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Retrospective evaluation of the survival rate of single tooth prostheses supported in external hexagonal implants: mean follow-up of 9 years

Avaliação retrospectiva do índice de sobrevivência de próteses unitárias suportadas em implantes de hexágono externo: média de acompanhamento de 9 anos

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Resumo

Introdução: O uso de implantes dentários osseointegrados para a reabilitação de pacientes revolucionou a Odontologia. **Objetivo:** Avaliar retrospectivamente o índice de sobrevivência e a frequência de complicações com plataformas de hexágono externo suportando coroas unitárias. **Material e método:** Foram utilizados prontuários de 110 pacientes que receberam 143 implantes na Faculdade Ilapeo (2004-2015). As variáveis foram: idade, sexo, envolvimento sistêmico no momento da cirurgia, região, desenho do implante, tipo de superfície, sistema de fixação, tipo de pilar e material da prótese. As variáveis de desfecho foram a incidência de complicações nos implantes e/ou próteses e o tempo em função. O tempo médio de acompanhamento foi de 9 anos. **Resultado:** 32,8% apresentavam alguma alteração sistêmica. Noventa e seis implantes (67,1%) foram instalados na maxila e 47 (32,9%) na mandíbula, 87 (60,8%) estavam em região posterior e 56 (39,2%) em região anterior, enquanto 40 (28%) necessitaram reconstrução óssea prévia. A maioria dos implantes (97,2%) apresentava tratamento de superfície, 42% eram cilíndricos e 58% cônicos. A maioria dos componentes protéticos (89,6%) eram UCLAs e a maioria das próteses fundidas em metal (79,7%). O índice de complicações protéticas foi de 19,58% e 3 implantes foram perdidos (97,9% de índice de sobrevivência). Não houve diferença estatística em relação às variáveis estudadas e a ocorrência de complicações protéticas e perda de implantes. **Conclusão:** Implantes com plataforma de hexágono externo são uma opção efetiva e previsível de reabilitação unitária e apresenta elevado índice de sobrevivência.

Descritores: Hexágono externo; implantes dentários; índice de sobrevivência; prótese unitária.

Abstract

Introduction: The use of osseointegrated dental implants for the rehabilitation of patients has revolutionized dentistry. **Objective:** To retrospectively evaluate the survival rate and the frequency of complications with external hexagon platform supporting single crowns. **Material and method:** Dental forms of 110 patients who received 143 implants at the Ilapeo College (2004-2015) were used. The variables were: age, gender, systemic involvement at the time of surgery, region, implant design, type of surface, fixation system, pillar type and prosthesis material. The outcome variables were the incidence of complications in the implant or prosthesis and time in use. The mean follow-up period was 9 years. **Result:** 32.8% had some systemic disease. Ninety-six implants (67.1%) were installed in the maxilla and 47 (32.9%) in the mandible, 87 (60.8%) were in the posterior region and 56 (39.2%) in the anterior region, while 40 (28%) were placed in regions that had received bone reconstruction. The majority (97.2%) of the implants presented surface treatment, 42% had a cylindrical design and 58% were tapered. The majority of the prosthetic components (89.6%) used were UCLAs and most of the prostheses were fused-to-metal (79.7%). The rate of prosthetic complications was 19.58% and three implants had been lost (97.9% survival rate). There was no statistical difference between the variables analyzed for both the occurrence of prosthetic complications and for the loss of the implant. **Conclusion:** Implants with external hexagon connection were an effective and predictable option to support crowns and had high survival rates.

Descriptors: External hexagon; dental implants; survival rates; single tooth prostheses.

INTRODUCTION

The use of osseointegrated dental implants for the rehabilitation of patients has revolutionized dentistry[1-3]. Numerous studies have shown successful results in the rehabilitation of patients, especially in cases of partial or total edentulism[1-3]. In the case of single tooth rehabilitation, survival rates higher than 94.4% have been reported[4-8].

Many factors influence the outcome of oral rehabilitations. They are associated with the patient characteristics, such as the existence of a systemic condition, bone quality and quantity in the region to be rehabilitated, implant characteristics (macro and microstructure) and the surgical technique used[6,9].

The planning of a rehabilitation treatment has to take into consideration whether it is of single or multiple teeth, because the distribution of forces varies accordingly. Prosthetic components can minimize problems in implants that have been installed without adequate planning. The components can compensate errors regarding the height and angulation of the implants and the distribution of stresses; they can also prevent fractures. In cases of excessive forces, the screw of the prosthesis fractures before the implant[10].

For single tooth rehabilitations with external hexagonal implants, there are several options of prosthetic components. Pre-manufactured titanium pillars for screwed or cemented prosthesis can be used. One can also fabricate cementable or screwable prostheses directly onto the implants using UCLA type components[11].

