ATATÜRK UNIVERSITY
ENGINEERING FACULTY
DEPARTMENT OF MECHANICAL ENGINEERING

Mode Medikal San. ve Tic. Ltd. Şti.

DENTAL IMPLANT SYSTEM

FATIGUE TEST

BIOMECHANICAL TEST RESULTS (Rev. 01)

(ISO 14801)

April 2018 (Rev. 01)

REPORT

This report contains the fatigue test results carried out for the Dental Implant System, which are provided by Mode Medikal San. ve Tic. Ltd. Şti.

Aim:

The aim of this test is to determine the fatigue properties and maximum bending moment value of the dental implant system under cyclic loading conditions.

Referenced Documents:

ISO 14801: Dentistry-Implants-Dynamic fatigue test for endosseous dental implants

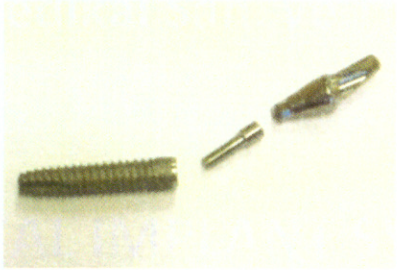
Arrival date of MODE products used in the tests: 22 February 2018

Test Period: 01 March 2018-04 April 2018

Materials Used in the Tests:

İmplant Name	: Level (Unique) Dental İmplant, Narrow Platform (Figure 1)
Packing Status	: Packaged and boxed (Figure 1)
Product Reference / Lot Number	: 1015-208 (Production Date: 10/2015)
Barcode Number	: 8680617141062
Implant Type	: Hybrid Design Implant
Connection Type	: Conic and octagon connection
Surface Treatment	: Sand blasted
Geometrical Properties	: Length 16 mm, Diameter 3.3 mm
Abutment	: Angled Abutment 25°, Tissue Level H:3 mm (Figure 1)
Abutment Barcode No	: 8680617146777
Abutment Reference / Lot Number	: 1015-310
Abutment Production Date	: 10/2015

(a)



(b)

Figure 1. Dental Implant System; packaged test sample **(a)**, dental implant and abutment **(b)**

The Test Method:

According to ISO 14801, This international standard specifies a method of fatigue testing of single post endosseous dental implants of the transmucosal type. While this standard simulates the functional loading of endosseous dental implant body and its premanufactured prosthetic components under "worst case" conditions, it is not applicable for predicting the *in vivo* performance of an endosseous dental implant or prosthesis. Particularly if more than one implant is used for prosthesis. The implants were supported 3mm below the anticipated crestal bone level, simulating 3mm of bone resorption. Dental implant as shown Figure 2 has been screwed to the testing block, which is made of Aluminium (active length is 4 mm and the gap of the screwing side has been filled with UHMWPE). Test information is tabulated in Table 1. Samples, which are not tabulated in the tables, have been used in the tests for adjustment of testing machine in the tests.

Table 1. Test information

Tightening Torque (N.m)	25
l (Active Length)-(mm)	4
Push Rod (mm)	60
Blok Angle	15°
R (Loading Ratio)	10
Frequency (Hz)	10
Testing Machine	INSTRON 8872 servo hydraulic fatigue test machine (with 1 kN load cell)
Test Temperature	Room temperature
Test Media (Usage of Solution)	Dry condition

Hemispherical support was screwed to the dental implant. Dental implant was screwed to the test block (applying a torque of 25 N.m which is the recommendation of manufacturer) and, dental implant was exposed to cyclic loading by means of push-rod (Figure 2).

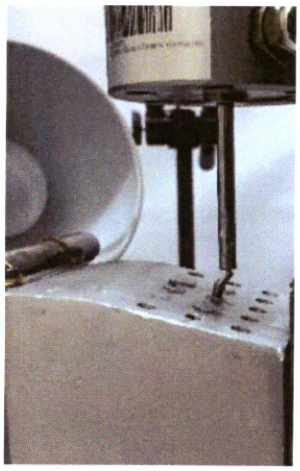


Figure 2. The image during the test

Conclusion:

Table 2. Results of the fatigue test

Specimen	Minimum Load (N)	Maximum Load (N)	Number of Cycles	Result
1	70	700	1	Failure
2	70	700	1	Failure
3	60	600	21206	Failure
4	60	600	39178	Failure
5	50	500	125472	Failure
6	50	500	201389	Failure
7	40	400	812563	Failure
8	40	400	701418	Failure
9	30	300	935492	Failure
10	30	300	1062743	Failure
11	20	200	2512811	Failure
12	20	200	3101760	Failure
13	18	180	5000000	No failure
14	18	180	5000000	No failure
15	18	180	5000000	No failure

