Factors associated with the loss of dental implants and the impact on the quality of life

Fatores associados com a perda de implantes dentários e o impacto sobre a qualidade de vida

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ABSTRACT
Introduction: Several factors can be associated with loss of dental implants and this loss can affect the quality of life. Objective: The objective of this work was to evaluate the factors involved in the loss of dental implants as well as the impact of the loss on the individual's quality of life. Methods: This study included 25 patients who reported the loss of at least one dental implant. Personal data were collected and regarding the medical and dental history. Data such as medication use, presence of systemic diseases, smoking, and consumption of alcoholic beverages were noted. In the dental history, the items relevant to this study were whether patients installed dental implants and whether or not they were lost and how long after installation. To assess the quality of life, oral health-related quality of life, quality of sleep and anxiety trait were used the WHOQoL-bref questionnaire, oral health-related quality of life questionnaire, Sleep Assessment Questionnaire (SAQ) questionnaire and the trait-state anxiety inventory (STAI-T), respectively. In addition, the presence of dental crowding, incisal spacing, and anterior open bite were evaluated. The time elapsed between installation and implant loss was counted in months. The data were submitted to statistical analysis (Spearman, Mann-Whitney, and Kruskal-Wallis correlation and Adjusted Generalized Linear Regression). Values of $p < 0.05$ were considered significant. Results: 25 patients participated in this study. The correlation test showed a significant moderate negative correlation between the Physical Domain of the WHOQoL-bref Questionnaire and Implant Loss Time in Months ($r = -0.4689$ $p = 0.024$). Patients with schooling up to high school lost their implants more quickly compared to patients with schooling up to higher education ($\beta = -8.48$; $p = 0.047$). When evaluating Implant Loss Time as an independent variable, no significant results were observed. Conclusion: The early loss of dental implants affects the general quality of life of individuals in the physical domain and this event is associated with low schooling.

Key Words: Dental implant, Risk factors, Quality of life.

RESUMO
Introdução: Vários fatores podem estar associados à perda de implantes dentários e essa perda pode afetar a qualidade de vida. Objetivo: o objetivo deste trabalho foi avaliar os fatores envolvidos na perda de implantes dentários, bem como o impacto da perda na qualidade de vida dos indivíduos. Métodos: Este estudo incluiu 25 pacientes que relataram a perda de pelo menos um implante dentário. Foram coletados dados pessoais e referentes ao histórico médico e odontológico. Dados como uso de medicamentos, presença de doenças sistêmicas, tabagismo e consumo de bebidas alcoólicas foram anotados. Na história odontológica, os itens relevantes para este estudo foram se os pacientes instalaram implantes dentários e se eles foram perdidos e quanto tempo após a instalação. Para avaliar a qualidade de vida em geral, qualidade de vida relacionada à saúde bucal, qualidade do sono e traço de ansiedade foram aplicados os questionários WHOQOL-bref, Oral Health Impact Profile (OHIP-14), SAQ (Sleep Assessment Questionnaire) e o inventário de ansiedade estado-traço (IDATE-T), respectivamente. Além disso, avaliou-se a presença de apinhamento dentário, espaçamento incisal e mordida aberta anterior. O tempo decorrido entre a instalação e a perda do implante foi contado em meses. Os dados foram submetidos à análise estatística (correlação de Spearman, Mann-Whitney e Kruskal-Wallis e Regressão Linear Generalizada Ajustada). Valores de p <0,05 foram considerados significativos. Resultados: 25 pacientes

participaram deste estudo. O teste de correlação mostrou correlação negativa moderada significativa entre o Domínio Físico do Questionário WHOQOL-bref e o tempo de perda do implante em meses (r= -0,4689 p= 0,024). Pacientes com escolaridade até o ensino médio perderam seus implantes mais rapidamente do que pacientes com escolaridade até o ensino superior (β= -8,48; p= 0,047). Ao avaliar o tempo de perda do implante como uma variável independente, não foram observados resultados significativos. Conclusão: A perda precoce de implantes dentários afeta a qualidade de vida geral dos indivíduos no domínio físico e esse evento está associado à baixa escolaridade.

Palavras chave: Implantes dentários, Fatores de risco, Qualidade de vida.

1 INTRODUCTION

In Brazil, the loss of teeth due to trauma, tooth decay, periodontal disease, and others, affects a large part of the population and, as a result, many individuals choose to install dental prostheses. In fact, according to the Oral Health Project Brazil (SB Brazil) carried out in 2010, approximately 75% of the Brazilian population uses some type of dental prosthesis (1) and the immediate reflexes can be felt in the systemic health of individuals since there is a functional and nutritional impact in addition to social integration, self-esteem, psychosocial well-being, and the general quality of life of individuals is seriously compromised (2).

