05
	Maxilla 193			Mandible 166			359			P>0.05
Maintenance time	11.6±8.57 months			18.32±11.78 months						P<0.05
Social class	A	B	C	A	B	C	A	B	C	
N (%)	1 (3.1)	9 (28.1)	22 (68.8)	21 (75)	3 (10.7)	4 (14.3)	22 (36.7)	12 (20)	26 (43.3)	P<0.05

Statistical tests performed in the analysis were: the Chi-square test, Student's t test for independent samples, the Mann-Whitney test and analyses of variance, both univariate and multivariate (ANOVA and MANOVA). Significance was set at 5%.

Regarding odds ratios (Table 2), the risk of radiographic bone loss with implants placed in the maxilla was observed to be 17 times greater than with implants placed in the mandible. The other variables did not present any perceived risk.

DISCUSSION

The results of the study showed that, regardless of the patient having undergone the delayed or immediate technique for the placement of implant-supported complete dentures, the results for radiographic bone loss were similar. An interesting finding of the study was greater bone loss with maxillary implants and in patients with older ages and female gender.

It has been recognised that immediate techniques (surgical and prosthetic) have resulted in tremendous advances in implantology. Considered professionally, operative time decreases, and the cost is lower, beyond the immediate aesthetic outcomes and gradual functional results [8]. Moreover, the greatest gains have been emotional benefit to patients. Several articles [1,9] have shown significant improvement in the quality of life of patients after rehabilitation with dental implants.

Despite the gains described above, there is a need for prudence in the indications for implants with immediate loading [10]. The surgical technique and surface anatomy of the implants, as well as the bone quality and care involved during the preoperative and postoperative periods, are relevant, and these factors can determine the success of the case [11]. The literature has shown good results with both techniques [12-14], but until now, few studies have directly compared numerical data [15].

Observing the average bone loss in this study, similarity was noted with other articles [12,16-18] describing the application of both techniques; however, there has been other evidence demonstrating reduced losses [15,19]. The clinical importance of bone loss of less than one millimetre seems to be minimal [20]. Clinically relevant differences are losses greater than two millimetres.

Considering the site of implant insertion and losses greater than four millimetres, it seems that there was a correlation between the number of sites and greater risk of loss of bone height in the mandible. Comparing these results, it is clear that the maxilla received a greater number of implants and had a higher incidence of failure [21]. Some cases in this study received more than six implants; however, these techniques sought harmony between aesthetics and function, and this goal seemed to affect the outcomes [22]. In this study, in common with other studies, there were equal numbers of dental implants placed in the maxilla and mandible [22]. Comparing

Table 2 - Data on the percentages of sites >4 mm and <4 mm using the risk rations for the following variables: technique, gender, location, number and social class

Categories	Subcategories	>4 mm	<4 mm	Amount	95% Confidence Interval	
Technique	**Delayed**	44.4%	57.1%	0.60	0.197	1.1825
	Immediate	55.6%	42.9%			
Gender	**Male**	44.4%	28.6%	2.0	0.63	6.28
	Female	55.5%	71.4%			
Location	**Maxilla**	88.9%	31.0%	17.84	3.57	89.1
	Mandible	11.1%	69.0%			
Number of Implants	**>5**	38.9%	50.0%	0.63	0.207	1.95
	<5	61.1%	50.0%			
Social Class	**A and B**	66.7%	52.4%	1.81	0.575	5.75
	C	33.3%	47.6%			

Contingency table comparing the odds ratios of sites >4 mm and «4 mm with other ordinal variables in the study.

both techniques with regard to sites with bone loss greater than four millimetres, no differences between the techniques, delayed or immediate, were found, and this finding agreed with the results in the literature [22]. It seems that loss was more related to implant bone quality [22], as well as to risk factors such as tobacco use and patient compliance [23]. The great majority of distances between the bony crests and the proximal edges of the implants were approximately 1.5 mm, compatible with the findings in the literature [15-19].

Some data from this study might draw attention, but they should be interpreted with caution. Greater bone loss related to female gender and to more advanced age were two factors regarding which our findings differed to some extent from others in the field of periodontics [24-26]. It seems that, in implantology, possible risk factors and treatments have not been well established [27]. With regard to osteoporosis and similar diseases, no systematic data have been collected with which to determine possible correlations. Major findings on the subject seem to be needed, particularly from appropriately designed studies of these issues.

One limitation of the present study was the short duration of this longitudinal study, compared with other trials [28]; despite this limitation, there were an adequate number of cases. Social class has been related to problems of oral origin. Among these problems, caries [29] and periodontal disease [30] both stand out. The results of the study showed no correlation with these variables; however, it appears that the patients who underwent implant therapy in this study were more likely to come from the poorer classes.

There were five patients, three of whom were light smokers (fewer than ten cigarettes daily) and two of whom were diabetic, so this group of five patients with these conditions was excluded from the statistical analysis. The analysis was performed with the removal of these data, but no significant changes were noticed. Another factor not considered in the study was race. None of the patients was black, possibly because of the site of data collection. The vast majority of the sample was from the south of Brazil, the population of which originates from the immigration of families from Western Europe. Younger patients were found to have undergone the delayed technique more often. Certainly, early loss of teeth in the younger population is a more impactful factor in today's society [31]. This factor certainly has stimulated early requests for this technique, which is older and has been established as the gold standard [3]. This paper presented promising results regarding the technique of immediate loading compared to delayed loading; however, longer follow-up is needed for longitudinal assessments.

CONCLUSION

1 - Implant-supported complete dentures undergoing maintenance experienced little bone loss.

2 - There were no differences in radiographic outcomes between the different techniques of rehabilitation.

3 - There was greater bone loss in the maxilla, compared with the mandible.

4 - There were no correlations between bone loss and social class, age or gender of the patients.

CONFLICT OF INTEREST

"No potential conflict of interest relevant to this article was reported".

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