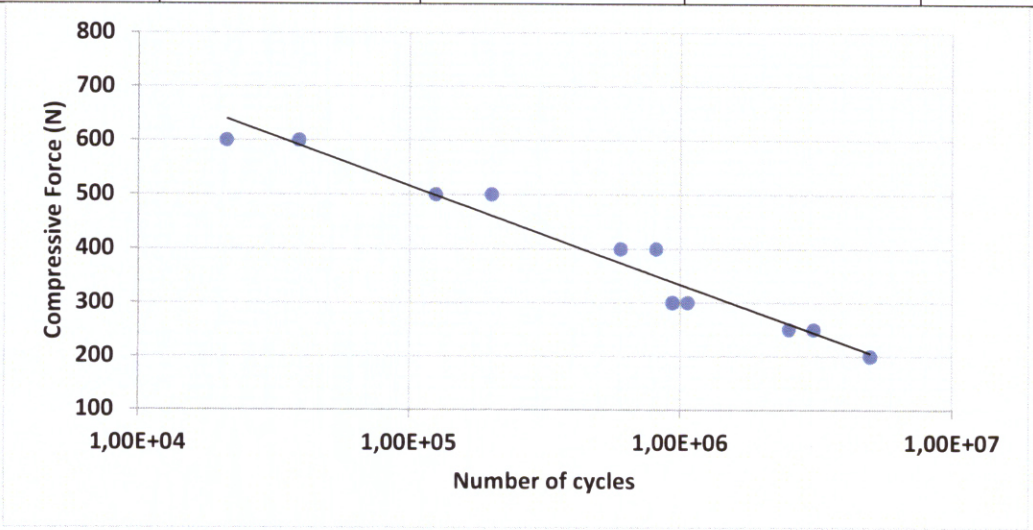
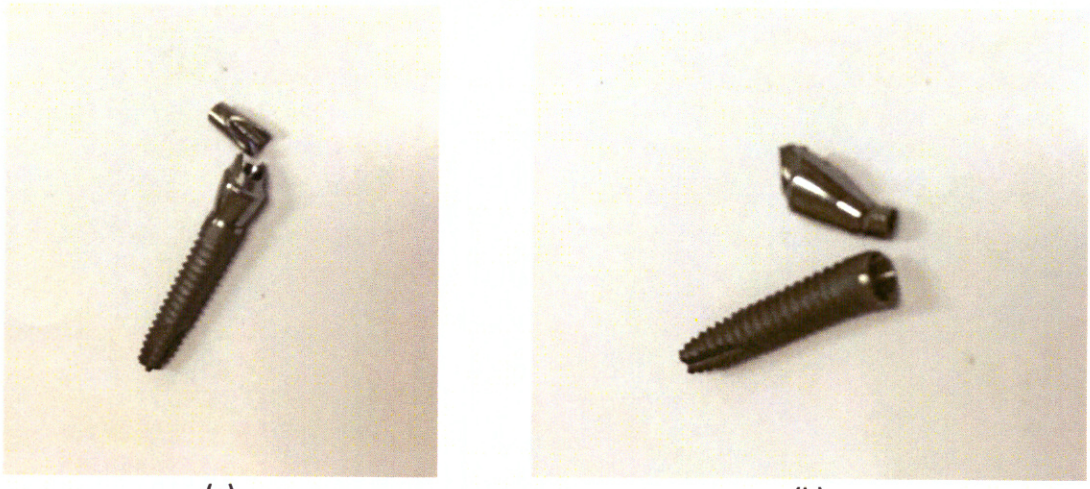


Figure 3. Load-Number of cycles diagram



(a) **(b)**

Fig. 4. Sample failure modes in dental implants: fracture of inter-connection screw **(a)** and abutment failure **(b)**

Fractures, which are emerged in the implants, have been observed in the screws, which are fixed within the implant (Figure 4). The load applied to angled abutments caused to initiate crack in abutment-implant connection screws and subsequently, fracture was observed in these screws. However, two specimens were fractured at their abutment where its angle has changed suddenly. Also, maximum load value has been determined as 180 N and correspondingly, maximum bending moment value has been calculated a value of 535.5 Nmm (0.5355 Nm). As clearly seen from examinations, the failure was occurred only inter connection screws and any fracture was not observed on dental implants.

COMPARISON:

The test performance of dental implants, which have similar properties or have different properties, was determined between 120N and 300N in the test laboratory stated herein. In this respect, it was seen that the dental implant reported in here exhibited closer test performance to other implants. However, it should be kept in mind that the general test results (120N-300N) are belonging to implants which have different diameters and geometries. Therefore, the comparison of test results directly can be deceptive.

Assist. Prof. Dr. Halim KOVACI **Res. Assist. M. Taha ACAR**

Note: Due to the number of specimens tested, no conclusions can be drawn concerning the statistical distribution of the mechanical properties of the whole production lot.