Studies have shown that variables such as the type of material used for making the prosthesis and prosthetic abutment interfere with the success of treatment[6,12,13].

The rehabilitation follow-up is of fundamental importance for the success of a treatment. This study aimed to retrospectively evaluate external hexagonal implants supporting single prostheses, by considering the survival rate and occurrence of complications. The study also analyzed the possible variables that affect success.

MATERIAL AND METHOD

The research project was approved by the Ethics Committee for Research on Human Beings of the International University Center (UNINTER), filed under number 921,522. Data were collected from patients who received implants with an external hexagonal connection (Neodent, Curitiba, Brazil) to support single crowns, at the Latin American Institute of Dental Research and Education (ILAPEO, Curitiba, Brazil), between 2004 and 2015.

The inclusion criteria were: rehabilitation treatment with implants with external hexagonal connection supporting single crowns, installed in one or two surgical steps. The exclusion criteria were: patients without the prostheses, or when their form had been incompletely filled.

Data were collected from the dental forms of patients and follow-up forms stored in the ILAPEO archives. All patients at ILAPEO were instructed to attend an annual follow-up consultation after the installation of the final prosthesis. During the follow-up consultation, a periapical radiographic examination is carried out in order to evaluate the crestal bone. The prosthesis examination is carried out to assess the status of the prosthesis and the peri-implant tissue, the implant stability and the need for occlusal adjustment (must be a light contact in centric occlusion).

The following exposure variables were analyzed and categorized as:

a) Patient-related: age, gender, systemic involvement at the time of implant installation;
b) Related to the area of rehabilitation: maxilla/mandible, anterior/posterior, area with or without bone reconstruction;
c) Implant-related: type (conical or cylindrical) and surface treatment (yes or no);
d) Related to the pillar and prosthesis: fixation system (cemented or screwed), type (UCLA, trunnion, abutment); and material used in the manufacture of prostheses (porcelain fused to metal, acrylic, all-ceramic).

The outcome variables were the presence of complications in the implant or prosthesis and the survival time in function.

Data were analyzed in order to estimate the association between exposure and outcome variables. To evaluate the association between the implant-related factors and the loss and prosthetic complications outcomes, Fisher's exact test and the chi-square test were used. P values <0.05 were considered statistically significant. For the analysis, IBM SPSS v.20 software was used.

RESULT

The dental records of 110 individuals were evaluated. Each individual received one to four implants between 2004 and 2015, totaling 143 implants. They were followed-up for a mean period of nine years (SD = 51.7 months). The survival rate of the implants was 97.9% (three implants lost). The loss causes were: fracture of the platform of the implant after 12 years in function, mobility of the implant after 10 months and loss of implant one year after installation, before receiving the prosthesis.

The mean age of patients in the sample was 42.4 years (SD = 11.8), 36 males and 74 females. The most common systemic conditions at the time of implant installation are listed in Table 1.

Regarding the implant installation region, 96 were installed in the maxilla and 47 in the mandible; 87 were installed to replace posterior teeth and 56 to replace anterior teeth; 40 implants were installed in areas with prior bone reconstruction.

Regarding variables related to implants, 58 had a cylindrical design and 80 were tapered, and the vast majority had surface treatment (139 implants).

Table 2 shows the types of abutments (n = 125) used to support the crowns. One hundred and twenty-three forms had a description of the type of crown used: 98 were porcelain fused to metal (PFM), 15 were all-ceramic and 10 were provisional acrylic resin. From a total of 59 prostheses, 45 were screwed and 14 cemented.

Of the 143 implants evaluated, 28 (19.58%) presented some type of prosthetic complication (Table 3).

Table 1. Systemic condition presented at the time of installation of implants

Condition	N	%
Hypertension	8	19.0
Anemia	5	11.9
Hepatitis	4	9.5
Smoking	1	2.4
Diabetes	1	2.4

Table 2. Types of abutments used to support the prosthesis

Component	n	%
Ucla of Tililte	45	36.0
Ucla (unspecified)	33	26.4
Ucla of titanium	13	10.4
CoCr Ucla	10	8.8
Calcinable Ucla	10	8.0
Post	7	5.6
Abutment	6	4.8
Total	125	100.0

Table 3. Type and frequency of prosthetic complications

Type of prosthetic complication	n	%
Loosening of screw - once	13	41.9
Loosening of screw - twice	3	9.7
Loosening of screw - three times	3	9.7
Fracture of the crown	2	6.5
Adjustment (increase) of porcelain	2	6.5
Fracture of the provisional crown	1	3.2
Maladjustment	1	3.2
Fistula	1	3.2
Loosening of screw and adjustment (increase) of porcelain	1	3.2
Bad odor and sensitivity	1	3.2
Total	28	100

There was no statistically significant difference between the exposure variables and outcome, regarding the loss of implant (Table 4). The rate of prosthetic complication was the same for the cemented and screwed abutments (p = 0.197) in the maxilla or mandible (p = 0.518) in the anterior and posterior region (p = 0.836) and was also the same regardless of the type of implant (p = 0.911). There was no statistically significant difference between the loss of the implant and the installation region, the maxilla and mandible (p = 1), anterior and posterior (p = 1), grafted areas or not (p = 0.560) and the type of material used for the prostheses (p = 0.720).

