International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2008, Vol 10 No 01, Poster 397

Dental magnetic systems as prosthetic attachments on retained roots

Language: English

Authors:
Carolin Ehring, OA Dr. med. dent. Arne F. Boeckler, Prof. Dr. med. dent. habil. Jürgen M. Setz
Martin-Luther-University Halle-Wittenberg, Poliklinik für Prothetik, Halle/Saale

Date/Event/Venue:
March 9-12, 2005
83rd General Session & Exhibition of the IADR
Baltimore, Maryland, USA

Sensodyne-Poster-Studien-Award 2009 für das beste Poster 2008

Introduction

Magnetic retention is a popular method of attaching removable prostheses to retained roots 1, 2. Despite their advantages, which include ease of cleaning, ease of placement for both dentist and patient, constant retention with number of cycles, automatic reseating and reduced lateral stresses on the roots, magnets have small attractive forces compared to other prefabricated prosthetic attachments 1 - 4. Nevertheless, there is a strong evidence that retention is of great importance for a patient's satisfaction 4, 5. Contemporary two different physical and technical concepts can be found: mono systems consisting of a magnet and a corresponding keeper from magnetizable alloy with an open (MO) or with a closed magnetic field (MC) 1. The force produced by any two magnets is inversely proportional to the square of the distance between them 6. Separation between magnet and keeper, however caused, will result in a drastic reduction in the retention. MC's produce the highest initial retention force. MO's are more voluminous and providing a comparatively lower initial retention force. Nevertheless, the release of the retention is not so noticeable when the magnets are separated for a small distance. The retention provided would be quite close to that claimed by the manufacturer as long as the magnet and the abutment remain in contact. This condition may not be possible in the clinical situation. The retention in function is very sensitive to distance. The point to be made, therefore, is that the manufacture's claimed retention may not be what is obtained clinically. Following the manufacturers' information recently developed or improved products despite their small size should produce high retention forces.

Objectives

The aim of this study was to verify and to compare the initial retention force and the force-distance relation of contemporary magnetic systems for dental implants.

Material and Methods

11 products of different height and diameter were tested (Tab). All of these retention systems consisted essentially of a magnetic assembly which is incorporated into the prostheses and a corresponding keeper. In the magnetic units rear earth magnets from NeFeB are embedded. To protect the brittle rare earth magnets against corrosion they are incorporated into a thin non magnetizable alloy casting (Ti or stainless steel). The keepers consist of a magnetizable corrosion resistant alloy. They can be classified into the cement-in keepers, the cement-on keepers and two types of cast keepers-those cast entirely in magnetizable alloys and those where a magnetizable keeper is incorporated into a non magnetizable alloy casting. From each product or combination 5 specimens were tested in an adjusted and computer navigated pull-testing machine (Z005, Zwick, Ulm, Germany). A special non magnetizable holder for the keepers was locked onto the base of the testing machine (Fig). To avoid tilting of the moving magnet it was fixed on the tip of a special holder which was connected with the crosshead by a nonflexible string. The crosshead speed was set at 20 mm/min (s=40 mm). The breakaway force was the maximum force during the separation of the magnet and the keeper when the magnet slowly moved away. The breakaway force measurement was repeated ten times and the mean for each sample was used. The results were descriptive and statistical analysed (H-/U-Test, p□0.05). The findings were compared with the manufacturers' statements.