In this sense, the installation of dental implants is currently one of the most sought-after treatment alternatives for dental rehabilitation due to the discovery of osseointegration, which guarantees a high degree of biological integration with the supporting bone tissues, thus guaranteeing a high success rate, around 84.9% to 100% (3.4). The use of dental implants for rehabilitation became popular in the 1960s by Branemark, who advocated the use of materials that guaranteed the direct structural and functional connection between living bone and the surface of an implant subjected to functional load and, despite rehabilitation because dental implants have a high success rate (5) implant losses still occur (6–8).

Studies show that several factors can be associated with loss of dental implants and, in general, the loss of the dental implant can be classified as an early loss, when it occurs before the osseointegration process, and late, after the dental implant receives the occlusal load (3,7,10). Early losses are always of biological origin, resulting from inflammatory processes such as occlusal overload, among others, while late losses can be of biological or mechanical origin, such as fractures and loosening of screws (11).

Exogenous factors, that is, mainly related to the dentist's ability to place the implant, surgical method (5,12), dental implant properties (3,13), or the type of biomaterial used should also be considered (12, 13) as factors that can lead to dental implant loss. As well as, the loss caused by endogenous factors, that is, by factors intrinsic to the individual, such as smoking habits (5,13,15), implant location, the posterior ones of the maxilla having a greater chance of failure (12) quality/bone quantity (3,5,12,13,15), peri-implantitis (16), systemic conditions, such as osteoporosis, diabetes, rheumatoid arthritis, among others (15), inadequate immunoinflammatory response (3,6), in addition to genetic history (4).

Assessing the quality of life of any individual is not an easy task, since the quality of life is defined by the World Health Organization (WHO, 1997), as a very individualized and subjective perception (17). However, some validated instruments can be used and reveal very reliable information about the quality of life, including the WHOQOL-bref, a reduced version of the WHOQoL-100, developed by the World Health Organization, which is used to assess the general quality of life (17); the Oral Health Impact Profile 14 (OHIP-14) which was developed by Slade and Spencer (1997) (18) which correlates oral health with quality of life; the Sleep Assessment Questionnaire (SAQ), developed in 1996, to track primary sleep disorders and abnormalities (19) and the Trait - State Anxiety Inventory (STAI-T), a self-report classification to measure dimensions of state anxiety, defined as transient anxiety (20). As previously mentioned, the etiology of implant loss is multifactorial and each individual factor contributes to the loss, therefore, the objective of this study was to evaluate the factors involved in the loss of the dental implant as well as the impact of the loss on the individual's quality of life.

2 MATERIAL AND METHODS

2.1 ETHICAL ASPECTS

This cross-sectional study was approved by the local Research Ethics Committee (CAEE number 01666018.7.0000.0093) and was conducted with patients seen at the Clinic for Specialization in Implantology at Universidade Positivo, Curitiba, Brazil. The volunteers were contacted by phone and received information about the purpose of the research, its risks, and benefits, and if they agreed to participate in the study, they were invited to anamnesis, clinical examination, and to sign the Informed Consent Form.

To calculate the sample number, a previous study by Derks et al (21) was used, which estimated that the loss of dental implants affects approximately 4% of the

individuals. Thus, considering a sampling error of 5%, a confidence interval of 90%, and that approximately 400 individuals are seen annually at the clinic, it is estimated that the representative sample number is 20 individuals. This study included 25 patients who reported the loss of at least one dental implant.

2.2 NON-CLINICAL DATA COLLECTION

In the anamnesis form, personal data were collected, such as sex and education, and about the previous medical and dental history. Data such as medication use, presence of systemic diseases, smoking and alcohol consumption were noted. In the dental history, the relevant items for this study were whether patients installed dental implants and whether or not they were lost and how long after installation.

To assess the quality of life in general, the WHOQoL-bref questionnaire (abbreviated World Health Organization Quality of Life) was applied, which consists of 26 questions, the first of which refers to quality of life in general and the second to satisfaction with their own health. The other twenty-four are divided into the physical (3,4,10,15,16,17,18), psychological (5,6,7,11,19,26), social relations (20,21, 22) and the environment (8,9,12,13,14,23,24,25). The calculation of WHOQoL-bref scores was performed as follows: it was verified that all 26 questions were filled with values between 1 and 5; all questions are reversed whose scale of responses is reversed (3,4,26); the scores of the domains are calculated by adding the scores of the average of the "n" questions that make up each domain, in the domains composed of up to seven questions, this will be calculated only if the number of facets not calculated is not equal to or greater than two, in the domains composed of more than seven questions, this will be calculated only if the number of facets not calculated is not equal to or greater than three and the result is multiplied by four, being represented on a scale of 4 to 20; domain scores are converted to a scale from 0 to 100; respondents who failed to complete or incorrectly complete more than six questions (80% of the instrument's total questions) were excluded from the sample.