Table 4. Variables of the three cases of failures

Variable	Implant 1	Implant 2	Implant 3
Age (years)	55.1	61.04	74.80
Gender	Male	Female	Male
Number of patient implants	1	1	1
Presence of systemic involvement	Yes	Yes	No
Maxilla / mandible	Maxilla	Maxilla	Mandible
anterior / posterior region	Posterior	Anterior	Posterior
Bone grafting	No	No	No
Diameter (mm)	4	3.3	5
Length (mm)	15	15	10
Prosthesis material	PFM	PFM	Acrylic
Component Type	-	Tilite Ucla	-
Time in function (months)	-	92.9	24.5

DISCUSSION

The implants that are used to support a single crown have high success rates. In our study we obtained a success rate of 97.9%, similar to other studies such as Duminil et al.[5], who had a success rate of 96.6% in the maxilla and 100% in the mandible, and Camargos et al.[6], who reported a success rate of 95.9%.

The mean age of the sample was 42.4 years, most of whom were females (74 females and 36 males). Similar results were found by Romeo et al.[14], who followed up 109 patients (69 females and 40 males) with a mean age of 41.3 years; Camargos et al.[6] studied 44 patients, 32 of whom were females and 12 males, with a mean age of 48 years; and Anitua et al.[8] followed up 31 patients, 65% of whom were female and the mean age of participants was 56 years.

The majority of the implants were installed in the maxilla (67.1%), a result similar to the study of Maló et al.[15], who evaluated 116 implants, 74 of which were installed in the maxilla and 42 in the mandible. The prosthetic complication and loss rate were statistically the same for rehabilitation in the maxilla (19.79%) and mandible (25.53% - p = 0.518), a result similar to that found by Eckert et al.[16], who found a rate, both in the mandible and maxilla, was 0.6%.

The rate of complication according to the type of prosthetic material was similar (p = 0.720): PFM (22.45%), ceramic (13.33%) and acrylic resin (20.00%). In the study by Jung et al.[12] the survival rate of the PFM crowns (95.4%) was significantly higher than the survival rate of all-ceramic crowns (91.2%). Anitua et al.[8] did not record any prosthetic complication after 10 years of follow-up of 34 single crowns. Pozzi et al.[13], using a prosthetic connection made by the CAD-CAM system found no failures up to three years of follow-up in any of the implants and prostheses. In our study, the prosthetic complication rate was significantly higher when

compared to the above mentioned. This might have been because undergraduate students installed the majority of implants and prostheses in our study, the follow-up period was longer[12,13] and the sample was larger[8,13].

Three implants in our study that were considered failures were removed. Two were late failures, one a fracture of the implant platform after 12 years of function and one due to mobility of the implant after 10 months. One implant had a premature failure, because the implant was removed one year after its installation, before the prosthesis had been installed (the cause of the failure was not described on the dental form). Implant rehabilitation studies with implants supporting single crowns have also found high survival rates. Romeo et al.[14] evaluated 187 implants and observed six late failures due to infection in the peri-implant tissue. Maló et al.[15] assessed 63 single prostheses with immediate loading in aesthetic areas and observed loss of four implants for different causes (93.7% survival). The number of failures in our study was very low (n = 3); therefore it was not possible to carry out a multivariate analysis.

Regarding prosthetic complications (19.58%), there was no statistically significant difference among the variables related to the patient, the implant installation region, the type of the abutment or installed implant.

In this retrospective study, we evaluated the patient records of 110 patients and 143 implants, which were followed up by a mean period of nine years (SD = 51.7). Thirty-six patients returned for follow-up consultations and 74 had their dental records assessed. This was a limitation of the study, since not necessarily all patients who had some type of complication were identified or sought care at the institution. Another factor that interfered with the results of this study was the lack of information concerning the variables, which were not always described in the forms and so we had to exclude them. In addition, several professionals participated in the follow-up consultation to assess the implants and prostheses, which may be a calibration bias.

CONCLUSION

Based on the data, it was possible to observe that implants with an external hexagonal connection had a high long-term survival rate (97.9%) for single crowns and a 19.58% complication rate.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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