

Journal section: *Implantology*
Publication Types: *Review*

doi:10.4317/medoral.26633

Retrospective study of a serie of pterygoid implants

Pablo Cea-Arestín ¹, Arturo Bilbao-Alonso ², Marta Hernández-DeOliveira ³

¹ ORCID ID: 0000-0002-0655-0412. Associate. Department of Surgery and Medical-Surgical Specialties, School of Medicine and Dentistry, University of Santiago de Compostela, Santiago de Compostela, Galicia, Spain

² ORCID ID: 0000-0002-3224-1007. MD, PhD, PhD, OMS. Maxillofacial Surgery Service, Santiago de Compostela Hospital Complex (CHUS), Galician Health Service (SERGAS). ZAGA Center A Coruña and Lugo, Galicia, Spain

³ Emeritus professor. Department of Surgery. University Complutense of Madrid, Madrid, Spain

Correspondence:

Department of Surgery and Medical-Surgical Specialties
School of Medicine and Dentistry University of Santiago de Compostela (USC)
Santiago de Compostela, Spain
pablo.cea@rai.usc.es

Received: 18/03/2024
Accepted: 29/04/2024

Please cite this article in press as: Cea-Arestín P, Bilbao-Alonso A, Hernández-DeOliveira M. Retrospective study of a serie of pterygoid implants. *Med Oral Patol Oral Cir Bucal*. 2024. doi:10.4317/medoral.26633

Abstract

Background: This article aspires to show that pterygoid implants are a magnificent and viable alternative to other posterior implants of the maxilla, especially in cases of atrophy.

Material and Methods: This study is based on a retrospective analysis of pterygoid implant data from 2003 to 2023, recollecting the following variables: year of placement, location, shape of the implant, diameter of the implant, length of the implant, torque of the implant, whether or not it was post-extraction, whether or not there was immediate loading, whether or not smoking was present (smoking habit), the brand of the implant and the success/survival or failure/non survival of the implant.

Results: The total of 178 pterygoid implants placed in the 113 patients eligible for the study was analysed by sub-groups, with percentage of global success of 98.3% (3 failures).

Conclusions: Pterygoid implants offer biomechanical and success/survival characteristics similar or superior to the so-called conventional implants and avoid a series of surgical and prosthodontic procedures more difficult than the ones required by other implants in many occasions.

Key words: *Pterygoid, implants, maxilla, atrophy.*

Introduction

Although the rehabilitation of oral architecture and function with implants is a predictable process and with a high percentage of long-term success, sometimes we have to resort to more heterodox sites to position them. This is the case of atrophic maxilla, for which an im-

plantation in the pterygoid process is proposed. This is a challenge due to the anatomy of the area, the risk factors, the biomechanical implications and the few studies that exist in this regard (1,2), reasons why we put this research as necessary.

Pterygoid implants are those placed through the max-

illary tuberosity, the pyramidal process of the palatine bone and the pterygoid process of the sphenoid bone (3-4). Thus, in the glossary of Oral and Maxillofacial Implants (GOMI) this kind of implants are defined as "implant placed through the maxillary tuberosity and into the pterygoid plate" (1).

Anatomically, the pterygoid process is determined by measures of 15 mm, although the angulation of the tuberopyramid-ptyerygoid column varies depending on whether it is a dentulous or edentulous maxilla. In dentulous maxilla, the angulation is 76,5° mesio-distal and 17,2° buco-palatal respect to the Frankfurt plane; while in edentulous maxilla, the angulation is 67,3° mesio-distal and 14,1° buco-palatal respect to the Frankfurt plane (5). Likewise, it's spatial position and it's relationship with pterygoid venous plexus, major palatine artery, internal maxillary artery and anterior palatine nerve should be taken into account (6).

For the positioning of a pterygoid implant, the Tulasne surgical technique is used, consisting in a midcrestal incision in the pterygomaxillary region with a vertical releasing incision mesial to homolateral canine with a full-thickness mucoperiosteal buccal flap (7). The inclination of the implant in relation to the pterygomaxillary area will be 30-55° with apico-palatine direction (8-9), although other studies speak of it's more verticalized implementation (10).

The indications of this type of implants would be: to avoid grafts in atrophic maxillas (1) and thus be able to carry out rehabilitation in a shorter time (11-14), to avoid cantilever prostheses and provide biomechanical stability (1,14-18), as an aid to short implants and zygomatic implants, and also as a rescue technique (2).