The questionnaire to assess oral health-related quality of life was the Oral Health Impact Profile (OHIP-14), in its short version with 14 questions and validated in Portuguese. This questionnaire was developed to assess the impact of quality of life related to the oral health of individuals from 14 years old, detecting their perception about dysfunctions, discomfort, and disabilities due to problems in the mouth in the last six months. The questions asked fall into 7 domains: functional limitation, physical pain,

psychological discomfort, physical limitation, psychological limitation, social limitation, and disability. Responses are scored on a Likert scale distributed as follows: Never = zero (0); Almost never = value one (1); Sometimes = value two (2); Almost always = value three (3); Always = value four (4). The final value of the OHIP-14 questionnaire is obtained by adding the values of the 14 responses. The score of the domain's ranges from 0 to 8 points and the total score ranges from 0 to 56 points, with a higher score indicating a worse impact of oral health problems on quality of life.

To assess the quality of sleep, the SAQ questionnaire (Sleep Assessment Questionnaire) was applied, a questionnaire validated with self-assessment of items with sensitivities and specificities for the six factors: insomnia, non-restorative sleep, disturbed sleep schedule, daytime sleepiness, apnea sleep and restlessness. It includes 17 items scored on a scale as follows: never = 0 points, rarely = 1 point, sometimes = 2 points, often = 3 points, and always = 4 points. The sum of these points indicates the sleep quality of each patient (range 0 to 68). High scores mean worse sleep quality.

The anxiety trait was assessed using the state-trait anxiety inventory (STAI-T), which is composed of two subscales each composed of twenty questions. One of them reveals how the individual feels at that moment, that is, evaluates the state of anxiety and was not evaluated in this study. The other scale shows how the person normally feels, that is, the anxiety trait (31). It was used because it is causally related to emotional factors that may be linked to the development of Temporal Mandibular Dysfunction (TMD). Each question has scores ranging from one to four, so the total answers can vary from twenty to eighty points and was used to categorize individuals as having mild anxiety (20 to 30 points), medium anxiety (31 to 49 points) and severe anxiety (greater than 50 points).

2.3 CLINICAL DATA COLLECTION

Prior to the clinical examination, a team of dental surgeons participated in the training process in which an examiner experienced in epidemiological surveys (gold standard) proceeded with the theoretical and practical training steps. The clinical examination was conducted with the patients sitting in a dental chair, using a mirror, forceps and a millimeter-length periodontal probe, after cleaning and drying the teeth with the aid of cotton or gauze. Biosafety standards were followed, using personal protective equipment, such as disposable gloves for procedures, disposable cap and mask, goggles, and lab coat. The presence of dental crowding, incisal spacing, and anterior open bite were evaluated.

2.4 STATISTICAL ANALYSIS

The time elapsed between installation and implant loss was counted in months. After analyzing the normality of the variable using the Shapiro-Wilk test to indicate non-normal data (p> 0.05), the Spearman Correlation test was performed between the time of implant loss and the quality-of-life questionnaires. The Mann-Whitney and Kruskal-Wallis tests compared the mean time of implant loss between the factors studied. In the Adjusted Generalized Linear Regression, the relationship between the factors studied on the time of implant loss was evaluated; in addition, time was also assessed as a factor in quality of life. Values of p <0.05 were considered significant. The IBM SPSS Statistics for Windows, Version 23.0 software was used for the analyzes (Armonk, NY: IBM Corp.).

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3 RESULTS

25 individuals participated in this research, 10 males (40%) and 15 females (60%) with a mean age of 53.5 (± 9.8) years. Most of this population had completed high school (n = 13; 52%). Table 1 shows the comparison of mean implant loss time in months and some variables analyzed. It is noticed that women, people with high school education, people who did not report pre-existing medical problems, who do not use drugs and smokers, lost their dental implant earlier, however there was no statistical association (p> 0.05). Among the evaluated occlusal factors, dental crowding and anterior open bite accelerate the loss of implants, however, again, without statistical difference (p> 0.05).

Table 1: Comparison of mean implant loss time (months) between predictive factors.

