

## Evaluation of implant osseointegration success: Retrospective study at update course

Avaliação do sucesso da osseointegração dos implantes em curso de formação: Estudo retrospectivo

Michelle Bianchi MORAES<sup>1</sup>, Vivian Grazielle Leite de TOLEDO<sup>2</sup>, Rodrigo Dias NASCIMENTO<sup>1</sup>, Fernanda de Cássia Papaiz GONÇALVES<sup>3</sup>, Fernando Vagner RALDI<sup>1</sup>

1 – Department of Diagnosis and Surgery – School of Dentistry – Institute of Science and Technology – UNESP – Univ Estadual Paulista – São José dos Campos – SP – Brazil.

2 – School of Dentistry – Institute of Science and Technology – UNESP – Univ Estadual Paulista – São José dos Campos – SP – Brazil.

3 – Department of Dental Materials and Prosthodontics – School of Dentistry – Institute of Science and Technology – UNESP – Univ Estadual Paulista – São José dos Campos – SP – Brazil.

### ABSTRACT

**Objective:** With the scientific and technological advances, the life expectancy of the population has increased over the years. With the advent of dental implants, a new possibility of treatment for oral rehabilitation was created to help or even help overcome the limits of conventional fixed dentures, removable and mainly total. Compared to conventional rehabilitation treatment on natural teeth, rehabilitation on implants has higher rates of success and longevity.

**Material and Methods:** For this research we evaluated the medical records of patients who received surgical treatment for implant placement in the update current school of Implantology ECO (Continuing Studies in Dentistry) in São José dos Campos, in the 2008 'period to 2012, in order to obtain, analyze and relate the following criteria: the patient gender; year and number of installed dental implants; the region of implant installation; the trademark of the installed implant and the successful osseointegration, or process in which there is a rigid fixation between the living bone and the surface of the implant installed. **Results:** According to the analyzed data, it was observed, along five years, a total of 434 implants placed in patients, mostly women in the mandibular region. However, the total loss was of 5 implants, most in the maxilla and in men, 3 of these, cone-Morse implants, one internal and one external hexagon. **Conclusion:** Thus, the success rate in the osseointegration implants seems to be more influenced by patient selection and surgical and prosthetic guidelines, compared the experience of the dentist.

### KEYWORDS

Dental implants; Oral rehabilitation; Retrospective study.

### RESUMO

**Objetivo:** Com os avanços científicos e tecnológicos, a expectativa de vida da população tem aumentado ao longo dos anos. Com o advento dos implantes dentários, uma nova possibilidade de tratamento para reabilitação oral foi criado para ajudar ou até mesmo superar os limites de próteses fixas convencionais, removíveis e até a total. Em comparação com o tratamento de reabilitação convencional em dentes naturais, reabilitação sobre implantes tem maiores taxas de sucesso e longevidade.

**Material e Métodos:** Para esta pesquisa foram avaliados os prontuários de pacientes que receberam tratamento cirúrgico para a colocação dos implantes no curso de atualização de Implantodontia da escola ECO (Estudos Continuados em Odontologia), em São José dos Campos, no período de 2008 a 2012, a fim de obter, analisar e relacionar os seguintes critérios: o sexo do paciente; ano e o número de implantes dentários instalados; a região de instalação do implante; a marca do implante instalado e a osteointegração bem sucedida, processo no qual há uma fixação rígida entre o osso vivo e a superfície do implante instalado. **Resultados:** De acordo com os dados analisados, verificou-se, ao longo de cinco anos, um total de 434 implantes colocados em pacientes, a maioria mulheres na região mandibular. No entanto, a perda total foi de 5 implantes, a maioria na maxila e nos homens, três deles, implantes cone-morse, um hexágono interno e dois externos. **Conclusão:** Assim, a taxa de sucesso dos implantes parece ser mais influenciada pela seleção do paciente e orientações cirúrgicas e protéticas, em comparação a experiência do dentista.

