



OCTOBER 2013

TREATMENT OF HEAVY SMOKERS WITH THE DENTAL RATIO IMPLANT SYSTEM

► Branislav Fatori

The objective of this practice-related study was to investigate the performance of the DENTAL RATIO Implant System in heavy smokers with over 20 cigarettes per day. Non-smokers were used as control group.

Over the past two decades, the restoration of partially or fully edentulous patients with dental implants has been established worldwide as an important treatment method. Tobacco smoke contains individual substances with harmful potential which affect the process of osseointegration. In particular these include nicotine, carbon monoxide, acetaldehyde, acrolein and hydrocyanic acid. Reduced blood supply with lowered matrix mineralization and corresponding cytotoxicity were observed as result of the negative effect on bone metabolism and the healing process.

Most studies to date indicate that smoking is related to reduced osseointegration. However, the risk of premature loss of implants is subject to quite varying interpretation (up to approx. 9 times higher than for non-smokers). An average estimate could result in a 2- to 4-fold increased risk [8, 9, 10, 11]. The largest retrospective study in this connection (1,727 patients) assumes a doubled risk of loss for smokers [12]. Plaque accumulation is increased in smokers, and there is a higher incidence of gingivitis and periodontitis up to increased resorption of the alveolar ridge [13]. Some authors have assessed the various factors such, that they led to corresponding losses with a total of 2,149 implants in a group of 540 patients, whereby smokers were subject to a considerably higher risk than non-smokers [14].

Smokers demonstrated considerably higher loss rates than non-smokers prior to functional loading. Comparable bone loss of osseointegrated implants in the smoker group was considerably higher than for non-smokers [15].

Comparable marginal bone loss surrounding osseointegrated implants has demonstrated that marginal bone loss was approx. 3 times higher in smokers with inadequate oral hygiene than with non-smokers.

Implant losses are the result of thus multifactorial process. Important factors which influence the prognosis include length, diameter and position of the implant, whereby the expansion of edentulous regions plays a role.

In terms of clinical complications, these latter mentioned factors affect the survival rate of the implants to be assessed. It is difficult to judge in this context, whether smoking alone is the single responsible factor for the corresponding implant losses. In terms of clinical complications, these factors lead to bone loss and peri-implant inflammation [15, 16]. The objective of this study was to demonstrate the incidence of complications and the survival rate in terms of dental implants between smokers and non-smokers, and to compare the effects of smoking by analyzing the data of 80 implants in 32 patients in the years 2011 to 2012.

Materials and methods

The patients were divided into two groups: group 1 (heavy smokers), group 2 (non-smokers). Complications immediately following surgical intervention and during the healing phase were examined. The complications include minor (spontaneous exposition of the implant) and major (loss of implant, pain, edemas, peri-implantitis) deviations from the norm.

The study is based on data from 32 patients who received a total of 80 implants. The information includes the entire medical and dental history, thorough clinical and radiological assessment with particular consideration of smoking habits.

There were 16 smokers with 42 implants and 16 non-smokers with 38 implants (Tables 1 and 2). The study did not analyze the number of cigarettes smoked per day and patient.

The implants were inserted in 2011 and 2012 by a surgeon under sterile conditions following the Brånemark protocol [17]. OKTAGON® implants by DENTAL RATIO (Manufacturer: Hager & Meisinger) were used.

The OKTAGON® implants consist of Grade 4 pure titanium and have a corundum-blasted and acid-etched surface in the endosseous area. This special surface treatment results in a residue-free, characteristic macro/micro structure. The scanning electron microscope image of the surface illustrates the surface structure of the OKTAGON® implant. The clusters of the macro structure have a circumference of approx. 20 - 40 µm, the micro structure has a circumference of approx. 2 - 4 µm and is characterized by micro wells. EDX analysis has proven that the surface again remains residue-free after surface treatment and that osseointegration is not negatively affected by foreign matter. The high surface quality of the OKTAGON® implants is documented in batch-related analyses as part of quality assurance [18].

RESULTS

Two implants did not show primary stability in the smoker group which equals a failure rate of 5 %. All implants were osseointegrated in the non-smoker group.

There were no significant differences in age and gender of the patients. From a relative point of view, the loss rate of 5 % shows that smokers can certainly be provided with implants as long as an appropriate strict protocol is adhered to [19]. The majority of past and current literature show smoking to be one of the prominent risk factors which affect the success rate.

5000-fold magnification of the etched surface topography did not reveal any contamination with organic compounds [20].