Factors		Average	SD	*p*
Sex	Male	8.9	14.32	0.18
	Female	2.7	3.74	
Schooling	Elementary	4.01	5.19	0.61#
	High	1.81	1.21	
	College	10.38	14.94	
Medical Problem	No	2.25	2.95	0.30
	Yes	7.51	12.42	
Medication Use	No	2.37	2.78	0.62
	Yes	8.31	13.32	
Smoker	No	5.85	10.46	0.50
	Yes	1.25	0.35	
Dental Crowding	No	5.61	10.27	0.87
	Yes	2.0	-	
Incisal Spacing	No	2.42	2.47	0.78
	Yes	10.16	15.08	
Anterior Open Bite	No	5.66	11.46	0.56
	Yes	4.87	4.93	

Note: Comparisons were made using the Mann-Whitney test. DP: Standard deviation. # Kruskal-Wallis test.

The statistical correlation test showed a moderate negative correlation between the physical domain of the WHOQOL-bref questionnaire and time to implant loss in months ($r = -0.4689$; $p = 0.02$). It is important to mention that the physical domain is composed of questions 3,4,10,15,16,17 and 18 and indicate that the perception of quality of life worsens as the time of loss increases. OHIP-14, WHOQOL-bref - questions 1 and 2, domains of social relations and environment, SAQ and IDATE did not reveal any correlation with the time of implant loss ($p > 0.05$). The results obtained are shown in table 2 and figure 1.

Table 2: Correlation between implant loss time and quality of life quality.

Questionnaires		r	CI 95%	p
OHIP-14		-0.044	-0.459 - 0.385	0.83
WHOQOL-bref (domains)	Questions 1 e 2	-0.337	-0.665 - 0.100	0.11
	Physical	-0.468	-0.744 - -0.057	**0.02**
	Psychological	0.084	-0.351 - 0.489	0.70
	Social relationships	-0,122	-0.518 - 0.317	0.57
	Environment	-0.012	-0.432 - 0.412	0.95
SAQ		0.260	-0.182 - 0.615	0.23
STAI-T		-0.068	-0.477 - 0.364	0.75

Notes: Spearman correlation. r: Correlation coefficient. CI: Confidence Interval. In bold, the values considered statistically significant ($p < 0.05$)

The Adjusted Generalized Linear Regression having the Implant Loss Time as a dependent variable demonstrated that patients with schooling up to high school lost their implants more quickly compared to patients with schooling up to higher education ($\beta= -$

8.48; p= 0.04). The other factors evaluated are shown in table 3 and were not correlated with the time of implant loss.

Figure 1 - Dispersion Graph between the Physical Domain of the WHOQoL-bref Questionnaire and Implant Loss Time in Months.
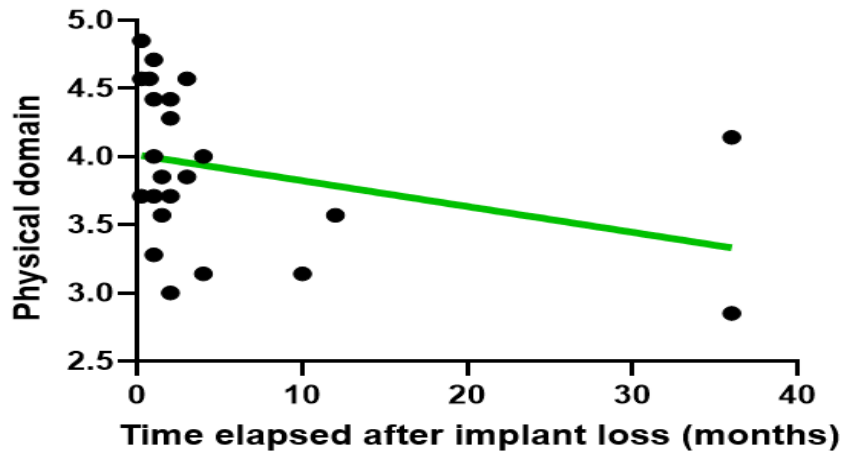

Table 3: Logistic Regression adjusted between implant loss time and associated factors.