### PALAVRAS-CHAVE

Implantes dentários; Reabilitação oral; Estudo retrospectivo

## INTRODUCTION

Over the last three decades, the rapid knowledge growth associated with scientific and technological advances have imposed significant challenges in training of dentists. With the global trend of increased elderly population who are keeping the teeth [1,2], the demand for targeted therapies and services is also increasing, not only to ensure the oral and general health, but also to improve the quality of life. Thus the treatment with dental implants has developed significantly during the past two decades [3,4].

According to the Brazilian Institute of Geography and Statistics (IBGE, 2003) the life expectancy of Brazilians has increased from 62.6 years in 1980 to 71.3 years in 2003, consequently increasing the number of elderly and the burden of dental care for this population. The loss of teeth and the need for prosthetic rehabilitation are common characteristics of elderly patients [5,6].

In this sense, dental implants have become a desirable treatment option [7,8] due to the high success rates [9], the increased interest and acceptance of the patient [10,11], the conservation of adjacent tooth structure, and the preservation of the alveolar bone [9].

Success criteria established for single osseointegrated implant [12-16] have minimum success rate of 85% at 5 years and 80% at 10 years.

In addition to the increased demand for this type of treatment by the population, implantodontists, general dentists, and other dentists are planning and delivering treatment through this technique attempting to attend the awareness and meet the expectations of patients regarding their oral health and aesthetic [3]. The learning in academic settings is strongly related to how students are tested or examined. The assessment should therefore be integrated, coordinated, and reflect learning outcomes. As

a consequence of the knowledge obtained in undergraduation, resulting in DDS degree, the supply and demand of postgraduate courses have increased.

Therefore, this study aimed to evaluate retrospectively the osseointegration success rate of implants installed between 2008 and 2012, in the Update Course in dental implants, taught at the Center of Continuing Studies in Dentistry (ECO) in São José dos Campos, SP, Brazil.

## MATERIAL AND METHODS

The sample was composed by 204 files. The patients voluntarily sought treatment in the institution. All patients received implants for oral rehabilitation.

Inclusion criteria were the presence of complete data of patients receiving at least one implant, comprising: identification, medical history questionnaire, extraoral and intraoral examinations, filling in of the date, implant type, area of installation, surgical description, and patient's signature. Exclusion criteria for the study were incomplete medical records of patients undergoing the study treatment.

All cases used imaging and study casts for treatment planning. All implants were installed under local anesthesia, under professor's supervision, at the institution of the course. Students were trained dentists, but with little experience in the field of implant dentistry.

The professor chose the implant trademark, type, size, and location of insertion in accordance with the prior planning. Surgical templates were manufactured meeting the needs of each patient, either for maxilla or mandible.

### *Preoperative protocol*

All patients underwent surgery regardless of the number of implants placed or area. Prior to surgery, all patients underwent extra- and intraoral asepis. The pre-operative drug protocol was standardized, as follows:

1) Amoxicillin (500 mg) - 2 tablets 1 hour before surgery or clindamycin (300 mg) - 2 tablets 1 h before surgery (in cases of allergy to penicillin);

2) Decadron (4 mg) - 2 tablets 1 h before surgery;

#### Postoperative protocol

The postoperative drug protocol was as follows:

1) Amoxicillin (500 mg) - 1 capsule of every 8 h for 7 days or clindamycin (300 mg) - 1 tablet of every 8 h for 7 days (in cases of allergy to penicillin)

2) Profenid (200 mg) - 1 tablet daily for 3 days

3) Paracetamol (750 mg) - 1 tablet every 6 h in case of pain.

All inserted implants showed primary stability above 32 N.

All patients were examined postoperatively after 2 weeks. Six months after implant placement, patients were clinically and radiographically examined to start the prosthetic treatment.

We analyzed 204 files of patients seen and treated during the five years (2008-2012). The evaluations were performed by date of appointment from June to December of each of the study years. The evaluation criteria was composed by:

- age and gender of the patients
- year of implant installation;
- number of implants installed;
- area of installation;
- the implant system;
- osseointegration success
- emergency cases

## RESULTS

The success rate of implant osseointegration was obtained for the period of 5 years and for each year and displayed in tables. Most patients received an average of two implants. The following trademarks were used: Neodent® (Paraná / Brazil) and Sin® System implants (São Paulo / Brazil).