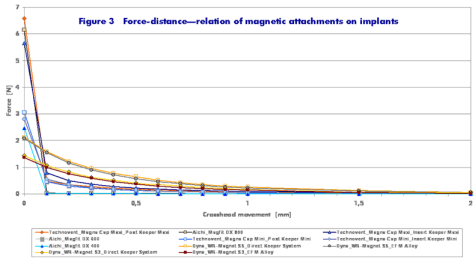


Fig. 3 Force-distance-relation of magnetic attachments on implants

Table 1 Magnetic attachments for retained roots

Manufacturer	Magnet assembly		Magnet characteristics		
	Keeper	Magnet	System	Field	Alloy
Aichi Steel (Japan)	Magfit DX 400	Magfit DX 400	mono	closed	NeFeB
	Magfit DX 600.	Magfit DX 600.	mono	closed	NeFeB
	Magfit DX 800	Magfit DX 800	mono	closed	NeFeB
Dyna (Netherlands)	Direct-System-Keeper	WR-Magnet S3 small	mono	open	NeFeB
	Direct-System-Keeper	WR-Magnet S5 standard	mono	open	NeFeB
	EFM Alloy	WR-Magnet S3 small	mono	open	NeFeB
	EFM Alloy	WR-Magnet S5 standard	mono	open	NeFeB
Technovent (Great Britain)	Insert Keeper - Mini	Magna Cap - Mini	mono	closed	NeFeB
	Insert Keeper - Maxi	Magna Cap - Maxi	mono	closed	NeFeB
	Post Keeper - Mini	Magna Cap - Mini	mono	closed	NeFeB
	Post Keeper - Maxi	Magna Cap - Maxi	mono	closed	NeFeB

Tab.1 Magnetic attachments for retained roots

Table 2 Initial retention forces of the tested magnetic attachments

Manufacturer	Magnet assembly		Initial retention force		
	Keeper	Magnet	Manufacturer's instructions	Results of measurement	Relation
			[N]	[N]	[N]
Aichi Steel (Japan)	Magfit DX 400	Magfit DX 400	3,9	2,5	63,5
	Magfit DX 600.	Magfit DX 600.	5,9	4,2	70,3
	Magfit DX 800	Magfit DX 800	7,9	6,2	78,0
Dyna (Netherlands)	Direct-System-Keeper	WR-Magnet S3 small	2,9	1,4	49,8
	Direct-System-Keeper	WR-Magnet S5 standard	4,9	2,1	43,1
	EFM Alloy	WR-Magnet S3 small	2,9	1,4	49,8
	EFM Alloy	WR-Magnet S5 standard	4,9	2,1	43,1
Technovent (Great Britain)	Insert Keeper - Mini	Magna Cap - Mini	4,0	2,8	70,0
	Insert Keeper - Maxi	Magna Cap - Maxi	7,2	6,6	91,2
	Post Keeper - Mini	Magna Cap - Mini	4,0	3,1	76,3
	Post Keeper - Maxi	Magna Cap - Maxi	7,2	5,7	78,6

Tab.2 initial retention forces of the tested magnetic attachments

Results

The highest initial retention force was 6.6 N. In a recently developed and distinctly smaller specimen an initial force of 6.2 N were found (Fig). The smallest initial breakaway force was measured with 1.4 N (Fig). Beside the different initial forces the recorded force-distance relations according to the respective type of magnetic system were characteristically for each of the samples. The highest retention forces achieved the MC's followed by the MO's. After a separation of 1 mm the remaining forces were reversed (Fig). The MO's produced about 25 % of their initial force whereas the MC's showed approx. 5 % of their initial breakaway forces. The value of the retention force is depending on the dimension of the magnet unit. Therefore the discrepancies of the recorded breakaway forces and the manufacture's claimed retention were determinate (Tab or Fig). No product achieved the retention that was claimed by the respective manufacturer. In one product there was more than 90 % of the indicated retention. In 5 samples there were more than 70 % but in 4 products under 50 % of the indicated breakaway force.

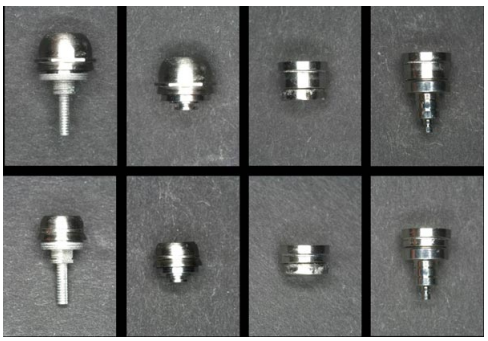


Fig.1 Tested specimens

Fig.2 Non magnetizable holder and mounting

Conclusions

Within the limits of this study it could be drawn that there were significant differences between the clinically important breakaway forces. No product achieved the retention that was claimed by the respective manufacturer. No product achieved the retention that was claimed by the respective manufacturer. In the majority of cases the maximum retention forces were found notable under the manufacturers' claimed retention. Mono-systems with a closed magnetic field produced the highest breakaway forces. Concerning the reseating forces the force-distance relations could indicate a slightly advantage for the mono-systems with an open magnetic field. These results should be taken into consideration when choosing implant supported magnetic attachments for individual situations.