Factors	β (CI 95%)	Error	p
Sex (Male)#	6.67 (-0.71 – 14.07)	3.77	0.07
High school*	-8.48 (-16.85 - -0.11)	4.27	**0.04**
Elementary school*	-7.16 (-19.62 – 5.28)	6.35	0.25
Age	0.13 (-0.31 – 0.59)	0.23	0.55
Quantity of implants installed	0.57 (-0.73 – 1.88)	0.66	0.39
Medical problem	0.68 (-8.96 – 10.34)	4.92	0.88
Medication Use	4.84 (-2.80 – 12.48)	3.89	0.21
Smoking	2.47 (-11.19 – 16.14)	6.97	0.72
Dental Crowding	0.56 (-18.02 – 19.21)	9.51	0.95
Incisal Spacing	4.77 (2.89 – 12.43)	3.91	0.22
Anterior Open Bite	4.36 (-4.16 – 12.89)	4.35	0.31

Note: Regression Adjusted for Age, Sex, Education and Quantity of Implants Lost. #: Compared to the female gender. * Compared to Higher Education. In bold, the values considered statistically significant (p <0.05).

Table 4 shows the Adjusted Generalized Linear Regression with quality-of-life questionnaires as dependent variables. When evaluating Implant Loss Time as an independent variable, no statistically significant results were observed.

Table 4: Adjusted Logistic Regression between Quality-of-Life Questionnaires and implant loss time.

Dependent variables		β (CI 95%)	Error	p
OHIP-14		0.10 (-0.40 – 0.61)	0.25	0.68
WHOQOL-bref	Questions 1 e 2	-0.02 (-0.05 – 0.00)	0.01	0.12
	Physical	-0.02 (-0.04 – 0.00)	0.01	0.10
	Psychological	-0.00 (-0.02 – 0.01)	0.00	0.79
	Social relationships	0.00 (-0.02 – 0.03)	0.01	0.86
	Environment	-0.00 (-0.02 – 0.01)	0.00	0.55
SAQ		-0.01 (-0.35 – 0.32)	0.17	0.91
STAI-T		0.07 (-0.32 – 0.46)	0.20	0.73

Notes: Regression Adjusted for age, sex, education and quantity of implants lost.

4 DISCUSSION

This cross-sectional study sought to identify the factors that may be associated with the length of dental implant loss and how this loss affects the quality of life of individuals. The results obtained allow us to make some observations regarding the factors associated with the loss of the dental implant and how this event can impact the quality of life of the individuals evaluated.

Regarding sex, in this research women reported that the loss of the dental implant occurred more quickly than men reported, which contradicts the consulted literature. In a recent systematic review Do et al (17) identified some factors that lead to implant loss, but that sex is not a determining factor.

The individuals' level of education was associated with faster implant loss, which corroborates the data presented by Oliveira et al (2018). According to these authors, oral health, in general, is worse in individuals with less education. Based on this information, it is assumed that the oral health condition is worse in individuals with less education and the lack of information accelerates the loss of the implant.

An interesting data raised in the systematic review by Do et al (17) is the information that the smoking habit does not interfere with the loss of the dental implant. In our study, smokers lost their implant earlier than non-smokers and,

although there is no significant difference, it is a biologically plausible result since there are proven associations between loss of dental implants and smoking (14).

As mentioned earlier, the etiology of implant loss is multifactorial, but it is assumed that patients who have systemic diseases such as osteoporosis, cardiovascular disease, diabetes mellitus, hypothyroidism, and who use drugs may have a lower implant survival rate (14, 23). In this research, the reporting of pre-existing medical problems or use of medications was not associated with early implant loss.

In the study by Bernhardt et al (2019) with 1202 patients, it showed that incisal crowding is related to periodontal disease only in a severe phase, while patients with spacing were associated with loss of inserted gums (24). Patients with periodontal diseases are 2.15% more likely to develop peri-implantitis (25), a factor related to both early and late dental implant loss (11). In our research, it was observed that patients with incisal crowding lost their dental implants later compared to patients who do not have crowding. On the other hand, patients who have spacing took an average of 8 months longer to lose the dental implant compared to those who do not have spacing.

Assessing the impact of implant loss on a person's general health and oral health is somewhat subjective. Sargolzaie et al (2017) showed that the general quality of life, that related to the mouth and that of psychological level, had a significant increase after the installation of dental implants (26). Therefore, the loss of the dental implant can be associated with a decrease in the quality of life, however, this reduction has no connection with the time of the loss. As for sleep quality, there was no statistical difference before or after surgery (26), consolidating the findings of this study.

However, the physical domain of WHOQOL-bref reveals that as the time of implant loss increases, there is a certain discomfort of the individual with the situation and there is a negative impact on the quality of life. It is suggested that the patient suffers greater consequences on quality of life as he would be more adapted to this dental implant. The findings of this study may be related to its limitations, among them, the sample size and the lack of knowledge of the type of implant installed on the patient.

5 CONCLUSION

The early loss of dental implants affects the general quality of life of individuals in the physical domain and this event is associated with a low level of school education, however, further studies are needed to better understand these results.

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