On the other hand, it's contraindications would be the lack of bone in the pterygomaxillary area plus the same as in the conventional implants. However, they present other difficulties: surgical due to the anatomy of the area, reduced space, inclination/angulation and prosthodontic. Possible complications should also be considered, such as: bleeding from the palatine artery, pterygoid venous plexus haemorrhage, absence of primary stability/migration, trismus, infection and paresthesia. However, only minor complications have been reported therefore is a safe insertion zone (1,18-20).

Continuing with their delimitation, they offer the advantages of: reduced treatment time (14,16,21), no need for donor area, no use of biomaterials, good primary stability and better resistance to forces than conventional implants (17), possibility of immediate loading (14,16,22-23), high predictability (21), lower morbidity (22-24), lower economic cost of treatment (24), and the degree of patient satisfaction is very high (in position, functionality, aesthetics, hygiene and speech terms (11-12,14,16-17,21).

Material and Methods

This study is based on a retrospective analysis of pterygoid implant data. These implants and data have been carried out and acquired in a private clinic in Santiago de Compostela, capital of Galicia, autonomous region of Spain, southern-western Europe, from 2003 to 2023.

Data collected have been compared with those of other studies, being the inclusion criterion that they have to deal with pterygoid implants, excluding the other types of posterior maxillary implants.

Participants were all subjects who had been fitted with pterygoid implants over the years, with all other types of implants placed excluded. Other criteria for the filter were not taken into account. All gave their written consent and were guaranteed the use of their data anonymously for the research in question.

The variables used were: year of placement, location, shape of the implant, diameter of the implant, length of the implant, torque of the implant, whether or not it was post-extraction, whether or not there was immediate loading, whether or not smoking was present (smoking habit), the brand of the implant and the success/survival or failure/non survival of the implant.

The data sources were the medical records of the patients who entered the study and the data collection was effected in the private practice where the positioning of the implants was carried out.

A sample size was obtained from 113 patients with a total of 178 pterygoid implants.

The coding, mechanization and statistical analysis of the data was executed using the computer and mathematical tool of Excel.

All ethical, health, medical-legal, data processing and administrative aspects were complied based on current provisions.

Results

The total of 178 pterygoid implants placed in the 113 patients eligible for the study was analysed as follows: percentage of global success, percentage of success at 7 years or more, percentage of success at 5 years or more and less than 7 years, percentage of success at 3 or more years and less than 5 years, percentage of success at less than 3 year, diameter, length, shape, torque, if it was post-extraction or not, if it received immediate load or not, smoking habit (yes, no, ex-smoker), location in the maxilla (right, left) and brand of pterygoid implants. And, among those that fail, common factors were sought by examining all the parameters available. Straightaway, results are presented in detail by subgroups in text and in Tables 1, Table 2, Table 3 and Table 4.

Table 1: Implant data by periods.

Period	Pterygoid implants under study	Success	Failure	Percentage of success (%)
Entire period of study 2003-2023	178	175	3	98.3
With 7 or more years of study 2003-2016	81	79	2	98.8
With 5 to 7 years (with 5 years not included) 2016-2018	54	53	1	98.2
With 3 to 5 years (with 3 years not included) 2018-2020	38	38	0	100
With less than 3 years 2020-2023	5	5	0	100

Table 2: Most commonly implant features.

Feature	Quantity from the overall	Percentage from the overall (%)
Most commonly used implant diameter: 4 mm	90	50.6
Most commonly used implant length: 16 mm	108	60.7
Most commonly used form of implant: conical	146	82
Implant torque: between more than 40 and 60 N/cm	100	100

Table 3: Post-extraction and immediate load data.

Feature	Yes (% from overall)	No (% from overall)
Post-extraction	44 (24.7)	134 (75.3)
Immediate load	23 (12.9)	155 (87.1)

Table 4: Implant brand data.

Implant brand	Number from overall	Percentage from overall (%)
Lasak BioniQ	90	50.5
Straumann	40	22.4
BioHorizons	20	11.2
Nobel Biocare	13	7.3
Zimmer Biomet	9	5.0
Astra Tech	4	2.1
Trinon Q	3	1.5

Discussion

The results obtained in our study on a large sample of pterygoid implants suggest their power by providing a high success in relation to their use, being able to report that they have the same or better success rates than other types of implants (17-18,20,25-27).

Comparing our data with those of other papers dealing with pterygoid implants, we see that the success rates are similar between studies (98.3% for our data), with the advantage that in our research we have a large sample (178 pterygoid implants analysed) in relation to most

of the studies analysed.

Following with the theme, data from other studies with which the comparison was made are provided, where the success of pterygoid implants, understood as their survival, was in the range of 80% to 99% (1,3,12-16,19-21,28-33). If we stop at two of the most recent, they provide a success/survival rate of 94.87% (20) and 96.45 (21).

