

Journal section: Oral Surgery
Publication Types: Review

doi:10.4317/medoral.16.e365
http://dx.doi.org/doi:10.4317/medoral.16.e365

Marginal bone loss in relation to the implant neck surface: An update

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Aloy-Prósper A, Maestre-Ferrín L, Peñarrocha-Oltra D, Peñarrocha-Diago M. Marginal bone loss in relation to the implant neck surface: An update. Med Oral Patol Oral Cir Bucal. 2011 May 1;16 (3):e365-8.
http://www.medicinaoral.com/medoralfree01/v16i3/medoralv16i3p365.pdf

Received: 11/03/2010
Accepted: 26/08/2010

Article Number: 16969 <http://www.medicinaoral.com/>
© Medicina Oral S. L. C.I.F. B 96689336 - pISSN 1698-4447 - eISSN: 1698-6946
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Indexed in:
Science Citation Index Expanded
Journal Citation Reports
Index Medicus, MEDLINE, PubMed
Scopus, Embase and Emcare
Indice Médico Español

Abstract

A review is made of the publications on the marginal bone loss of implants with a polished neck, rough neck with microthreading, and rough neck without microthreading.

A PubMed search was carried out with the following key words: machined neck implant, polished neck implant, marginal bone loss, covering the period between January 1998 and March 2009. Inclusion was limited to those human clinical studies involving a minimum follow-up of 12 months, and registering the level of bone loss from the time of placement of the implant or prosthetic restoration to the end of follow-up.

For most of the authors there were no significant differences in marginal bone loss between polished neck and rough neck implants. On the other hand, implants with a rough neck and microthreading showed significantly less bone loss than those with a polished neck or with a rough neck without microthreading. The survival rate of the implants with a polished neck ranged from 87% to 97.7%, versus 94.5% to 100% for those with a rough neck, and 100% for the rough neck implants with microthreading. No peri-implant disease was registered in the different studies.

Key words: Dental implants, polished neck, machined neck, rough neck, bone loss.

Introduction

Marginal bone loss is observed after dental implant placement (1,2). This loss begins at the neck of the implant and spreads to the first thread of the body of the implant or to the first contact between the bone and the rough surface of the implant (3). Peri-implant bone resorption depends on a number of factors such as the surface of the neck (1-10) and reduction of the implant

platform (11-13). There is no agreement regarding the influence of performing surgery in one or two steps (14-16) or of the cylindrical or conical morphology of the neck (3,4).

The present article analyzes the publications related to the marginal bone loss of implants according to the implant neck surface involved (i.e., polished neck and rough neck with or without microthreading), and evalu-

ates marginal bone loss associated with the different types of neck, the survival rate of the implants, and the possible complications associated to their morphology.

Inclusion criteria and search strategy

A literature review was carried out covering the period between January 1998 and March 2009 relating to the bone loss of implants with a polished neck and with a rough neck. Inclusion was limited to those human clinical studies involving a minimum follow-up of 12 months, and registering the level of bone loss from the time of placement of the implant or prosthetic restoration to the end of follow-up.

A PubMed search was carried out with the following key words: machined neck implant, polished neck implant, marginal bone loss. Articles were included from the following journals: The International Journal of Oral and Maxillofacial Implants, Clinical Oral Implants Research, Journal of Oral Rehabilitation, Journal of Periodontology, Journal of Oral and Maxillofacial Surgery, Clinical Implant Dentistry and Related Research.

A total of 33 articles were found, of which 23 were excluded: 5 reviews, 4 studies in animals, 2 studies with a follow-up of under 12 months, and 12 papers failing to report data on bone loss from the time of placement of the implant or of the prosthetic restoration to the end of follow-up. Ten studies were thus finally considered (Table 1), with collection of the following data from each of them: year of publication, type of study; type of implant neck, number of implants, duration of follow-up, and results.

Three study groups were established: implants with a polished neck, implants with a rough neck without microthreading, and implants with a rough neck and microthreading. In all the reviewed studies the implants were placed at bone crest level. All the authors measured bone loss from the start of prosthetic loading to the end of follow-up, except Nickening et al. (6), who measured loss from the time of placement of the implants.

Not all the studies compared implants differentiated only according to the neck surface involved, since comparisons were also made of different commercial brands

Table 1. Summary of studies reviewed.

