REPORT

DENTAL DYNAMIC ABUTMENT AND IMPLANT SYSTEM. RESULTS OF STATIC RESISTANCE TO COMPRESSION BENDING

On request of: **TALLADIUM ESPAÑA**

OCTOBER 2008

SIGNATURES AND AGREEMENT CONDITIONS

Date: 01/10/2008

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1. The Instituto de Biomecánica de Valencia (IBV) is only responsible for the results stated in this report, which refer exclusively to the materials or samples indicated in it and which will remain in our hands. Unless otherwise stated, the samples have been freely chosen and sent by the petitioner
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C o n t e n t s

1. INTRODUCTION, ANTECEDENTS AND OBJECTIVES

This report presents the results related to static tests of compression bending for a dental dynamic abutment and implant system, according to the standard ISO 14801:2007 *Dentistry – Implants – Dynamic fatigue test for endosseous dental implants*.

The tests have been requested by the company TALLADIUM ESPAÑA, S.L. sited in Avda. de Madrid, 17 - Altillo 1ª, 25002 – Lleida (SPAIN).

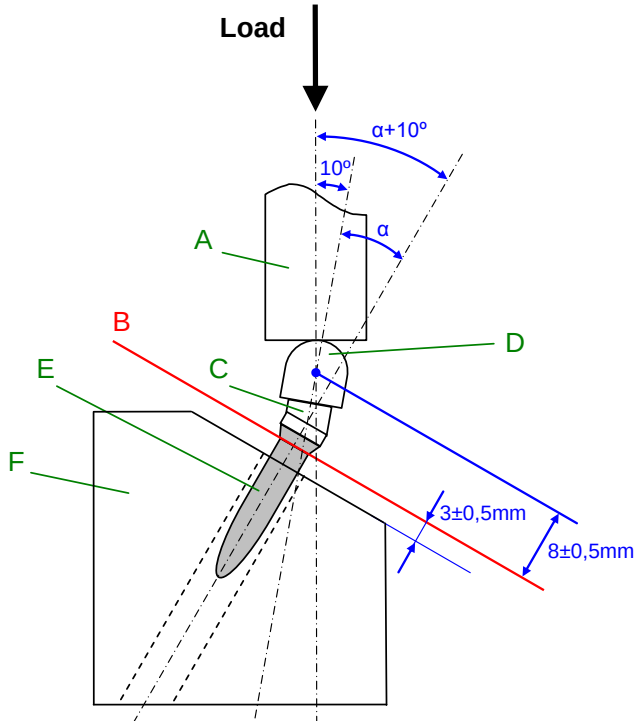
2. MATERIAL AND METHODS

The description of the tested specimens is presented in Table 1.

Element	Reference	Description	Material	Measures
Abutment	PDINT	Dynamic abutment of internal connection	Tilite with Titanium	D 4.8 mm α 20º
Screw	TPDSYN	Synocta dynamic abutment screw	Grade 5 – Titanium alloy	Torque 30 N·cm
Transepithelial	EBRPL43	Dynamic abutment transepithelial for Replace internal connection	Titanium	Height 0.8 mm Torque 35 N·cm
Implant	29414	Dental implant Nobel Biocare Replace Select Tapered TiUnite RP	Titanium	D 4.3 mm L 13 mm

Table 1. Description of the tested specimens

The loading geometry for the tests (Figure 1) is described in section 5 of the standard ISO 14801:2007. Figure 2 shows some pictures of the test set-up.



A. Loading device
B. Nominal bone level
C. Connecting part
D. Hemispherical loading member
E. Dental implant body
F. Specimen holder

Figure 1. Loading geometry for the tests (α=20º) (ISO 14801:2007)

a) 

b) 

c) 

Figure 2. Test set-up for the dental dynamic abutment and implant system:
a) Tightening the transepithelial, b) Tightening the screw, c) Testing the specimen.

The static resistance to compression bending of the dental abutment and implant system has been evaluated with the aim of determining the load and displacement at the rupture point, the load and displacement at the yield point and the stiffness (Figure 3). Testing environment conditions have been the ones indicated by the standard ISO 14801:2007.