Despite the limitations of the study, such as the contribution of a greater number of variables (as, for example, more toxic habits involved) or larger sample size (1), the

placement of pterygoid implants is a very good option in certain cases such as the atrophic postero-superior maxilla (1,11,14) due to its good primary stability (16), very high success with minimal complications (17) and good acceptance by patients (33). In statements about pterygoid implants extracted from The American College of Prosthodontists “implants in the pterygoid region offer a scientifically validated and predictable treatment option”.

Conclusions

This study aims to show that pterygoid implants are a magnificent and viable alternative to other posterior implants of the maxilla, especially in cases of atrophy. Pterygoid implants offer biomechanical and success/survival characteristics similar or superior to the so-called conventional implants and avoid a series of surgical and prosthodontic procedures more difficult than the ones required by other implants in many occasions.

Acknowledgement

Declared none.

Institutional Review Board Statement

No authorization was required but the article is in law with Helsinki Declaration and all the patients signed an informed consent about their participation and publication of the data obtained.

Author Contributions

Study conception and design:

Arturo Bilbao Alonso, Pablo Cea Arestín

Acquisition of data:

Arturo Bilbao Alonso, Pablo Cea Arestín

Analysis and interpretation of data:

Pablo Cea Arestín, Arturo Bilbao Alonso, Marta Hernández De Oliveira

Drafting of manuscript and/or critical revision:

Pablo Cea Arestín, Arturo Bilbao Alonso, Marta Hernández De Oliveira

Final approval and guarantor of manuscript:

Pablo Cea Arestín, Arturo Bilbao Alonso, Marta Hernández De Oliveira

Funding

None.

Conflict of interest

The authors declare no conflict of interest, financial or otherwise.

References

- Bidra AS, Huynh-Ba G. Implants in the pterygoid region: a systematic review of the literature. *Int J Oral Maxillofac Surg.* 2011;40:773-81.
- Loewenstein AG, Bidra AS, Balshi TJ. Management of Maxillary Cluster Implant Failures with Extra-Maxillary Implants: A Clinical Report. *J Prosthodont.* 2020;29:369-73.
- Graves SL. The pterygoid plate implant: a solution for restoring the posterior maxilla. *Int J Periodontics Restorative Dent.* 1994;14:512-23.
- Lee SP, Paik KS, Kim MK. Anatomical study of the pyramidal process of the palatine bone in relation to implant placement in the posterior maxilla. *J Oral Rehabil.* 2001;28:125-32.
- Yamaura T, Abe S, Tamatsu Y, Rhee S, Hashimoto M, Ide Y. Anatomical study of the maxillary tuberosity in Japanese men. *Bull Tokyo Dent Coll.* 1998;39:287-92.

kyo Dent Coll. 1998;39:287-92.

6. Turvey TA, Fonseca RJ. The anatomy of the internal maxillary artery in the pterygopalatine fossa: its relationship to maxillary surgery. *J Oral Surg.* 1980;38:92-5.

7. Agliardi EL, Tetè S, Romeo D, Malchiodi L, Gherlone E. Immediate function of partial fixed rehabilitation with axial and tilted implants having intrasinus insertion. *J Craniofac Surg.* 2014;25:851-5.

8. Fernández Valerón J, Fernández Velázquez J. Placement of screw-type implants in the pterygomaxillary-pyramidal region: surgical procedure and preliminary results. *Int J Oral Maxillofac Implants.* 1997;12:814-9.

9. Nocini PF, Albanese M, Fior A, De Santis D. Implant placement in the maxillary tuberosity: the Summers' technique performed with modified osteotomes. *Clin Oral Implants Res.* 2000;11:273-8.

10. Venturelli A. A modified surgical protocol for placing implants in the maxillary tuberosity: clinical results at 36 months after loading with fixed partial dentures. *Int J Oral Maxillofac Implants.* 1996;11:743-9.

11. Balshi TJ, Lee HY, Hernandez RE. The use of pterygomaxillary implants in the partially edentulous patient: a preliminary report. *Int J Oral Maxillofac Implants.* 1995;10:89-98.

12. Balshi TJ, Wolfinger GJ, Balshi SF 2nd. Analysis of 356 pterygomaxillary implants in edentulous arches for fixed prosthesis anchorage. *Int J Oral Maxillofac Implants.* 1999;14:398-406.

13. Balshi SF, Wolfinger GJ, Balshi TJ. Analysis of 164 titanium oxide-surface implants in completely edentulous arches for fixed prosthesis anchorage using the pterygomaxillary region. *Int J Oral Maxillofac Implants.* 2005;20:946-52.