In the case of inorganic residues, one must differentiate between individual spots and extensive process-related residues which cover the entire implant surface, for example, remains of Al_2O_3 .

CASE REPORT

A 64-year old male patient and very heavy smoker, received single-component implants in December 2010. These were immediately loaded and restored with a single-piece plastic bridge.

All implants were primary stable with high periotest values (-0.4). After 6 weeks, all implants were unstable due to loss of osseointegration.

8 months later, in September 2011, the patient was restored with 6 DENTAL RATIO implants 4.1 x 12 mm. Final restoration was concluded in February 2012.

This case demonstrates that DENTAL RATIO implants are well suited for compromised, severe cases (Figs. 1 to 6).

SMOKERS	No.	Age Years	Gender	Number Cigarettes/day	Implant Region	Osseo-integration	not Osseointegrated
	1	64	M	35	14-24	6	0
	2	62	W	25	43-33	2	0
	3	58	M	50	14-15	2	0
	4	33	M	20	15	1	1
	5	39	M	20	24	1	0
	6	40	W	25	36	1	0
	7	34	M	20	15	1	0
	8	36	M	25	34, 35, 36	3	0
	9	48	M	20	15	1	0
	10	55	M	50	47-37	7	2
	11	35	M	20	36	1	0
	12	57	M	20	11	1	0
	13	40	W	25	35, 36, 37	3	0
	14	47	W	30	14-17	3	1
	15	60	M	25	44-34	8	0
	16	48	W	20	15	1	0
Ø 47,3						42	4

Table 1: Overview smokers

NON-SMOKERS	No.	Age Years	Gender	Number Cigarettes/day	Implant Region	Osseo-integration	not Osseointegrated
	1	60	M	-	14-16	3	0
	2	50	W	-	24-27	4	0
	3	68	W	-	44-34	7	0
	4	33	W	-	26	1	0
	5	45	W	-	13	1	0
	6	38	M	-	45	1	0
	7	36	M	-	15-26	8	0
	8	45	M	-	16-17	2	0
	9	31	W	-	33	1	0
	10	50	M	-	22	1	0
	11	39	W	-	14	1	0
	12	38	M	-	27	1	0
	13	56	W	-	34-35	1	0
	14	47	W	-	46	2	0
	15	46	M	-	42	1	0
	16	33	M	-	12-14	3	0
Ø 44,7						38	0

Table 2: Overview non-smokers

DISCUSSION

The practice study demonstrates that smoking impairs healing following mucogingival surgery. The consumption of tobacco promotes inflammation and gingival bleeding following mucogingival surgery.

Several authors have pointed out that smoking is a factor which can lead to implant loss during the healing phase of the implant. It was observed that the loss rate is twice as high in smokers than in non-smokers. In this study the loss rate was very low, therefore all complications have been combined. Although classified as a complication in this study, spontaneous, early exposition after insertion of the implant or the loss of primary stability were observed in most cases.

Although the spontaneous exposition of an implant was defined as a complication, this did not necessarily lead to a loss of the implant.

Most failed implants in this study were observed in the extremely heavy smoker group, whereas the healing process in the non-smoker group was inconspicuous.

The group of smokers as well as non-smokers was relatively small, nonetheless the smoker group showed clear signs of a complication rate.

Within the scope of this article it was not possible to discuss all the mechanisms which lead to complications within the context of smoking [16]. This study does not provide insights into the complication mechanisms for the mentioned smokers.

It is however probable that these factors, for example, systemic vasoconstriction, reduced perfusion and increased thrombocyte aggregation relate to functional disturbances of the neutrophil granulocytes which were observed in the smoker group.

SUMMARY

Patients and their treating surgeons should be aware that smoking represents a risk factor. Smokers have a higher incidence of complications, especially in the case of transgingival healing implants.

However, most complications do not lead to failure. Immediate implants have higher loss rates than delayed inserted implants.

Although relationships exist as significant factors between complications and smoking, the intensity of exposition (number of cigarettes), the type of implant (internal or external HEX) and the time of implantation (immediate/delayed implantation), it cannot be assumed that they are the sole or most important factors [15].

Further studies are necessary to identify other possible factors which could lead to failures.

However, potential implant patients should be informed that smoking has a harmful effect on dental implants and that a reduction in smoking may reduce possible complication rates.

During this observation phase, the DENTAL RATIO implants have demonstrated high quality and very fair prices when compared with equal other products.

NOTE: the insertion of the implant was via a transfer guide which needs to be removed after insertion of the implant.



Fig.1: OPG post OP.



Fig.2: Implants with immediate loading in situ.