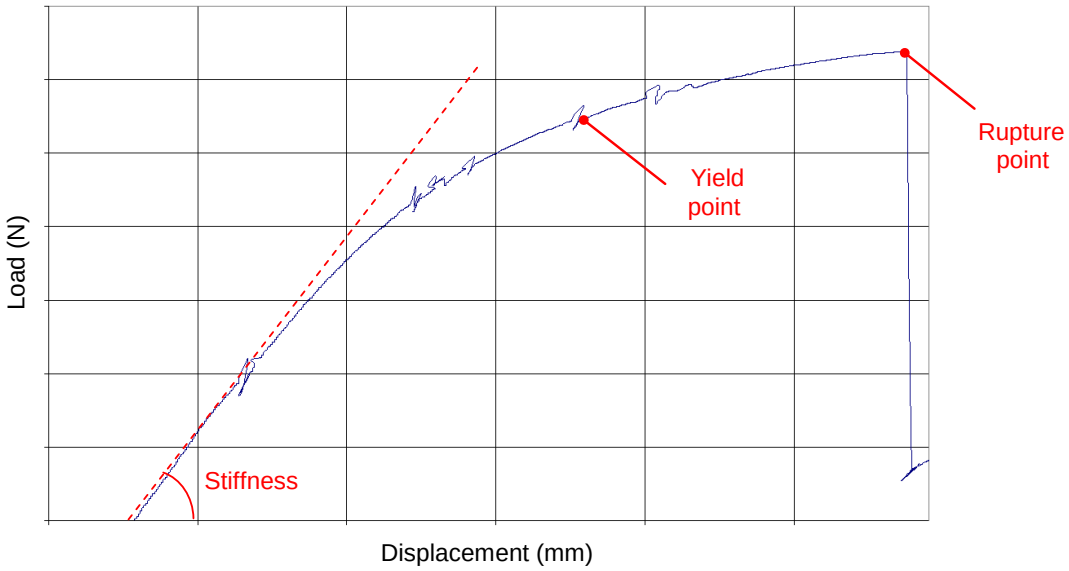


Figure 3. Parameters of the static resistance test

3. RESULTS

Table 2 presents the results of the static tests for the dental abutment and implant system. The values of this table correspond to the mean and standard deviation of the five specimens tested. The results, as well as mode of failure of the specimens, are described in detail in the ANNEX.

System	Stiffness (N/mm)	Load at the yield point (N)	Displacement at the yield point (mm)	Load at the rupture point (N)	Displacement at the rupture point (mm)
Dynamic abutment system	**4207 ± 654**	**1833 ± 528**	**0,51 ± 0,10**	**2182 ± 318**	**0,79 ± 0,13**

Table 2. Results of static tests

4. ANALYSIS OF RESULTS

The failure to static resistance of the tested dental abutment and implant systems has been produced due to the material yielding.

The load at the yield point for the system with dynamic abutment has been **1833 N** (mean of five specimens), with the loading geometry indicated by the standard ISO 14801:2007.

The tested systems are used in anterior and posterior teeth. Scientific studies about maximum bite forces with natural teeth in several materials have been found, which have observed values between **50 and 370 N** for the maximum bite force with incisive teeth (Paphangkorakit and Osborn, 1997; Fontijn-Tekamp *et al.*, 2000; Regalo *et al.*, 2008), between **50 and 200 N** for the maximum bite force with canine teeth (Sinn *et al.*, 1996; Fontijn-Tekamp *et al.*, 2000), between **100 and 260 N** for the maximum bite force with premolar teeth (Sinn *et al.*, 1996; Fontijn-Tekamp *et al.*, 2000) and between **60 and 645 N** for the maximum bite force with molar teeth (Sinn *et al.*, 1996; Fontijn-Tekamp *et al.*, 1998; Pereira-Cenci *et al.*, 2007; Regalo *et al.*, 2008). The measured values in the static tests widely exceed these load values.

5. CONCLUSIONS

In conclusion it can be stated that the results obtained in the static tests for the dental dynamic abutment and implant system are satisfactory, as the systems have withstood static load values higher than the usual biting forces.

In the static tests, the dental dynamic abutment and implant system has reached a load value at the yield point of 1833 N. The maximum bite force with incisive teeth ranges from 50 to 370 N, the maximum bite force with canine teeth ranges from 50 to 200 N, the maximum bite force with premolar teeth ranges from 100 to 260 N and the maximum bite force with molar teeth ranges from 60 to 645 N. Therefore, results of the static tests are satisfactory because the measured static loads are higher than the ones expected during the usual activity of the abutment and implant system.

6. REFERENCES

FONTIJN-TEKAMP FA, SLAGTER AP, VAN 'T HOF MA, GEERTMAN ME, KALK W. Bite forces with mandibular implant-retained overdentures. *Journal of Dental Research* 1998; 77(10); 1832-1839.

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SINN DP, DE ASSIS EA, THROCKMORTON GS. Mandibular excursions and maximum bite forces in patients with temporomandibular joint disorders. *Journal of Oral and Maxillofacial Surgery* 1996; 54(6); 671-679.

ANNEX

REPORT. Dental implants. Evaluation of static resistance to compression bending

REPORT

DENTAL IMPLANTS. EVALUATION OF STATIC RESISTANCE TO COMPRESSION BENDING

Direct to: **TALLADIUM ESPAÑA S.L.**

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SEPTEMBER 2008

SIGNATURES AND AGREEMENT CONDITIONS

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Date: 30/09/08

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Contents

1. INTRODUCTION AND OBJECTIVES

The objective of this test is to evaluate the static resistance to compression bending of a dental abutment and implant system with dynamic abutment.