14. Peñarrocha M, Carrillo C, Boronat A, Peñarrocha M. Retrospective study of 68 implants placed in the pterygomaxillary region using drills and osteotomes. *Int J Oral Maxillofac Implants.* 2009;24:720-6.

15. Vrielinck L, Politis C, Schepers S, Pauwels M, Naert I. Image-based planning and clinical validation of zygoma and pterygoid implant placement in patients with severe bone atrophy using customized drill guides. Preliminary results from a prospective clinical follow-up study. *Int J Oral Maxillofac Surg.* 2003;32:7-14.

16. Curi MM, Cardoso CL, Ribeiro Kde C. Retrospective study of pterygoid implants in the atrophic posterior maxilla: implant and prosthesis survival rates up to 3 years. *Int J Oral Maxillofac Implants.* 2015;30:378-83.

17. Balaji VR, Lambodharan R, Manikandan D, Deenadayalan S. Pterygoid Implant for Atrophic Posterior Maxilla. *J Pharm Bioallied Sci.* 2017;9:S261-3.

18. Dryer RR, Conrad HJ. Displacement of a Dental Implant into the Pterygoid Fossa: A Clinical Report. *J Prosthodont.* 2019;28:1044-6.

19. Valerón JF, Valerón PF. Long-term results in placement of screw-type implants in the pterygomaxillary-pyramidal region. *Int J Oral Maxillofac Implants.* 2007;22:195-200.

20. Araujo RZ, Santiago Júnior JF, Cardoso CL, Benites Condezo AF, Moreira Júnior R, Curi MM. Clinical outcomes of pterygoid implants: Systematic review and meta-analysis. *J Craniofac Surg.* 2019;47:651-60.

21. Fernández-Valerón JR, Fernández-Carreras J, Valerón PF. Results of Total Maxillary Edentulism Rehabilitation Protocol with Implant-Supported Protheses in the Pterygomaxillary-Pyramidal Region as Posterior Anchorage Loci. *Int J Oral Maxillofac Implants.* 2020;35:767-72.

22. Balshi TJ. Single, tuberosity-osseointegrated implant support for a tissue-integrated prosthesis. *Int J Periodontics Restorative Dent.* 1992;12:345-57.

23. Balshi TJ, Wolfinger GJ. Teeth in a day for the maxilla and mandible: case report. *Clin Implant Dent Relat Res.* 2003;5:11-6.

24. Bahat O. Brånemark system implants in the posterior maxilla: clinical study of 660 implants followed for 5 to 12 years. *Int J Oral Maxillofac Implants.* 2000;15:646-53.

25. Goiato MC, dos Santos DM, Santiago JF, Jr Moreno A, Pellizzer EP. Longevity of dental implants in type IV bone: a systematic review. *Int J Oral Maxillofac Surg.* 2014;43(9):1108-16.

26. Lopes LF, da Silva VF, Santiago JF Jr, Panzarini SR, Pellizzer

- EP. Placement of dental implants in the maxillary tuberosity: a systematic review. *Int J Oral Maxillofac Surg.* 2015;44:229-38.
27. Moraschini V, Poubel LA, Ferreira VF, Barboza Edos S. Evaluation of survival and success rates of dental implants reported in longitudinal studies with a follow-up period of at least 10 years: a systematic review. *Int J Oral Maxillofac Surg.* 2015;44:377-88.
28. Balshi TJ, Wolfinger GJ, Slauch RW, Balshi SF. Brånemark system implant lengths in the pterygomaxillary region: a retrospective comparison. *Implant Dent.* 2013;22:610-12. doi:10.1097/ID.0b013e3182a5d181
29. Linkow LI. Maxillary pterygoid extension implants: the state of the art. *Dent Clin North Am.* 1980;24:535-51.
30. Bahat O. Osseointegrated implants in the maxillary tuberosity: report on 45 consecutive patients. *Int J Oral Maxillofac Implants.* 1992;7:459-67.
31. Krekmanov L. Placement of posterior mandibular and maxillary implants in patients with severe bone deficiency: a clinical report of procedure. *Int J Oral Maxillofac Implants.* 2000;15:722-30.
32. Ridell A, Gröndahl K, Sennerby L. Placement of Brånemark implants in the maxillary tuber region: anatomical considerations, surgical technique and long-term results. *Clin Oral Implants Res.* 2009;20:94-8.
33. Candel E, Peñarrocha D, Peñarrocha M. Rehabilitation of the atrophic posterior maxilla with pterygoid implants: a review. *J Oral Implantol.* 2012;38:461-66.