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Testing of IDL Standard Multi Unit Angular Hex-30-3 w/Coping on IDL EVO Implant, Internal Hex Ø3.5mm L10mm, in Air

Introduction

Fatigue and static tests were performed on 15 implant assemblies using IDL Standard Multi Unit Angular Hex-30-3 w/Coping on IDL EVO Implant, Internal Hex Ø3.5mm L10mm, as shown in Table I. All testing was conducted in room temperature air and consisted of holding the implant/abutment system at a 40° angle so the 30° angled abutment was under-corrected by 10 degrees.

TABLE I

Description	Qty	Reference No.	Lot No.
IDL EVO Implant, Internal Hex Ø3.5mm L10mm	15	EVO 1035	13553
IDL Standard Multi Unit Angular Hex-30-3	15	SMUH30-3-K	13293
IDL Coping w/Screw	15	SSTFNU-K	11653

Test Methods

The abutments and copings were installed by EML with torques of 25Ncm and 15Ncm respectively. EML potted the implants into brass sleeves (modulus of elasticity of 103 GPa) 3.0mm below the bone level datum (top of implant) representing a 3mm bone recession. A test fixture was used to hold the implant/abutment system 40° off-axis to simulate 10 degrees of uncorrected angulation. EML provided the spherical end caps such that the center of the contact point was 11mm above the holding line of the implant measured along the axis of the implant as specified in ISO 14801: 2016E Test Method, see Figure 1. Test loads were applied to the hemispherical tip of the abutment with a hardened stainless steel rod greater than 50 mm in length, by point contact at the machine interface. This allows unconstrained motion in the transverse direction, and will not reduce the magnitude of the applied bending moment.

A moment arm length of 4.71mm was calculated from a drawing provided by IDL.

40° Static Compression Tests

The same test fixture was utilized for both static load and fatigue tests. Material Test System, MTS Model 810 with a 250 lb. capacity load range and 1.27 mm/min. (0.05 in./min.) crosshead speed was used for the static tests. The maximum loads prior to failure are listed in Table II. Static tests were conducted in 20 °C ± 10 °C air. The load versus deflection curves for these tests are included in Figure 2 and the typical failure mode is shown in Figure 3.

40° Compression Fatigue Tests

Fatigue testing particulars:

- Minimum fatigue load is 10% of maximum fatigue load
- Test speed - 15 cycles/second
- Tests conducted at room temperature in air
- Krouse Testing Machine Co. axial fatigue machine designed for low loads.

Fatigue loads provide data points between 41,600 and 5,000,000 cycle run out load of 231 N (52 lbf), Table III. Bending moment corresponding to the run-out load is 108.9 Ncm. Figure 4 shows the data with the best fit fatigue curve. Pictures of the typical failure modes are shown in Figures 5 - 8.

Summary of Test Results

The average ultimate static load was 512N (115.2 lbf.) and one failure mode was observed: 1) Bellmouth yielding of the implant collar.

The fatigue 5,000,000 cycle run out load for three implant systems was 374 N (84 lbf.) with a corresponding bending moment of 161.8 Ncm. Five failure modes were observed during fatigue testing: 1) Implant crack below pot line & abutment screw failure, 2) Vertical crack in implant collar, 3) Abutment crack at top of hex & abutment screw yielding, 4) Vertical crack in implant collar & abutment screw failure.