In total, 434 implants were installed: 289 in females and 145 in males. The mean age of patients was 50.27 years.

In 2008, a total of 22 patients (13 women and 9 men) were treated. These patients received 58 implants: 31 in the mandible and 27 in the maxilla. The average age of the patients was 50 years. No implant loss was reported in this year (Table 1).

In 2009, the total number of patients was higher (n = 39, 23 women and 16 men) and the mean age of patients was higher than that of 2008 (54.4 years). In total, 87 implants were installed

**Table 1** - Number, gender, and age of patients; area of installation, number, and loss of implants, per year

Year	N patients	Females	Males	Total number of implants	Maxilla	Mandible	Mean age	Loss
2008	22	13	9	58	27	31	50	0
2009	39	23	16	87	28	59	54.4	4
2010	44	30	14	91	36	55	47.3	0
2011	55	34	21	116	39	77	48.68	0
2012	44	22	12	82	42	40	51	1
2008 to 2012	204	122	72	434	172	262	50.27	5

(59 in the mandible and 28 in the maxilla). The evaluation of implant osseointegration showed 4 implant losses (Table 1).

In 2010, 44 patients were treated (30 women and 14 men), with lower mean age of patients than that of previous years (47.03 years). In total, 91 implants were installed (55 in the mandible and 36 in the maxilla). No implant was lost (Table 1).

In 2011, 55 patients were treated (34 women and 21 men), with lower mean age than those of 2008 and 2009, but higher than that of 2010 (48.68 years). In total, 116 implants were installed (77 in the mandible and 39 in the maxilla). No implant was lost (Table 1).

Finally, in 2012, a small number of patients were treated (n = 34, 22 women and 12 men), with average age of 51 years. In total, 82 implants were installed (40 in the mandible and 42 in the maxilla). One implant was lost (Table 1).

During the 5 year period, a total of 434 implants were installed, mostly in women, in the mandible. Five implants were lost during this period, mostly in maxilla and in men. Of these 5 losses, 3 were morse taper implants, one was internal hexagon implant, and one was external hexagon implant (Table 2). The confidence interval (CI) estimation of the implant loss prevalence of the sample (n = 204) was five losses (2.45%). Considering a 95% CI, the implant loss prevalence would range from 0.8% to 5.62% over five years.

## DISCUSSION

Although implant-supported prosthetic rehabilitation shows higher rates of success

and longevity [12], failures might occur. The osseointegration failures in implant-bone interface may occur before or after the prosthesis delivery with infection, delayed healing, and overload [17]. The early loss causes might be: overheating, infection and trauma during surgery, bone amount/quality, lack of immediate primary stability, and incorrect indication. On the other hand, late implant loss can occur due to peri-implantitis, occlusal trauma, and overload [18]. In this study, two losses occurred one year after the prosthesis delivery and one just after the prosthesis delivery, corroborating the literature. The reasons for two losses were not reported.

The success of any implant procedure depends on the relationship among many phenomena: biocompatibility of the material; implant macro- and microscopic surface; the area of installation; health (uninfected) and morphological context (bone quality); the surgical technique alone; the undisturbed healing phase; prosthetic design; prosthetic material used; patients' hygiene; and systemic factors [12,14,17].

In our study, we assessed the implant site and the patient's gender. The success rate of implants placed in the mandible (99.61%) without statistically significant differences from the maxilla (97.67%) was similar to that of other studies [19,20]. However, these results differ from studies of Jem T et al. [21] Adell R et al. [22] Susin C et al. [23] Lazzara RJ et al. [24] which show higher success rates in the maxilla. Considering the patient's gender, the percentage of success in women (99.18%) and in men (94.44%) was different from that

**Table 1** - Number, gender, and age of patients; area of installation, number, and loss of implants, per year

loss	year	Implants	Type	Area	Male/female	Time
1	2009	Neodent CM-Alvim	morse taper/taper	Maxilla	Man	After rehabilitation
1	2009	Sin SA 413(5)	external hexagon/cylindrical	Mandible	Man	Not reported
2	2009	Neodent Tit WS 5x5 (1)/ Tit CM 3.75x9	morse taper/ cylindrical	Maxilla	Man	one year after rehabilitation
1	2012	SIN-SW 4513	Internal hexagon/cylindrical-conical	Maxilla	woman	Not reported

of the study of Babbush CA e Shimura M [19], in which the highest percentage of success was reported in males. In all of these studies, although the authors consider the location of implant installation and the patient's gender, they did not report the possible causes of implant failures.