Author (year)	Type of study	Neck implant surface	No. implants	Implant survival rate (%)	Follow-up (months)	Differences in marginal bone loss between groups
Karlsson et al (1998)	Prospective	Polished	64	95,3	24	Non significative
		Rough	64	100		
Norton (1998)	Retrospective	Rough + microthreading	33	100	6 - 48	-
Astrand y Karlsson (1999)	Prospective	Polished	187	95,7	12	Non significative
		Rough	184	99,5		
Puchades-Roman et al. (2000)	Prospective	Polished	15	-	≥ 24	Significative
		Rough + microthreading	15	-		
Van Steenberghe et al. (2000)	Prospective	Polished	45	97,7	24	Significative
		Rough	30	100		
Hallman et al. (2005)	Prospective	Polished	84	87	60	Non significative
		Rough	72	94,5		
Lee et al. (2007)	Prospective Randomized Split-mouth	Rough	17	100	36	Significative
		Rough + microthreading	17	100		
Bratu et al. (2009)	Prospective	Polished	46	100	12	Significative
		Rough + microthreading	46	100		
Nickening et al. (2009)	Prospective Split-mouth	Polished	63	100	12	Significative
		Rough	70	100		
Piao et al. (2009)	Prospective	Polished	61	100	12	Non significative
		Rough	62	100		
Piao et al. (2009)	Prospective	Polished	61	100	12	Significative
		Rough + microthreading	66	100		

(7-9) or different connecting morphologies between the implant and the abutment (3,4). Comparisons and conclusions were thus difficult to establish. Lee et al. (3) compared cylindrical polished neck implants versus conical rough neck implants with microthreading - a fact that may have affected the results obtained.

Results

-Bone loss

Polished neck versus rough neck without microthreading

In the studies published by Van Steenberghe et al. (9) and Nickening et al. (6), significantly greater bone loss was recorded with the polished neck implants versus the rough neck implants after one and two years of follow-up, respectively. Van Steenberghe et al. (9) in turn recorded a bone loss of 2.3 ± 0.6 mm for polished neck implants and 1.66 ± 0.3 mm for rough neck implants. In the study of Nickening et al. (6), the bone loss values for the implants with a smooth neck were 0.5 mm, 0.8 mm and 1.1 mm after 3, 6 and 24 months, respectively, while in the group of rough neck implants with microthreading the values were 0.1 mm, 0.4 mm and 0.5 mm after 3, 6 and 24 months, respectively.

In contrast, other authors such as Karlsson et al. (17), Astrand et al. (2), Hallman et al. (18) and Piao et al. (4) found no statistically significant differences in bone loss.

It is not clear whether a rough neck without microthreading reduces bone loss compared with a polished neck - though most authors have recorded no statistically significant differences between the two types.

In 1998, Brägger et al. (19), inserted implants at supra-crestal level in order to eliminate the possible influence of the polished neck upon bone loss. After one year of follow-up, they recorded a bone loss of 0.78 mm, and concluded that a rough surface was not sufficient to avoid crestal bone loss - though the mentioned study did not meet the inclusion criteria of our review.

Polished neck versus rough neck with microthreading

Puchades-Roman et al. (8), Bratu et al. (10) and Piao et al. (4) observed statistically significant differences between polished neck implants and rough neck implants with microthreading, after a minimum follow-up of one year. Puchades-Roman et al. (8) in turn compared 15 polished neck implants with 15 rough neck implants with microthreading - recording bone loss values of 1.6 mm and 0.6 mm, respectively. Bratu et al. (10), in their study of 46 polished neck implants and 46 rough neck implants with microthreading, reported a bone loss of 0.69 ± 0.25 mm in the rough neck implants versus 1.47 ± 0.4 mm with the polished neck implants. According to Piao et al. (4), the bone loss was 0.89 ± 0.27 with the polished neck implants and 0.42 ± 0.27 in the case of the rough neck implants with microthreading.

According to these authors (4,8,10), microthreading of the implant neck could contribute to preserve marginal bone.

Rough neck versus rough neck with microthreading

Norton (5) studied 33 implants with a rough neck and microthreading, and after four years of follow-up the bone loss values were 0.3 mm mesial and 0.34 mm distal. According to Lee et al. (3) and Piao et al. (4), the differences in bone loss between implants with a rough neck and microthreading versus a rough neck without microthreading were statistically significant. Lee et al. (3) recorded a bone loss of 0.28 mm with rough neck implants versus 0.14 mm with microthread implants, after one year of follow-up. According to Piao et al. (4), bone loss was 0.81 ± 0.27 mm in the case of rough neck implants without microthreading and 0.42 ± 0.27 mm in the case of microthread implants. In the opinion of these authors (3-5), microthreading of the neck of the implant could reduce marginal bone loss.

In all the reviewed studies, marginal bone loss with polished neck implants was greater three months after implant placement, while bone loss with rough neck implants with and without microthreading was greater 6 months after insertion of the implants. In the studies involving a follow-up of over year (3,8,9,17,18), the greatest bone loss was seen to occur during the first year, and then gradually decreased.

-Survival rate

The survival rate of the polished neck implants ranged from 87% (18) to 100% (4,6,10). In the case of the rough neck implants without microthreading, the survival rate varied from 94.5% (18) to 100% (3,4,6,9,17). Lastly, in the rough neck implants with microthreading, the survival rate was found to be 100% (3-5,10).

-Complications

According to Cosyn et al. (20), rough neck implants favor bacterial plaque retention when exposed to the oral environment. This in turn would imply an increased risk of peri-implant disease such as mucositis or peri-implantitis (19,20). However, none of the reviewed studies reported disorders of this kind.

Conclusion

The incorporation of microthreading to rough neck implants has led to minimal marginal bone loss over follow-up.

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