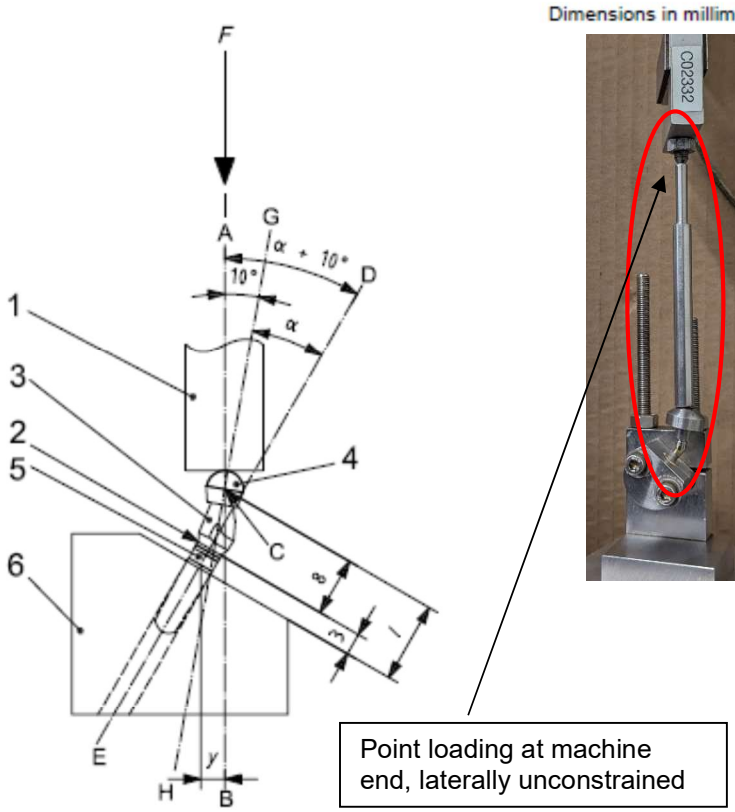
Testing Equipment Used

1. 20,000 Lb. Capacity MTS Model 810 ECN 1119 & 1082 Material Test System using 250 lb. ECN 1084 full scale range. Cal date: 12/10/25, Cal Due: 12/10/26.
2. Krouse axial fatigue machine, Model ECN 1130, 1129, & 1066.
3. Strain gage load cells, S/N 1180198, C02332, D18303, & 699825 with Dataq DI-2008 Data Acquisition system for dynamic load readout. Cal date: 5/5/25, Cal Due: 5/5/26.
4. Tohnichi 60Ncm Torque Gage, Model 6BTG-N, Serial No. 501777K. Cal date: 9/18/25, Cal Due: 9/18/26.

All of the above test equipment is in current calibration, and is directly traceable to ANSI Z540-1-1994 and ISO 10012:2003 (E) standards.

Respectfully submitted,

K. A. Dortch



Key

1 loading device [shall be allowed free movement transverse to loading direction (see 5.2.6)]
2 nominal bone level (see 5.3.2)
3 connecting part
4 hemispherical loading member
5 dental implant body
6 specimen holder

Figure 1 ISO 14801 Test Set-Up for Angled Abutments

TABLE II

40° Static Compression Tests – IDL Standard Multi Unit Angular Hex-30-3 w/Coping on IDL EVO Implant, Internal Hex Ø3.5mm L10mm

Testing Conditions

Testing Temperature: 20° C ± 10°C
Environment: Air
Cross Head Speed: 0.05 in./min.

Sample I.D.	Max Load (lbf.)	Max Load (N)	Failure Mode
EI-1	115.2	512	1
EI-2	112.9	502	1
EI-3	117.5	523	1
Average	**115.2**	**512**	

(1) Bellmouth yielding of implant collar, Figure 3.

TABLE III

40° Compression Fatigue Test - IDL Standard Multi Unit Angular Hex-30-3 w/Coping on IDL EVO Implant, Internal Hex Ø3.5mm L10mm

Testing Conditions

Testing Temperature: Room Temp Air
Environment: Air
Test Speed: 15 Hz

Sample I.D.	Maximum Load (N)	Maximum Bending Moment (Ncm)	Minimum Load (N)	Cycles to Failure	Failure Mode
EI-4	356	167.6	36	133,000	2
EI-5	356	167.6	36	645,800	3
EI-6	320	150.8	32	237,400	4
EI-7	289	136.2	29	385,800	3
EI-8	258	121.5	26	403,200	4
EI-9	231	108.9	23	5,000,000	1
EI-10	231	108.9	23	5,000,000	1
EI-11	231	108.9	23	5,000,000	1
EI-12	258	121.5	26	5,000,000	1
EI-13	320	150.8	32	192,100	3
EI-14	289	136.2	29	5,000,000	1
EI-15	356	167.6	36	41,600	5

(1) No failure - Test discontinued at 5,000,000 cycles.

(2) Implant crack below pot line and abutment screw failure, Figure 5

(3) Vertical crack in implant collar, Figure 6.

(4) Abutment crack at top of hex & abutment screw yielding, Figure 7.

(5) Vertical crack in implant collar & abutment screw failure. Figure 8.