In addition to discussing the possible causes of osseointegration failure, this study also aimed to determine whether the professional experience would influence on the final outcome. Some authors believe that the limited clinical experience can be considered a risk factor for implant success [25]. However, studies comparing the outcome of implants placed by students or experts demonstrated high osseointegration success rates [26-28]. In this study, the success rate obtained from 2008 to 2012 by newly-graduate students was 98.84%, higher than that (95.2%) obtained in the private practice in the study of Ribeiro FS et al. [28]. Among prosthetic platforms and implant types used in this study, two were also present in the study of Ribeiro FS et al. [28]: external hexagon/cylindrical and internal hexagon/cylindrical-conical. In addition to the implant type, the average age of the patients can be compared. The average age of the study of Ribeiro FS et al. [28] was shorter (45.4 years) than that of the present study (50.27 years). The total implant loss of this present study was similar to that of the study of Nixon K et al. [29] (98.4%) in 1,000 implants placed at private practice. Accordingly, our study showed a satisfactory outcome, with small losses reported. The mean age of 50 years also represented the highest percentage in the study [29].

Thus, according to the results obtained, we agree with Melo M et al. [26]; Vidal R et al. [27]; Ribeiro FS et al. [28], because the dentist's experience was not a risk factor for implant failure.

## CONCLUSION

It was concluded that the success rate seems to be more influenced by patient selection

and surgical/prosthetic guidelines than by the dentist's experience.

**Conflicts of interest:** No conflicts of interest declared.

**Source of funding:** This research was carried out without funding.

## REFERENCES

1. Zitzmann NU, Hagmann E, Weiger R. What is the prevalence of various types of prosthetic dental restorations in Europe? *Clin Oral Implants Res.* 2007;18 Suppl 3:20–33.
2. Holm-Pedersen P, Lang NP, Muller F. What are the longevities of teeth and oral implants? *Clin Oral Implants Res* 2007;18 Suppl 3:15–9.
3. Lang NP, Pjetursson BE, Tan K, Bragger U, Egger M, Zwahlen M. A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years. II. Combined tooth-implant-supported FPDs. *Clin Oral Implants Res.* 2004;15(6):643–53.
4. Jung RE, Pjetursson BE, Glauser R, Zembic A, Zwahlen M, Lang NP. A systematic review of the 5-year survival and complication rates of implant-supported single crowns. *Clin Oral Implants Res.* 2008;19(2):119–30.
5. Haas R, Mensdorff-Pouilly N, Mulath G, Watzck G. Survival of 1920 IMZ implants followed for up to 100 months. *Int J Oral Maxillofac Implants.* 1996;11(5):581-8.
6. Leung WK, Ng DK, Jin L, Corbet EF. Tooth loss in treated periodontitis patients responsible for their supportive care arrangement. *J Clin Periodontol* 2006; 33(4):265-75.
7. Zarb GA. Introduction to osseointegration in clinical dentistry. *J Prosthet Dent.* 1983; 49(6): 824. [Section Research and Education]. Available from: [http://www.thejpd.org/article/0022-3913\(83\)90357-8/abstract](http://www.thejpd.org/article/0022-3913(83)90357-8/abstract)
8. Feine JS, Carlsson GE, Awad MA, Chehade A, Duncan WJ, Gizani S, et al. The McGill consensus statement on overdentures, Montreal, Quebec, Canada. May 24-25. *Int J Prosthodont.* 2002;15(4):413-4.
9. Schmitt A, Zarb Ga. The longitudinal clinical effectiveness of osseointegrated dental implants for single-tooth replacement. *Int J Prosthodont.* 1993;6(2):197-202.
10. American Dental Association. Survey reveals increase in dental implants over five-year period. Chicago: ADA; 2002. Available from: <http://www.webdentistry.com/Article457-spa.html>
11. Zarb GA, Schmitt A. The longitudinal clinical effectiveness of osseointegrated dental implants in anterior partially edentulous patients. *Int J Prosthodont* 1993;6(2):180–8.
12. Pjetursson BE, Tan K, Lang NP, Bragger U, Egger M, Zwahlen M. A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years I. Implant-supported FPDs. *Clin Oral Impl Res* 2004;15(6):625-42.
13. Tan K, Pjetursson BE, Lang NP. A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years III. Conventional FPDs. *Clin Oral Impl Res* 2004;15(6):654-66.

14. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria for success. *Int J Oral Maxillofac Implants*. 1986 Summer;1(1):11-25.
15. Smith DE, Zarb GA. Criteria for success of osseointegrated endosseous implants. *J Prosthet Dent*. 1989 Nov;62(5):567-72.
16. Spiekermann H. Atlas de implantodontia. Porto Alegre: Artes Médicas Sul; 2000. p.353-5.
17. Esposito M, Hirsch J, Lekholm U, Thomsen P. Differential Diagnosis and Treatment Strategies for Biologic Complications and Failing Oral Implants: A Review of the Literature. *Int J Oral Maxillofac Implants*. 1999;14(4):473-90.
18. Ko SM, Lee JK, Eckert SE, Choi YG. Retrospective multicenter cohort study of the clinical performance of 2-stage implants in South Korean populations. *Int J Oral Maxillofac Implants*. 2006;21(5):785-8.
19. Babbush CA, Shimura M. Five-year statistical and clinical observations with the IMZ two-stage osteointegrated implant system. *Int J Oral Maxillofac Implants*. 1993;8(3):245-53.
20. Lemmerman KJ, Lemmerman NE. Osseointegrated dental implants in private practice: a long-term case series study. *J Periodontol*. 2005 Feb;76(2):310-9.
21. Jem T, Lekholm B, Adell R. Osseointegrated implants in the treatment of partially edentulous patients: A preliminary study in 876 consecutively placed fixtures. *Int J Oral Maxillofac Implants*. 1989 Fall;4(3):211-7.
22. Adell R, Lekholm B, Rockler B, Branemark, PI. A 15 year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg*. 1981;10(6):387-416.
23. Susin C, Haas SC, Opermann RV, Albandar JM. Tooth loss in young population from south Brazil. *J Public Health Dent*. 2006;66(2):110-5.
24. Lazzara R, Siddiqui AA, Binon P, Feldman SA, Weiner R, Phillips R, et al. Retrospective multicenter analysis of 3i dental implants placed over a 5 year period. *Clin Oral Implants Res*. 1966;7(1):73-83.
25. Sennerby L, Roos J. Surgical determinants of clinical success of osseointegrated oral implants: a review of the literature. *Int J Prosthodont*. 1998;11(5):408-20.
26. Melo M, Shafie H, Obeid G. Implant survival rates for oral and maxillofacial surgery residents: A retrospective clinical review with analysis of resident level of training on implant survival. *J Oral Maxillofac Surg*. 2006;64(8):1185-9.
27. Vidal R, Greenwell H, Hill M, Papageorgakopoulos G, Scheetz JP. Success rate of immediate implants placed and restored by novice operators. *Implant Dent*. 2010;19(1):81-90.
28. Ribeiro FS, Pontes AEF, Marcantonio E, Piattelli A, Boeck Neto RJ, Marcantonio Jr E. Success rate of immediate nonfunctional loaded single-tooth implants: immediate versus delayed implantation. *Implant Dent*. 2008 Mar;17(1):109-17.
29. Nixon KC, Chen ST, Ivanovski S. A retrospective analysis of 1000 consecutively placed implants in private practice. *Aust Dent J*. 2009 Jun;54(2):123-9.

**Michelle Bianchi Moraes  
(Corresponding address)**

Av. Eng. Francisco José Longo, nº 777 Jardim São Dimas  
12245-000 - São José dos Campos, SP  
Department of Diagnosis and Surgery – School of  
Dentistry – Institute of Science and Technology – UNESP  
– Univ Estadual Paulista

Date submitted: 2015 Jul 07

Accept submission: 2015 Dec 08