Journal section: Oral Surgery
Publication Types: Review

Implant platform switching concept: An updated review

Laura López-Marí [1], Jose Luis Calvo-Guirado [2], Beatriz Martín-Castellote [1], Gerardo Gomez-Moreno [3], Marta López-Marí [4]

[1] Postgraduate Student of Master in Implant Dentistry, Faculty of Medicine and Dentistry University of Murcia. Spain
[2] Senior Lecturer of General Dentistry. Chairman and Head Lecturer of Implant Dentistry, Faculty of Medicine and Dentistry, University of Murcia, Spain
[3] Senior Lecturer of Special Care Patients. Faculty of Dentistry, University of Granada, Spain
[4] Dental Student, Faculty of Dentistry, University of Valencia, Spain

Correspondence:
Mozart Nº 1, 1º G
Murcia, Spain, 30002
laura_mediser@hotmail.com

Received: 09/11/2008
Accepted: 16/03/2009

López-Marí L, Calvo-Guirado JL, Martín-Castellote B, Gomez-Moreno G, López-Marí M. Implant platform switching concept: An updated review. Med Oral Patol Oral Cir Bucal. 2009 Sep 1;14 (9):e450-4.
http://www.medicinaoral.com/medoralfree01/v14i9/medoralv14i9p450.pdf

Article Number: 2549 http://www.medicinaoral.com/
© Medicina Oral S. L. C.I.F. B 96689336 - pISSN 1698-4447 - eISSN: 1698-6946
eMail: medicina@medicinaoral.com
Indexed in:
-SCI EXPANDED
-JOURNAL CITATION REPORTS
-Index Medicus / MEDLINE / PubMed
-EMBASE, Excerpta Medica
-SCOPUS
-Indice Médico Español

Abstract

Purpose: To review published articles dealing with platform switched implants in order to assess survival rates and clarify their influence both on marginal bone loss around the cervical region of the implant and on soft tissue aesthetics.
Material and Methods: PubMed and GallileUM databases were used to identify any studies or clinical cases involving implant platform switching published between January 2000 and August 2008. Studies both of human beings and animals were reviewed whenever they included the relevant implant diameter, length, surface and connection data.
Results: Twelve studies of platform switching in humans (75%) and in animal models (25%) were evaluated. Mean implant length was found to be 11.66 ± 0.2 SD mm and mean diameter was 4.9± 0.52 SD mm.
Conclusion: It was shown that platform switching helps to prevent crestal bone loss after implant placement and helps obtain satisfactory aesthetic results.

Key words: *Platform switching, crestal bone loss, biologic width, immediate loading, immediate provisionalization, immediate implants, crestal bone remodeling, bone implant contact (BIC).*

Introduction

There is a range of factors involved in achieving a good aesthetic result with implants. The correct positioning of the implant is one of the most important, together with establishing the optimum volume of hard and soft tissues. The optimal position is at the center of the tooth to be replaced, 1.5 to 2.0 mm to palatal which, over time, ensures the maintenance of the buccal bone margin and mucosa margin stability. The platform switching technique consists of using 5mm standard implants with 4 mm abutment diameters which has been found to keep interproximal bone height stable after a year (1).

One study has suggested that countersinking procedure during implant placement, implant loading and stress concentration on the cortical plate could be responsible for bone remodeling (2).

Several published studies have shown that crestal bone loss occurs following implant placement and its connection to the abutment. (1,2) Lazzara explained that bone loss has vertical and horizontal components within what is considered a normal loss–a loss of between approximately 1.5 and 2 mm down to the first thread during the first year of loading (3).

Others studies indicate that such remodeling is the result of localized inflammation of soft tissue at the implant-abutment junction (microgap), as a biological seal becomes established (4,5). Once the biologic width has been established, the soft tissue takes on a protective function of the crestal bone. This situation has important consequences for the aesthetics of the interdental papilla which can suffer mesial and distal bone loss of around 0.07 mm after a 6 month follow-up period (6).

Platform switching concept

The platform switching concept was developed to control bone loss after implant placement; it refers to the use of an abutment of smaller diameter connected to a implant neck of larger diameter; this connection shifts the perimeter of the implant-abutment junction inwards towards the central axis (the middle of the implant) improving the distribution of forces (3, 6-7).

Degidi et al. 2007, explained that when the horizontal relationship between the outer edge of the implant and a smaller-diameter component ("platform switching") is altered, a reduction to crestal bone loss occurs (8). Furthermore, immediate loading allows improved functional and aesthetic rehabilitation (9).