The tests have been requested by the company TALLADIUM ESPAÑA, S.L., sited in: Avda. de Madrid, 17 – Altillo 1ª. 25002 – Lleida (SPAIN).

2. MATERIAL AND METHODS

The test sample and its codification appear in the following table:

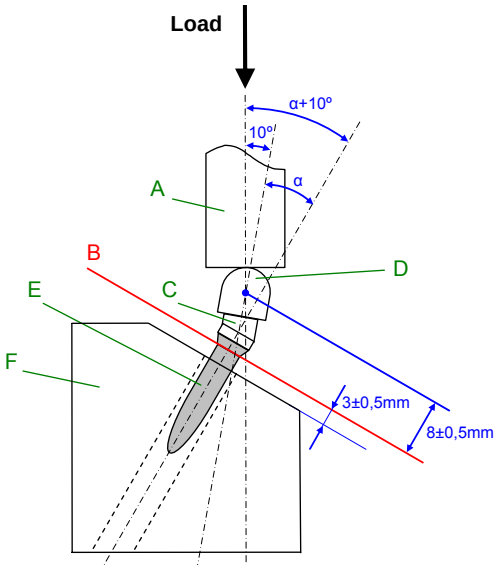
CODE	DESCRIPTION	UNITS
MU08-0742	Dynamic abutment systems formed by: one dynamic abutment of internal connection D4.8 (PDINT), one screw (TPDSYN), one transepithelial for Replace internal connection D4.3 (EBRPL43) and one dental implant Replace Select Tapered TiUnite RP D4.3xL13 from Nobel Biocare (29414).	5

The test samples will be given back to the client after the tests.

The tests have been performed using an INSTRON 8501 universal testing device.

The tests have been done on 19th September 2008, with an ambient temperature of 22ºC and humidity of 51%.

For the test, the implant is inserted between the actuators of the testing machine and compression loads are applied as shown in the following picture.



A. Loading device
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F. Specimen holder

The conditions of test have been:

- The test has been performed by displacement control.
- The displacement velocity of the actuator has been 0.01 mm/s.
- The test has been finished when the implant failure has been reached.

3. RESULTS

The following table presents the individual results, mean values and standard deviations of: stiffness, load at the yield point, displacement at the yield point and load and displacement at the rupture point of the tested dental implant.

Code	Stiffness (N/mm)	Load Yield point (N)	Displ. Yield point (mm)	Load Rupture point (N)	Displ. Rupture point (mm)	Observations
MU08-0742	4618	2398	0,66	2610	0,74	[1]
	4466	2367	0,55	2400	0,60	[1]
	4850	1488	0,40	1846	0,79	[1]
	3869	1689	0,52	2107	0,90	[1]
	3233	1225	0,43	1947	0,93	[1]
	4207 ± 654	**1833 ± 528**	**0,51 ± 0,10**	**2182 ± 318**	**0,79 ± 0,13**	-

[1] All systems fail because of rupture of the threaded part of the transepithelial, which joins the implant with the abutment (Figure 1).

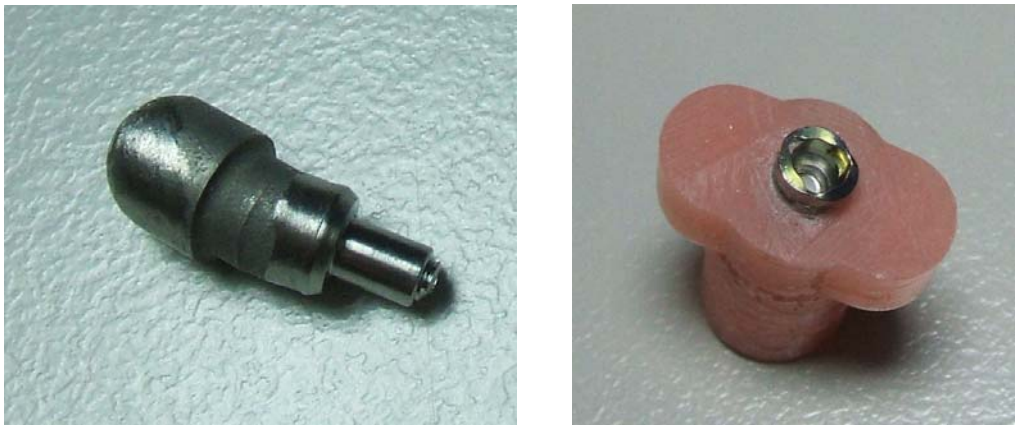

Figure 1