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Original Research Article

Implant therapy in a higher education institution: changes or paradigms?

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Abstract

Introdution: Since the 1970, dental rehabilitation of partially or totally edentulous patients has been an increasingly used practice, due to improved materials and methods and high rates of survival and success. **Objective:** This study aimed to evaluate patients from the Faculty of Dentistry of the University of Passo Fundo, between 2015 and 2018, with indication and installation of dental implants. **Material and methods:** Data on age and gender of the patients, indication and region of the implants, technique, type of connection and shape of the implants, bone density, need for grafting and image modality used for surgical planning were collected from dentistry records. **Results:** In total, 55 patients and 105 implants were evaluated. The age group ranged from 21 to 82 years, and women were the majority group (64%). Among the implant indications, 71% of the patients had only one tooth missing, and the lower first molars comprised most of the implants performed (21%). The conventional surgical technique was the most used (86%), as well as the cylindrical shape cone morse model. **Conclusion:** The proper selection of indications for implants seeks to be based on scientific evidence, and the protocols are essential to achieve high success rates.

Introduction

Currently, dental implants therapy is popularized, due to the simplification of this procedure, the greater acceptance by patients and clinicians, the wide spectrum of indications in partially edentulous patients, bone graft and the simplification of the surgical technique [5]. However, some changes in precepts and paradigms have occurred over time, such as: immediate and early implant placement in post-extraction regions, different loading protocols, dimensions and formats associated with mechanical principles [7]. There is consensus, for example, on the superiority of implants with surface treatment in relation to machined implants, leading to the creation of different treatment methods to enhance tissue responses [14].

Advances in the design of implants, clinical protocols and biomaterials provide opportunities to accelerate treatment, increasing efficiency, predictability and patient satisfaction [14]. Therefore, it is important to understand that these changes, if not predictable, can trigger negative results and increased risks in relation to clinical success [19]. Thus, the success of dental implants is a constant search, which requires retroactive analysis of the implants performed.

A study at the University of Bern (Swiss) [11] found an increasing demand for dental implants in the elderly population in order to fill edentulous spaces, and that the proper selection of cases and surgery based on evidence and protocols were essential for high success rates. At the same institution, another previous study [5] had already found that the age group that most demanded this type of therapy was over 50 years old, and that the success rate was 99.3%. In Brazil, community educational institutions (philanthropic) are places that assist patients with economic limitations to hire this type of rehabilitation, which has also contributed to the expansion of implantology, as predicted by Dr. Per-Ingvar Brånemark [16]. Thus, this study aimed to describe the set of patients who received dental implants between 2015 and 2018 in the operating room of the Faculty of Dentistry of the University of Passo Fundo.

Material and methods

Patients

The present study included 55 patients, in a total of 105 implants that were installed between 2015 and 2018 in the clinics of the Faculty of Dentistry of the University of Passo Fundo (FO/UPF), located in the city of Passo Fundo, state of Rio Grande do Sul, Brazil. Most participants were between 41 and 50 years old (31%) and, of the total, 64% were women. Among the patients, 11% were smokers and 36% reported absence of chronic diseases. The protocol for this study was approved by the Research Ethics Committee of the University of Passo Fundo (protocol number: 2.097.298).

Clinical procedures

The patients underwent an image exam (tomography, periapical and/or panoramic radiography) and the day before the implant, they received antibiotic, anti-inflammatory and analgesic medication. The surgeries were performed by professors specialized in Implantology at FO/UPF. Surgical procedures were performed under local or regional infiltrative anesthesia using low trauma surgical technique. When single-stage surgeries were not performed after four (mandible) and six months (maxilla), prosthetic rehabilitation on osseointegrated implants was performed by academics, under the guidance of the prosthesis teachers.

Descriptive analysis

Two researchers, trained by the Kappa test (0.90) analyzed the patients dentistry records in order to obtain information on the following variables: 1) indication for implantation: for all patients, the indication for implant insertion was among the following: missing a tooth; intermediary edentulous spaces; distal extension; edentulous arch; 2) distribution of implants by location: the location was determined according to the investigation of the tooth to be implanted, in four types: anterior maxilla, posterior maxilla, anterior mandible and posterior mandible. Anterior indicates teeth located from canine to canine; posterior indicates premolars and molars; 3) distribution of implants according to the tooth: the teeth were classified by the Universal system; 4) bone density of the implant site: I – cortical quite dense; II – thick and dense cortical, to a lesser degree than the previous one and with a certain degree of porosity at the ridge crest (porous cortical); III – porous and thin cortical at the edge, involving a thin trabecular bone (coarse trabecular); IV – thin trabecular and practically no cortical, a very thin

cortical (thin trabecular) [18]; 5) platform type: internal hexagonal, external hexagonal and Morse cone; 6) implant shape: cylindrical or conical; 7) surface of the implant: smooth or rough; if rough, which type is used; 8) type of technique: conventional, immediate implant, immediate loading and immediate implant; 9) image modality used for surgical planning: periapical, panoramic, periapical + panoramic and tomography; 10) need for graft: whether or not there was a need for bone graft and, in this case, observing the place where it was performed; 11) report of complications and failures: six months after the implant, patients were asked about possible problems and failures.