Material and Methods

Literature involving platform switching implants was sourced using the PubMed and GalileUM databases. A total of nineteen texts were evaluated but only sixteen of them were used for this review as the other three did not include sufficient data for our purposes.

Inclusion Criteria

Human studies, both of males and females, aged over 17 years, using hexed implants, with immediate placement in fresh extraction sockets, with or without immediate provisionalization; experimental studies of animals with a minimum follow-up of one month and 3D finite element models simulating implants and surrounding bone.

Exclusion Criteria

Those papers for which only the abstract was available (incomplete information).

Studies with no results.

No indexed manuscripts.

Results

Data drawn from the twelve articles was reviewed (Fig.1). Most of the studies of platform switching were carried out on human subjects (75%) but 25% used animal models (Fig.1).

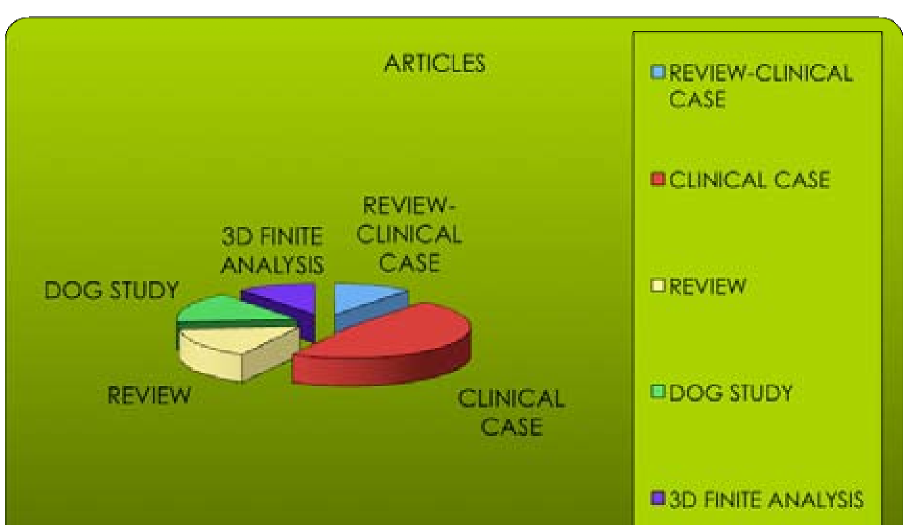

Fig. 1. Review of platform switching manuscripts.

Table 1. Authors' follow-up of platform switching technique.

Author	Marginal Bone Loss	Follow-up	Success Rate	Implant Length	Implant Diameter	Surface	Connection	Type of Implant	Nº Im-plants	Human/ Animal
Baumgarten, 2005	no data	2 months	no data	13 mm	5 mm	osseotite	internal	certain prevail	2	human
Gardner, 2005	1.3-1.4 mm	4 months	no data	13 mm	5 mm	osseotite	internal	certain	1	human
Vela-Nebot, 2006	Mesial 0.76 mm. Distal 0.77 mm	6 months	no data	10, 11.5, 13, 15 mm	5 mm	osseotite	internal	certain	60	human
Calvo Guirado, 2007	0.05-0.07 mm	6 months	100%	13, 15 mm	4/5/4 mm -5/6/5 mm	osseotite	internal	certain prevail	10	human
Canullo L, 2007	0.78 ± 0.36 mm	22 months	no data	no data	6 mm	no data	no data	standard	10	human
Becker, 2007	0.52±0.5 mm	3 years	94.4%	11 mm	5 mm	CAM_CPS	internal	camlog	54	animal
Hermann, 2007	no data	no data	no data	no data	no data	not specified	internal	revois	1	human
Degidi, 2007	no resorption	1 month	no data	8 mm	3.5 mm	sla	internal	straumann	3	human
Hurzeler, 2007	0.12±0.40 mm	12 months	100%	no data	4 mm- 5 mm	osseotite	internal	certain	22	human
Weiner, 2008	no data	6 months	no data	8 mm	4 mm	laserlock	internal	biolock	36	animal
Calvo-Guirado, 2008	0.6 mm	16 months	99.1 %	13-15 mm	4/5/4 mm -5/6/5 mm	osseotite	internal	certain prevail	105	human
Sarment et cols, 2008	no data	no data	no data	no data	no data	osseotite	internal	std/wide/xp	60	animal