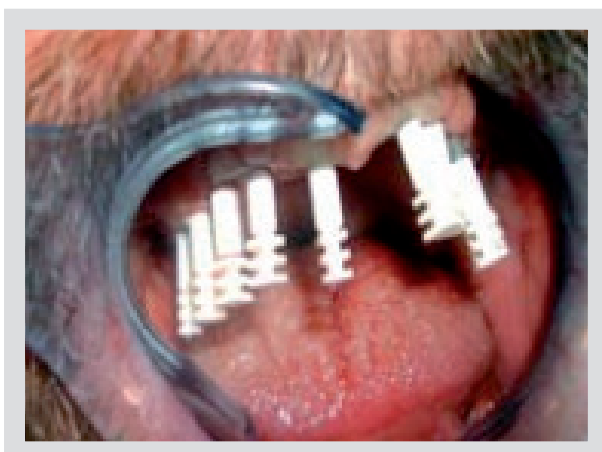


Fig.3: Temporary cylinder in situ.

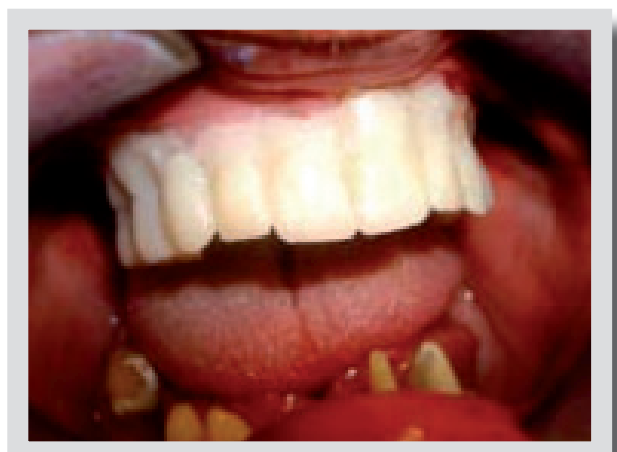


Fig.4: Temporary denture in situ.

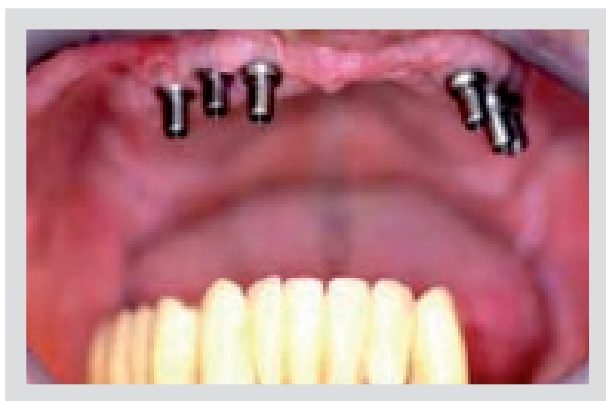


Fig.5: DENTAL RATIO Implants in situ.

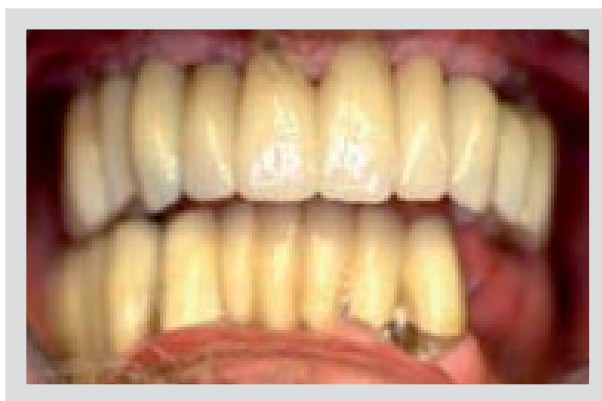


Fig.6: Temporary mounted zirconium bridge.



Fig.7: OPG with restoration. Extraction of the periodontally damaged teeth in the mandible is planned with immediate implantation.

ACKNOWLEDGEMENTS

DENTAL RATIO has supported this study by providing the OKTAGON® implants for study purposes. Our special thanks go to the CEO Mr Ulf-Christian Henschen and Mr Nazir Zeqiri K6, Dental Fachlabor Zurich, for the illustration and preparation of the tables and images.