Statistical analysis

The data were submitted to descriptive statistics. Subsequently, the association between the implant technique and shape, type of platform, region and bone density, and between bone density and region of the dental arch was tested, using the contingency coefficient, according to the statistical program Biostat [1].

Results

Indication and type of implanted teeth

Most patients (70.9%) were referred for therapy due to the lack of a tooth, which totaled 65 implants; 9.1% had an indication due to the distal extension, 12.7% due to intercalary edentulous spaces and 7.3% for the case of edentulous arch (table I). In relation to the greater number of implanted teeth, the occurrence was found in the lower first molars, which together comprised 21% of the total implants. In order, an implant was performed in the first right upper premolar, with an accumulation of 28% and adding to these, with an accumulated frequency of 57%, there was the installation of implants in the region of upper central incisors, upper left and lower right premolar seconds and lower left canine. On the other hand, the smallest number (n=1) of implants to supply the absence of teeth occurred in the upper left first molar, lower left central incisor, lower second molars and central and lateral inferior right incisors, with a total of 100% accumulated.

Table I – Indication and distribution of implants placed between 2015 and 2018 in the operating room of the Faculty of Dentistry, University of Passo Fundo

Indication/Region	Patients		Implants	
	n	Subtotal (%)	n	Subtotal (%)
Absence of a tooth				
Maxilla	20	36.4	30	28.6
Mandible	19	34.5	35	33.3
Subtotal	39	70.9	65	61.9
Distal extension				
Maxilla	2	3.6	9	8.6
Mandible	3	5.5	6	5.7
Subtotal	5	9.1	15	14.3
Intermediate edentulous space				
Maxilla	3	5.5	9	8.6
Mandible	4	7.3	6	5.7
Subtotal	7	12.7	15	14.3
Edentulous arcade				
Maxilla	1	1.8	6	5.7
Mandible	3	5.5	4	3.8
Subtotal	4	7.3	10	9.5
Total	55	**100**	105	**100**

Bone density and region

The largest number of implants was installed in the posterior mandible region, followed by the anterior maxilla, posterior maxilla and anterior mandible region (table II). In the mandible, there was a preponderance of the posterior region (36%) and in the maxilla region the opposite was found, with 26% in the anterior region and 23% in the posterior region. There was parity between the mandible and maxilla regions regarding the distribution of implants, with 51% in the mandible and 49% in the maxilla. As for bone density, 60% of the implants were installed on bone of density III and the lowest percentage was found in density IV (table II). In the mandible region there was no implantation in bone of density II and in the maxilla region this was observed in density I. Only 11% of the implants required grafting, and of these, 55% were in the anterior maxilla region.

Table II – Distribution of dental implants that occurred between 2015 and 2018 in the operating room of the Faculty of Dentistry, University of Passo Fundo, according to region and bone density

Region	I		II		III		IV		Total	
	n	%	n	%	n	%	N	%	N	%
Anterior mandible	14	13.3	0	0	2	10.5	0	0.0	16	15.2
Posterior mandible	2	1.9	0	0	35	21.9	1	1.0	38	36.2
Anterior maxilla	0	0	2	1.9	25	13.3	0	0.0	27	25.7
Posterior maxilla	0	0	18	17.1	1	15.2	5	4.8	24	22.9
Total	16	**15.2**	20	**19.0**	63	**60.0**	6	**5.7**	105	**100**
Mandible	16	15.2	0	0	37	35.2	1	1.0	54	51.4
Maxilla	0	0	20	19.0	26	24.8	5	1.9	51	48.6
Anterior	14	13.3	2	1.9	27	25.7	0	0	43	41.0
Posterior	2	1.9	18	17.1	36	34.3	6	5.7	62	59.0

Contingency coefficient density x region=0.7763 (p<0.001)

Implantation technique

Most implants (86%) were performed using the conventional method, as opposed to immediate implant + immediate load (2%) (table III). The implantation technique showed a significant correlation (p<0.05) with the region: the conventional technique was administered in the four dental regions, which was not verified in the other practices. The immediate implant was not used when the indication was in the posterior mandible, the immediate load was not applied to the posterior maxilla region and the combination of these two techniques was exclusive to the anterior maxilla.