Mean implant length was 11.66 ± 0.2 SD mm and the mean diameter was 4.9± 0.52 mm. All studies had internal connection with one exception, Canullo et al. 2007, whose dimensions were not specified (10). Four different implant surfaces were evaluated in the studies, osseotite (58%), CAM-CPS (CAM,sand blasted and acid etched, screw type implants, CPS, smaller diameter healing abutments) (12 %), SLA (20 %) and Laserlock (10%). The type of implant varied from study to study (Certain Prevail, certain, standard, camlog, revois, straumann, biolock, std/wide/xp). Sample sizes varied between 1 and 105 implants (the mean number of implants was 30.3± 1.3) and follow-up periods varied from 1 to 36 months (mean follow-up 11.1 months). The minimal marginal bone loss registered was 0.05-0.07 mm and the maximum was 1.3-1.4mm. (2, 6-16) (Table 1).
Three of the manuscripts used dog models and revealed crestal bone changes, (11) the formation of a peri-implant cuff significantly higher in expanded platform implants (height= 1.4 mm, width=2.8mm), greater attachment to the bone and the development of biologic width (12,13).
Maeda et al. used 3D finite element models, noting that when connecting an abutment of smaller diameter, the stress level in the cervical region is reduced compared with abutments of regular diameter. This shows that platform switching shifts the area where stress is concentrated away from the cervical bone implant interface, whilst stress increases in the abutment or abutment screw (7).
The last nine texts described clinical studies and these proved more useful for the purposes of this review. All of the authors agree with the fact that firstly, the main bone loss is observed during the first month after oral exposure and secondly, that the reduction in bone loss is much lower in all those cases in which platform geometry is modified resulting in a better aesthetic outcome.
Some studies specified both mesial and distal bone loss, which varied between 0.05-1.5 mm at the mesial plate and 0.06-1.5 mm at the distal plate. Most used Osseotite Certain Prevail implants, with lengths varying from 8.5 to 15 mm and diameters from 4 to 6 mm. (4,6).

Discussion

Clinical studies in human beings

Hermann et al. reviewed biologic width, platform switching, implant design in the cervical region, nanoroughness, fine threads, insertion depths, abutment design and avoidance of microlesions in the periimplant soft tissue as factors that determine the preservation of crestal bone levels. He explains that these factors along with several others, determine the aesthetic outcomes of implant restorations (2).
Vela-Nebot et al. concludes that platform switching improves aesthetic results and that when invasion of the biologic width is reduced, bone loss is reduced ($p<0.0005$). However, he says that further microbiological, pathological and clinical studies are necessary to confirm both these results as well as the study's working hypothesis (4).
Lazzara et al. discovered that during a thirteen year radiographic periapical observation period of wider implants with reduced abutments, improved crestal bone preservation was revealed, but it was thought that further investigation is needed to prove the real advantages of this technique (3).
Baumgarten et al. describes the platform switching technique and its usefulness in situations where shorter implants must be used, where implants are placed in aesthetic zones, and where a larger implant is desirable but prosthetic space is limited. He believes that a sufficient tissue depth (approximately 3 mm or more) is necessary to accommodate an adequate biologic width. He states that platform switching helps prevent the anticipated bone loss and also preserves crestal bone; he cites a particular case report as the basis of his theory (5).
Gardner discusses the literature dealing with the changes that occur when an implant is placed in bone and he presents a case study using platform switching implants. He states that its main advantage is that it is an effective way to control circumferential bone loss around dental implants but he concludes that platform switching needs further investigation. Furthermore, he notes several potential disadvantages of this procedure such as the need for components that have similar designs (the screw access hole must be uniform) and the need for enough space to develop a proper emergence profile (1).
In his article "Platform switching with a new implant design", 2007, Calvo Guirado et al. notes the success of the placed implants after eight months with minimal marginal resorption (less than 0.8 mm) and highly satisfactory aesthetic results (6).
In their prospective study, Hürzeler et al. revealed that although bone remodelling is encountered during the first year after the final restoration with platform switching implants, there are significant differences compared to non-platform switching implants. In his opinion, a larger number of patients should be studied to confirm these results (14).
Degidi et al. evaluated the histology and histomorphology of three morse cone connection implants in a real case report and he explains that when there is zero microgap and no micromovement, platform switching shows no resorption. He also observes that this method provides better aesthetic results (8).
Canullo et al. is in favour of platform switching and he evaluates the relation between immediate loading with these implants and its effects on soft and hard tissues (10).

Esposito et al. tests different flap designs in order to determine which are the best techniques for soft tissue handling but he does not specify the implant system utilized (15).

Animal studies

In his histomorphometric study in dogs, Becker et al. concluded that twenty eight days after implant placement, both CAM (sand blasted and acid etched screw type implants with either matching) and CPS (smaller diameter healing abutments) revealed crestal bone level changes but he found no significant differences between them. He thinks that further studies with a higher number of animals and implant sites are needed in order to clarify the influence of platform switching on crestal bone changes (11).