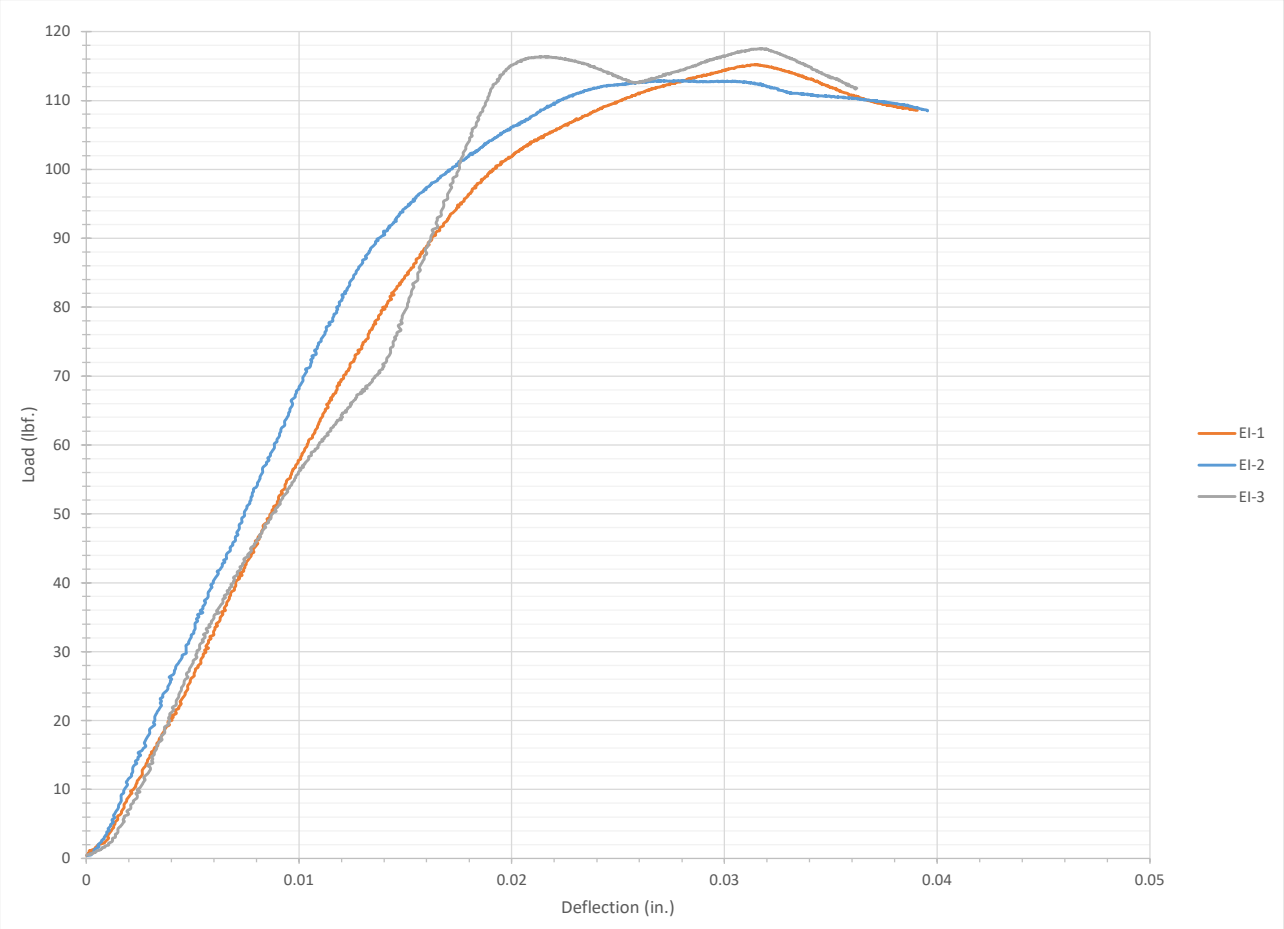


Figure 2 – Static Load versus Deflection Curves – IDL Standard Multi Unit Angular Hex-30-3 w/Coping on IDL EVO Implant, Internal Hex Ø3.5mm L10mm

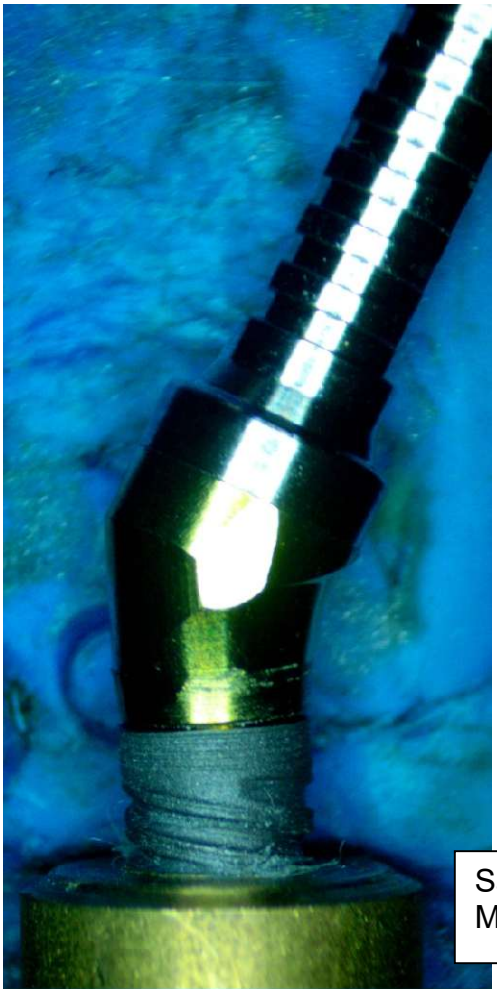


Figure 3 - Static Compression Test Failure Mode – Bellmouth yielding of implant collar

