第 1 日

P-28　新規ワンステップボンディングシステム「ワンナップボンドF」の理工学的特性
……○小栗　真，佐藤　猛，風間秀樹（トクヤマ）

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Flexural Behavior of Three Different Materials used for CAD/CAM

○François DURET, Somchai URAPEPON, Kiyoshi KAKUTA, Hideo OGURA, Kimihiko SATO[1]

Department of Dental Materials Science, School of Dentistry at Niigata, The Nippon Dental Univ., Japan
[1] GC corporation, Tokyo, Japan

[INTRODUCTION]

When dental restorations are fabricated using CAD/CAM, the material is exposed not only to friction but also to cutting force from the milling. If the material is subjected to some force during the milling the accuracy of the restoration might depend upon the flexural behavior of the material and its support size. At the 34th meeting of the Japanese Society for Dental Materials and Devices, we reported the deflection behavior of the newly developed composite for CAD/CAM under 500gf. For dental restorations, however, several different materials such as titanium and ceramics can be applied for CAD/CAM.

The purpose of the present study is to investigate the deflection behavior of three different materials used for CAD/CAM.

[MATERIALS AND METHODS]

Rectangular specimens with two different sizes (3×3×25mm, 5×5×25mm) were prepared from three different materials (composite, ceramic and titanium) for a flexural test. The three point flexural test with a support distance of 20 mm was carried out using a universal testing machine (Autograph DSS-5000, Shimadzu Ltd, Japan) with an extensometer. The specimen was subjected to flexural force at the cross-head speed of 1mm/min. The force and deflection were continuously recorded on a chart. From the chart, the deflection under 500gf was obtained. The data were analyzed for two main factors, material and specimen size, using a two-way ANOVA and a Tukey's multiple comparison test.

[RESULTS AND DISCUSSION]

The result of a two-way ANOVA showed that the effects of two main factors and their interaction significantly influenced on the deflection. As shown in Fig.1, a significant difference in the deflection was found among three materials at the smaller size (3×3×25mm). The composite material showed the highest deflection and titanium did the lowest among three materials. The deflection of the composite and ceramic greatly decreased as the specimen size (5×5×25mm) increase, although the composite still had significantly higher deflection than titanium at this size. It should be noted that this deflection was measured under both end support but for some CAM, the specimen is fixed only at one end, which have the deflection greater than both end support by 16 times under the same condition. The results of the present study suggest that the selection of the material and the size of the support are important factors to avoid high deflection of a material during the fabrication of a dental restoration using CAD/ CAM.

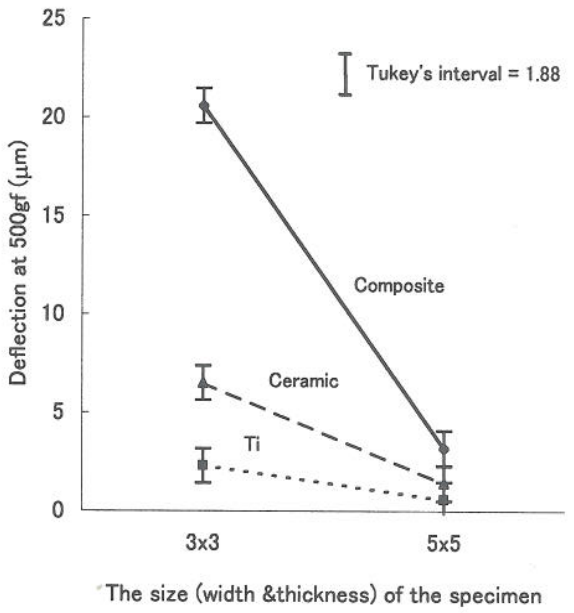

Fig1. The deflection of three different materials used for CAD/CAM

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$$Ld = \frac{Pl^3}{48lE} \quad \ldots\ldots(1)$$

$$Lc = \frac{Pl^3}{3l} \quad \ldots\ldots(2)$$

From (1) and (2)

$$Lc = 16Ld \quad \ldots\ldots(3)$$

Where, Ld = deflection under three points bending
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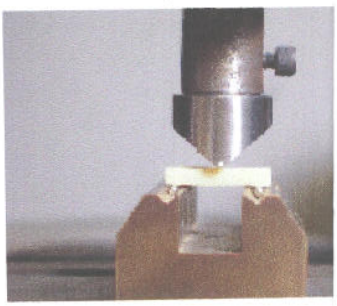
l = length of the specimen
I = Moment of inertia
E = Elastic modulus of the material



SUMMARY

The deflection under load of the newly introduced materials for CAD/CAM were investigated in order to see the deflection be this materials under the load which would occur during milling, which related to the precision of the restoration.. *The results of study suggest that the selection of the material and the size of the support are important factors to avoid high deflection of a mate the fabrication of a dental restoration using CAD/CAM.*

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Materials	Size	Mean	SD	N
Composite	S 3x3	20,5600	1,4582	4
	M 5x5	3,2500	8,000E-02	4
	Total	11,9050	9,3018	8
Titanium	S 3x3	2,3050	0,2489	4
	M 5x5	0,5850	4,123E-02	4
	Total	1,4450	0,9341	8
Ceramic	S 3x3	6,4575	1,4224	4
	M 5x5	1,3750	0,1100	4
	Total	3,9163	2,8726	8
Total	S 3x3	9,7742	8,2304	12
	M 5x5	1,7367	1,1697	12
	Total	5,7554	7,0843	24

Factor	Sum of square	df	Mean square	F value	P value
Mat	478,237	2	239,118	339,042	0,000
Size	367,608	1	367,608	549,584	0,000
MAT * SIZE	269,244	2	134,622	190,878	0,000
error	12,695	18	0,705		
Total	1147,784	23			

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Materials	Size	Mean	SE	95% confidence interval Lower limit	Upper limit
Composite	S 3x3	20,560	0,420	19,678	21,442
	M 5x5	3,250	0,420	2,388	4,132
Titanium	S 3x3	2,305	0,420	1,423	3,187
	M 5x5	0,585	0,420	0,897	1,467
Ceramic	S 3x3	6,457	0,420	5,675	7,340
	M 5x5	1,375	0,420	0,493	2,257

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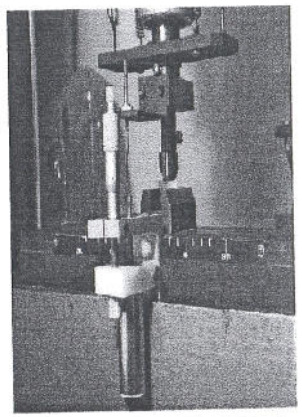

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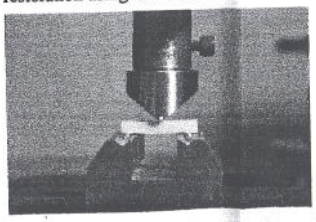

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