Weiner et al. connects the development of biologic width with the implant surface. He does not mention platform switching but focuses his study on the use of shift tissue-engineered collars with microgrooving (13).

Sarment et al. is found some changes in the width and height of bone when using platform switching implants (12).

3d Finite element studies

Maeda et al. utilized a 3D finite element model to examine the biomechanical advantages of platform switching. He notes that this procedure shifts the stress concentration away from the bone-implant interface, but these forces are then increased in the abutment or the abutment screw (7).

Conclusion

Having reviewed the available literature, we have reached the conclusion that platform switching is capable of reducing or eliminating crestal bone loss to a mean of 1.56 mm ± 0.7 mm. It also contributes to maintaining the width and height of crestal bone and the crestal peak between adjacent implants and it also limits the circumferential bone loss.

We conclude that the implant design modifications involved in platform switching offer multiple advantages and potential applications, which include situations where a larger implant is desirable but the prosthetic space is limited and in the anterior zone where preservation of the crestal bone can lead to improved aesthetics.

References

1. Gardner DM. Platform switching as a means to achieving implant esthetics. N Y State Dent J. 2005;71:34-7.
2. Hermann F, Lerner H, Palti A. Factors influencing the preservation of the periimplant marginal bone. Implant Dent. 2007;16:165-75.
3. Lazzara RJ, Porter SS. Platform switching: a new concept in implant dentistry for controlling postrestorative crestal bone levels. Int J Periodontics Restorative Dent. 2006;26:9-17.
4. Vela-Nebot X, Rodríguez-Ciurana X, Rodado-Alonso C, Segalà-Torres M. Benefits of an implant platform modification technique to reduce crestal bone resorption. Implant Dent. 2006;15:313-20.
5. Baumgarten H, Cocchetto R, Testori T, Meltzer A, Porter S. A new implant design for crestal bone preservation: initial observations and case report. Pract Proced Aesthet Dent. 2005;17:735-40.
6. Calvo Guirado JL, Saez Yuguero MR, Pardo Zamora G, Muñoz Barrio E. Immediate provisionalization on a new implant design for esthetic restoration and preserving crestal bone. Implant Dent. 2007;16:155-64.
7. Maeda Y, Horisaka M, Yagi K. Biomechanical rationale for a single implant-retained mandibular overdenture: an in vitro study. Clin Oral Implants Res. 2008;19:271-5.
8. Degidi M, Iezzi G, Scarano A, Piattelli A. Immediately loaded titanium implant with a tissue-stabilizing/maintaining design ('beyond platform switch') retrieved from man after 4 weeks: a histological and histomorphometrical evaluation. A case report. Clin Oral Implants Res. 2008;19:276-82.
9. Calvo Guirado JL, Ortiz Ruiz AJ, Gómez Moreno G, López Marí L, Bravo González LA. Immediate loading and immediate restoration in 105 expanded-platform implants via the Diem System after a 16-month follow-up period. Med Oral Patol Oral Cir Bucal. 2008;13:E576-81.
10. Canullo L, Rasperini G. Preservation of peri-implant soft and hard tissues using platform switching of implants placed in immediate extraction sockets: a proof-of-concept study with 12- to 36-month follow-up. Int J Oral Maxillofac Implants. 2007;22:995-1000.
11. Becker J, Ferrari D, Herten M, Kirsch A, Schaer A, Schwarz F. Influence of platform switching on crestal bone changes at non-submerged titanium implants: a histomorphometrical study in dogs. J Clin Periodontol. 2007;34:1089-96.
12. Sarment DP, Meraw SJ. Biological space adaptation to implant dimensions. Int J Oral Maxillofac Implants. 2008;23:99-104.
13. Weiner S, Simon J, Ehrenberg DS, Zweig B, Ricci JL. The effects of laser microtextured collars upon crestal bone levels of dental implants. Implant Dent. 2008;17:217-28.
14. Hürzeler M, Fickl S, Zuhr O, Wachtel HC. Peri-implant bone level around implants with platform-switched abutments: preliminary data from a prospective study. J Oral Maxillofac Surg. 2007;65:33-9.
15. Esposito M, Grusovin MG, Talati M, Coulthard P, Oliver R, Worthington HV. Interventions for replacing missing teeth: antibiotics at dental implant placement to prevent complications. Cochrane Database Syst Rev. 2008;3:CD004152.
16. Cappiello M, Luongo R, Di Iorio D, Bugea C, Cocchetto R, Celletti R. Evaluation of peri-implant bone loss around platform-switched implants. Int J Periodontics Restorative Dent. 2008;28:347-55.