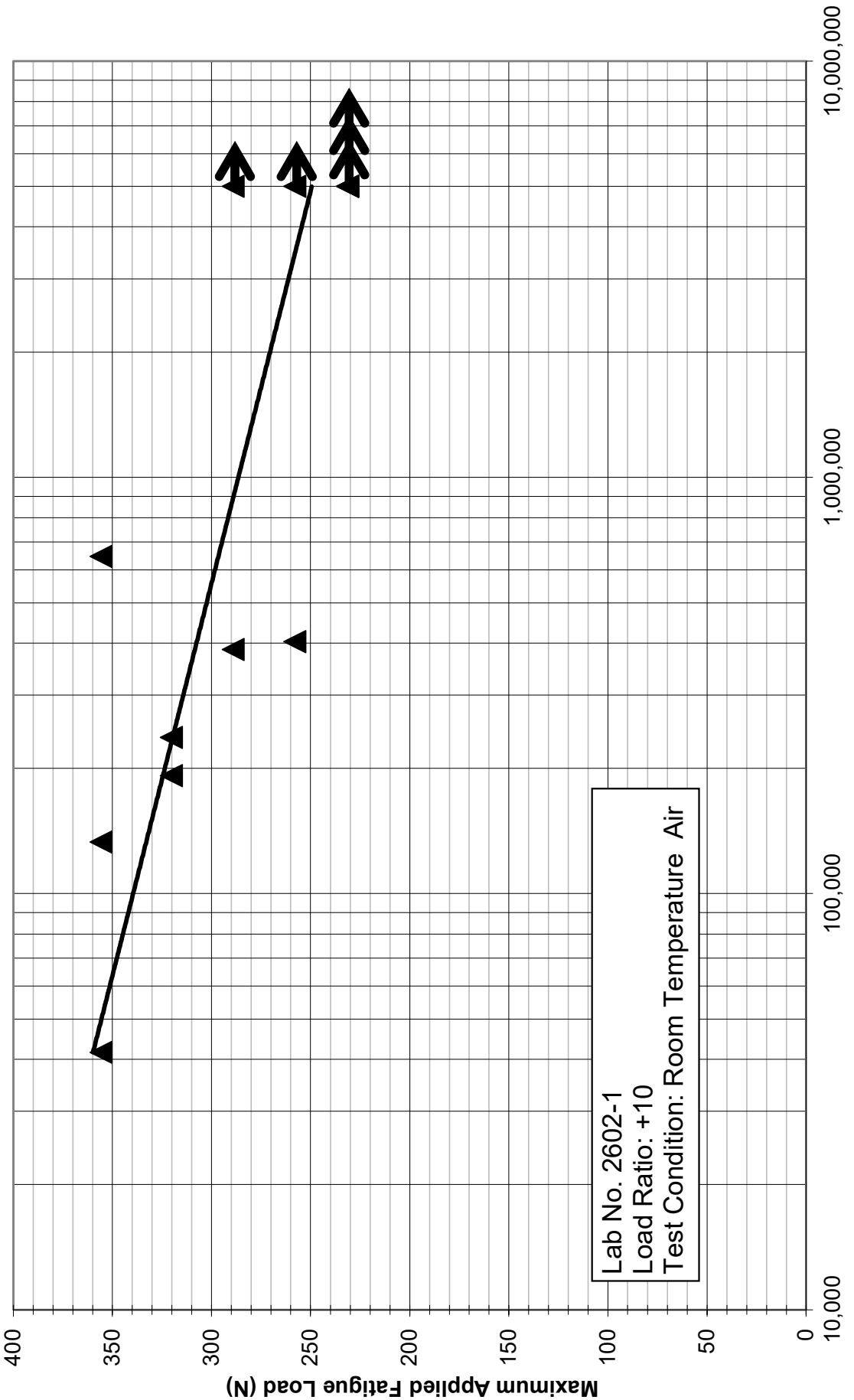


Figure 4 – Fatigue Curve - IDL Standard Multi Unit Angular Hex-30-3 w/Coping on IDL EVO Implant, Internal Hex Ø3.5mm L10mm

Figure 5 - Fatigue Test Failure Mode – Implant crack below pot line and abutment screw failure

Figure 6 - Fatigue Test Failure Mode – Vertical crack in implant collar.

Figure 7 - Fatigue Test Failure Mode – Abutment crack at top of hex & abutment screw yielding.

Figure 8 - Fatigue Test Failure Mode - Vertical crack in implant collar & abutment screw failure