Table III – Type of technique used in implants performed in the operating room of the Faculty of Dentistry of the University of Passo Fundo in the period from 2015 to 2018 according to region and bone density

Region	Conventional		Immediate implant		Immediate load		Immediate implant + immediate load	
	n	%	n	%	n	%	N	%
Anterior mandible	10	9.5	2	1.9	4	3.8	0	0.0
Posterior mandible	36	34.3	0	0.0	2	1.9	0	0.0
Anterior maxilla	22	21.0	2	1.9	1	1.0	2	1.9
Posterior maxilla	22	21.0	2	1.9	0	0.0	0	0.0
Total	90	**85.8**	6	**5.7**	7	**6.7**	2	**1.9**
Bone density	**n**	**%**	**n**	**%**	**n**	**%**	**N**	**%**
I	10	9.5	2	1.9	4	3.8	0	0.0
II	19	18.1	1	1.0	0	0.0	0	0.0
III	56	53.3	2	1.9	3	2.9	2	1.9
IV	5	4.8	1	1.0	0	0.0	0	0.0
Total	90	**85.7**	6	**5.7**	7	**6.7**	2	**1.9**

Contingency coefficient: Technique x region=0.4108 (p=0.0113*); Technique x bone density=0.3640 (p=0.0661ns)

Most patients (53%) had type III bone density, so the conventional technique and the immediate implant were applied to all types of density. In 2015, only the conventional method was used, with a decrease of 2.5% in 2016 and 20% in 2017 (figure 1A). In 2017 there was an 8% increase in the use of immediate load; that year, immediate implant + immediate load was performed for the first time. Thus, in 2018, the use of the conventional technique was only 40%, resulting in a decrease of 60% from 2015 to 2018. At this time, the immediate load grew by 20% compared to the previous year and culminated at the same level as the conventional technique (40%) (figure 1A).

Types of implant platform, shape and surface

The type of platform most used was the cone morse, but this varied over time (figure 1B): in 2015, about 50% of the implants were performed with this model, remaining at this level until 2017; from that year on, there was an increase of 20% in its use and, in 2018, it culminated in 60% of use. The external hexagonal platform represented 28% of the total in 2015, with an increase of 15% in 2016; however, in 2017 its use decreased by 20% and, in 2018, no implant used this type of connection. The use of the internal hexagonal platform decreased by around 10% between 2015 and 2016, but thereafter it increased by 25% and resulted in 40% employment in 2018. As for the shape of the implant, the predominant type was cylindrical, with a variation from 95% (2016) to 65% (2017) (figure 1C). There was a sharp decrease in the cylindrical shape in favor of the conical type between 2016 and 2017, which was reversed in the following years. The implant surface was predominantly rough (86%) and, in this case, 87% were porous and the others were vulcan and neoporous. Only one implant was lost, which represented less than 1% of the cases evaluated: it occurred in a woman, 58 years old, non-smoker, in which two implants were installed.

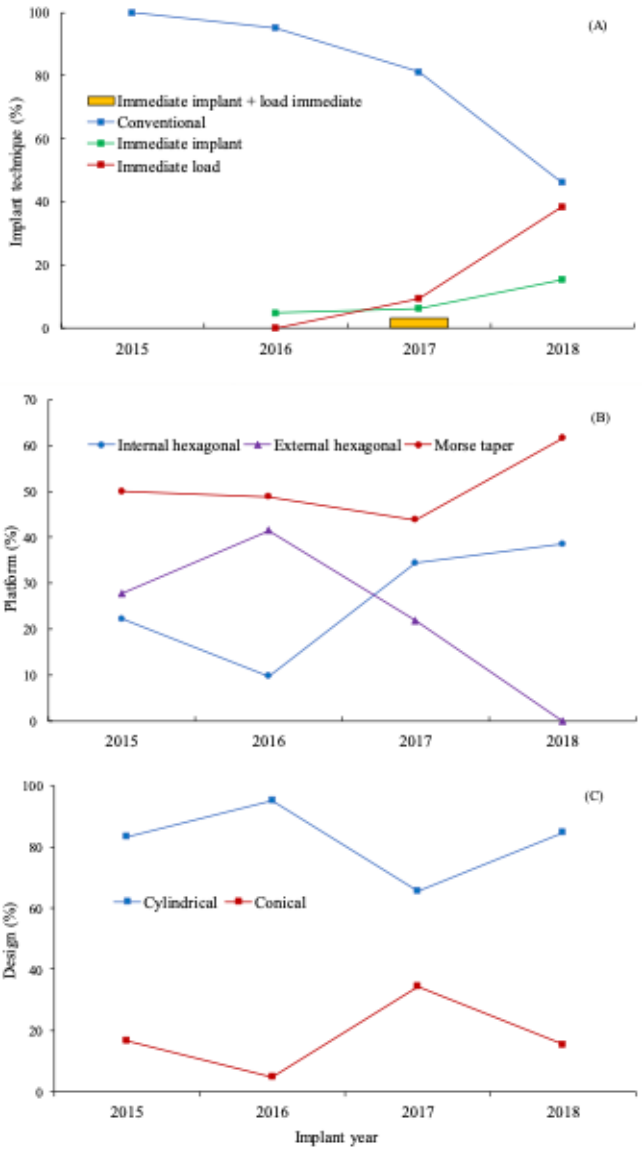

Figure 1 – Percentage evolution of the technique (A), platform (B) and implant design (C) that occurred between 2015 and 2018 in the operating room of the Faculty of Dentistry, University of Passo Fundo, Rio Grande do Sul, Brazil