DR. DR. BRANISLAV FATORI

Hüyssenallee 5
45128 Essen

E-Mail info@dr-fatori.ch



LITERATURE

- [1] Bain CA, Wenig D, Meltzer A, Kohles SS, Stach RM. A Metaanalysis evaluating the risk for implant failure in patients who smoke. *Compend Contin Educ Dent* 2002;23:695-699,702,704.
- [2] Kumar A, Jaffin RA, Berman C. The effect of smoking on achieving osseointegration of surface-modified implants: a clinical report. *Int J Oral Maxillofac Implants* 2002;17:816-819.
- [3] Kan JYK, Rungcharassaeng K, Lozada JL, Goodacre CJ. Effects of smoking on implant success in grafted maxillary sinuses. *J Prosthet Dent* 1999;82:307-311
- [4] Geurs NC, Wang IC, Shulman LB, Jeffcoat MK. Retrospective radiographic
- [5] Analysis of sinus grafts and implants placement procedures from the Academy of Osseointegration Consensus Conference on Sinus Grafts. *Int J Periodontics Restorative Dent* 2001;21:517-523.
- [6] Mazor Z, Cohen DK. Preliminary 3-dimensional surface texture measurement and early loading results with a microtextured implant surface. *Int J Oral Maxillofac Implants* 2003;18:729-738.
- [7] Silverstein P. Smoking and wound healing. *Am J Med* 1992;93: (suppl)22S-24S.
- [8] Lindquist LW, Carlsson GE, Jemt T. Association between marginal bone loss around osseointegrated mandibular implants and smoking habits: A 10-year follow – up study. *J Dent Res* 1997;76:1667-1674.
- [9] Haas R, Haimböck W, Mailath G, Watzek G. The relationship of smoking on peri-implant tissue: A retrospective study. *J Prosth Dent* 2009, 76:6,592-596
- [10] Hinode D, Tanabe S-I, Yokoyama M, Fujisawa K, Yamauchi E, Miyamoto Y. Influence of smoking on osseointegrated implant failure: a meta-analysis. *Clin. Oral Impl. Res.* 17,2006; 473-478
- [11] Levin, L, Schwartz –Arad, D. The Effect of Cigarette Smoking on Dental Implants Related Surgery. *Implant Dent* 2005, 14;4: 357-363
- [12] Cavalcanti R, Oreglia F, Manfredonia MF, Gianserra R, Esposito M. The influence of smoking retrospective cohort study of 1727 patients. *Eur J Oral Implantol.* 2011 Spring;4(1):39-45.
- [13] Klokkeveld PR, Newman MG. Current stats of dental implants - A periodontal perspective. *Int J Oral Maxillofac Implants* 2000;15:56-65
- [14] Bain CA, Moy PK. The association between the failure of dental implants and cigarette smoking. *Int J Oral Maxillofac; Implants* 1993;8:609-615.
- [15] Schwartz-Arad D, Samet NA, Samet NAC, Mamlider A. *J Periodontol* 2002;2:153-157
- [16] Lindquist LW, Carlsson GE, Jemt T. Association between marginal bone loss around osseointegrated mandibular implants and smoking habits: A 10 year follow-up study. *J Dent Res* 1997;76:1667-1674
- [17] Branemark P-I, Hansson BO, Adell R, et al. Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year study period. *Scand J Plast Reconstr Surg* 1977;16:1-132.
- [18] Angaben aus dem Prospekt von DENTAL RATIO.
- [19] Fatori B, Wachter P. Behandlung von periimplantären Defekten state of the art Dent. *Implantol* 2007;5:358-365
- [20] Ingenieurgesellschaft Meyer & Horn-Samodelkin. Prüfbericht: PB-Nr. 310a-12
- [21] Bergstrom G, Floderus-Myrhed B. Co-twin control study of the relationship between smoking and some periodontal disease factors. *Community Dent Oral Epidemiol* 1983;11:113-116
- [22] Bergstrom J, Eliasson S. Noxious effect of cigarette smoking on periodontal health. *J Periodont Res* 1987;22:513-517.
- [23] Gorman LM, Lambert PM, Morris HF, Ochi S, Winkler S. The effect of smoking on implant survival at second stage surgery. *Implant Dent* 1994;3:165-168.
- [24] Kenney EB, Kraal JH, Saxe SR, Jones J. The effects of cigarette smoke on human polymorphonuclear leukocytes. *J Periodont Res* 1977;12:227-234.
- [25] Noble RC, Penny BB. Comparison of leukocyte count and function in smoking and non-smoking young men. 1975;12:550-555
- [26] MacFarlane GD, Herzberg MC, Wolff LF, Hardie NA. Refactory periodontitis associated with abnormal polymorphonuclear leukocyte phagocytosis and cigarette smoking. *J Periodontol* 1992;63:908-913.