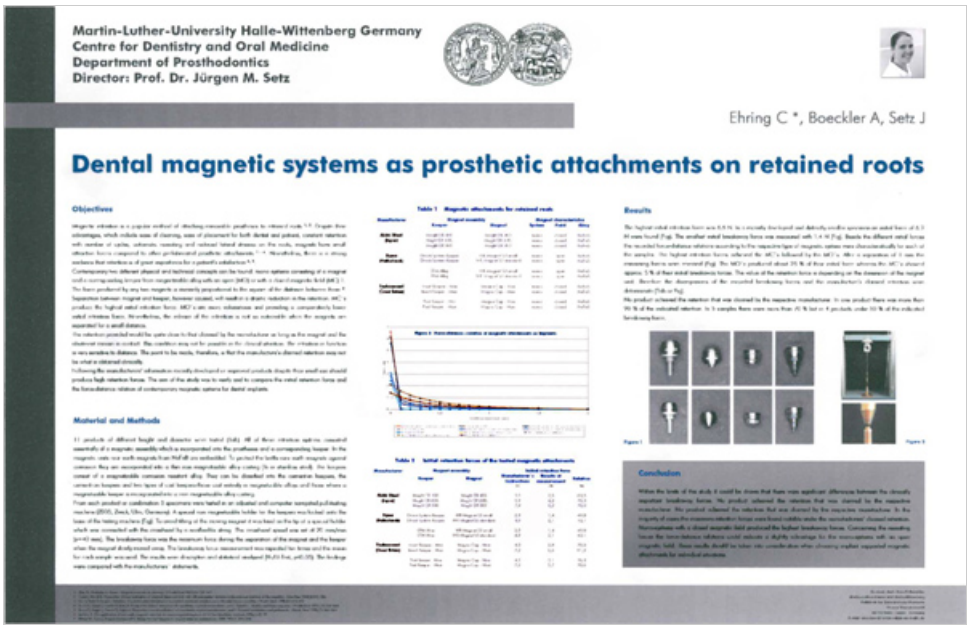
Literature

1. Riley M, Walmsley A, Harris I. Magnets in prosthetic dentistry. J Prosth Dent 2001;86:137-142.
2. Coca I,.Klimek K. Prospective clinical evaluation of retained abutment teeth with different partial dentures in the reduced dentition of the mandible. Zahn Prax 2002;5:252-254.
3. Setz J, Seok H, Engel E. Retention of prefabricated attachments for implant stabilized overdentures in the edentulous mandible. J Prosth Dent 1998;80:323-329.
4. Burns D, Unger J, Elswick R, Beck D. Prospective clinical evaluation of mandibular implant overdentures: part I. Retention, stability and tissue response. J Prosth Dent 1995;73:354-363.
5. Burns D, Unger J, Elswick R, Giglio J. Prospective clinical evaluation of mandibular implant overdentures: part II. Patients' satisfaction and preference. J Prosth Dent 1995;73:364-369.
6. Jackson T. The application of rare earth magnetic retention to osseointegrated implants. Int J Oral Maxillofac Implants 1986;1:81-92.
7. Wisser W, Coca I, Ruppel-Schönewolf K. Design for root keepers in magnet retained overdentures. ZWR 1996;7:374-378.

This Poster was submitted by Dr. med. dent. Arne F. Boeckler.

Correspondence address:
OA Dr. med. dent. Arne F. Boeckler
Poliklinik für Zahnärztliche Prothetik
Martin-Luther-Universität Halle-Wittenberg
Grosse Steinstrasse 19
06108 Halle / Saale

Poster Faksimile:



Martin-Luther-University Halle-Wittenberg Germany
Centre for Dentistry and Oral Medicine
Department of Prosthodontics
Director: Prof. Dr. Jürgen M. Setz

Ehring C *, Boeckler A, Setz J

Dental magnetic systems as prosthetic attachments on retained roots

Objectives

Material and Methods

Results

Conclusion