Discussion

In this retrospective study, a set of patients who received a dental implant at a higher education institution between 2015 and 2018 was evaluated to verify the dynamics of indications and choices of implant techniques and formats. The predominant age group (60%) was between 41 and 60 years old, which converges with similar studies carried out at the University of Bern, in which 60% of the patients were ≥50 years old [5, 11].

The first lower molars represented the majority of implants (21%) installed in this study, so it is important to note that the first permanent molars constitute the first dental group to erupt and also the most important of permanent dentition, due to their central role in development and for being responsible for the second physiological phase of occlusion [9]. However, due to the age at which they emerge, the circumstances in which they appear in the mouth (without exfoliating primary teeth) and their anatomical characteristics, they end up being exposed to risk factors and dental caries progressively, resulting in destruction and premature loss of these teeth [15, 22], which may justify the greater number of implants installed in the region of lower first molars in the present study, thus highlighting the importance of these teeth in occlusion and their loss can lead to serious clinical problems, with changes in the position of neighboring and antagonistic teeth [20].

Likewise, maxillomandibular bone density and different responses to dental procedures are of special importance in the case of implants [23]. This was demonstrated, since the correlation with the implant region was highly significant and of great magnitude (0.78; $p < 0.001$). It is known that bone density and volume are determinants in the success of implants, as both type I (mandible) and type IV (maxilla) quality bone can hinder the procedure [13]. The patients evaluated in this research had predominantly density III (thin compact), which is better for implant survival compared to densities I and IV [13]. In fact, only one case of implant loss (0.95%) was reported, which may be related to the type of bone density.

Among the techniques adopted in the 55 patients evaluated, the most used protocol was the conventional technique, whereby the implants need to be without load for a period in order to occur osseointegration [6]. Implants with immediate load were performed only on the anterior part, both of the mandible and the maxilla. Although the immediate load has gained popularity, as it reduces the duration of treatment, it is not yet clear whether the clinical results are comparable to the conventional method. However, a meta-analysis study [8] demonstrated that implants installed in the immediate load modality had a shorter survival.

One of the central aspects in procedures of this type concerns the type of connection used, as it depends on the union and stability of the implant/abutment interface [4]. In this study, it was found widespread use of cone morse, with a tendency to increase between 2015 and 2018, and the opposite occurred with the use of the external hexagonal connection, which ended in disuse in this work. Among the reasons for the preference for the cone mrose is its stability, strength, predictability and adaptation to the transfer of lateral loads, in addition to significantly reducing bacterial colonization between implant and abutment [2]. In turn, the internal hexagonal connection allows the reduction of the vertical height of the restorative platform, being suitable for installing implants of a surgical stage and decreasing the possibility of micro movements during loads [10]. In addition, compared to the external hexagonal, this type of platform favors the homogeneous distribution of stresses around the implants and absorbs external overloads [3].

With regard to implant formats, the cylindrical type was chosen in most cases. The design of the implants has undergone changes over time to improve primary and secondary stability [12]. This stability is defined as the absence of movement when the implant is placed (primary stability) or when the osseointegration process is in progress (secondary stability), and which are positively associated [17]. However, the implant surface also proved to be a major factor in osseointegration, in addition to the type of connection and design, since it can accelerate the process of secondary stability and decrease the waiting time for placing the load [14]. Different methods for implant surface treatment have been developed seeking to accelerate osseointegration and strengthen the integrated interface, such as blasting, laser beam modification, anodizing, acid attack and blasting + acid attack [14]. In this work, most of the implants had a treated surface (86%), mainly with acid (porous). With acid treatment, microcavities are formed, so that the surface becomes rough, providing a better condition for cell proliferation, increasing the surface area and promoting better cell bioadhesion compared to the machined or sandblasted surface [21].

Conclusion

In the studied sample, the main cause of indication for implants is the lack of a tooth, mainly in the lower arch. The most used connection was a cone morse cylindrical shaped. The type of conventional surgery (not immediate) was characterized as the most used technique. Such findings seek to guide dental professionals in establishing appropriate conducts and to consolidate dental implant indications based on scientific evidence and observations.

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