

P-16 High-strength GICs for the ART Technique: Two-year Results. Y. LUO*, E.C.M. LO, M.W.FAN* and S.H.Y. WEI. (Faculty of Dentistry, The University of Hong Kong and *School of Stomatology, Hubei Medical University, Wuhan, China)

This study was a prospective randomized clinical trial to compare the clinical performance of two glass-ionomer cements, ChemFlex (Dentsply DeTrey, Germany) with Fuji IX GP (GC, Japan), when used in the Atraumatic Restorative Treatment (ART) in China. 92 school children (6-14 years) who had 1-2 bilateral matched pairs of carious posterior teeth were included. A split mouth design was used to randomly assign the use of the two materials when placing restorations in the teeth on contra-lateral sides. The performance of the restorations was assessed at baseline, 6 months, 12 months and 24 months. The evaluation criteria were success (filling present and sound; or slight defect or wear less than 0.5mm) and failure (major defect or wear > 0.5mm; filling dislodged or in need of replacement). After two years, the cumulative survival rates of ART restorations in the primary teeth, were 93% for ChemFlex restorations and 90% for Fuji IX GP restorations placed in the Class I cavity preparations; while only 40% of Class II restorations were assessed as clinically satisfactory. In the permanent dentition, only Class I restorations were involved and the survival rates were 93% and 96% for ChemFlex and Fuji IX GP, respectively. Differences between the two materials were not significant for any type of restorations ($p>0.05$). The clinical performance of ART restorations was also assessed using the modified USPHS criteria. The results obtained were similar to that using the ART criteria. Silicon impressions were taken at each recall period and study casts were made in order to measure occlusal wear using the Rheinberger scale. After two years, the mean wear values for ChemFlex and Fuji IX GP in the permanent teeth were 74.5 ± 23.0 and 79.4 ± 25.4 micrometers, respectively. There was no statistical significant difference between the two materials ($p>0.05$). It is concluded that the clinical performances of ChemFlex and Fuji IX GP over a 24 months period were similar and they were satisfactory for use with the ART approach in Class I cavities in both primary and permanent teeth. (This study was supported in part by a grant from Dentsply DeTrey.)

P-17 Application of Novel MAC to Dentin Primer N.NISHIYAMA*, K.NEMOTO (Nihon University School of Dentistry at Matsudo, Chiba, JAPAN)

In this study, the methacryloyloxy aliphatic carboxylic acids (MAC) with different methylene lengths (methylene number=1: O-methacryloyl glycolic acid, MGA; methylene number =2: 3-methacryloyloxy propionic acid, MPA) were synthesized for a dentin primer. The effects of the methylene number in the MAC molecule on the bond strength of resin to acid-etched dentin were examined. After the ground dentin of the bovine tooth was etched with 40% phosphoric acid for 15 s, the dentin surface was primed with MAC solution. Immediately thereafter, the bonding agent was applied and then the composite resin was adhered to the dentin surface. When the MAC primers were applied to the etched dentin, the bond strength of the resin to dentin increased dramatically from 5 MPa to 12 MPa (Scheffe's $p<0.05$). However, the application of thermocycling (10,000 times for each bath of 4 and 60°C for 1 min) decreased the bond strength of resin, even though the etched dentin was treated with the MACs. The decrease in the bond strength to the dentin primed with MGA was lower than that obtained with MPA. It is concluded that the synthesized MAC primers enhance the bonding at the resin-dentin interface and improve the hydrolytic stability of bond strength.

Table 1 The bond strength of resin to the etched dentin primed with MAC before and after thermocycling

| | Before thermocycling | After thermocycling |
|------------|----------------------|---------------------|
| Non-primer | 5.0 (2.2) | 1.6 (0.8)* |
| MGA primer | 12.1 (3.7) | 11.6 (2.1) |
| MPA primer | 13.4 (3.1) | 10.8 (2.6) |

*Significant difference corresponded to the bond strength before and after thermocycling (Scheffe's $p<0.05$)

P-18 Microleakage of Class II Restorations Using SONICSYS[®]: An In Vitro Investigation. HOANG D.B.T.* and HOANG T.H. (Faculty of Odonto-Stomatology, HCM City, Vietnam).

SONICSYS[®] (Kavo-Vivadent) is a direct restorative technique using sonically driven diamond-coated tips to prepare standardized cavities to receive prefabricated ceramic inlays.

The aim of this study was to evaluate in vitro microleakage of Class II SONICSYS[®] inlays using two different luting agents: a light-cured flowable composite (Tetric[®] Flow, Vivadent) with etching and application of bonding agent (Syntac[®] Single Component, Vivadent) and a self-cured resin-modified ionomer cement (Protec-CEM, Vivadent). 36 freshly extracted noncarious human permanent molars were prepared with the SONICSYS[®] approx tips and then randomly divided into 2 groups of 18 each. Syntac[®] Single Component/Tetric[®] Flow, following etching was used in Group 1. Protec-CEM without etching in Group 2 to lute the ceramic inlays.

All specimens were stored in physiological saline at 37°C for 24 hours and thermocycled between 5°C and 60°C for 100 cycles, prior to 12 hour-immersion in 2% methylene blue dye. Microleakage was assessed under stereo microscope ($\times 30$) by 2 independent, calibrated evaluators according to the degree of dye penetration at cervical margins, on a 4-degree scale. The main results were as follows:

| Score | 0 | 1 | 2 | 3 |
|---------|---|---|---|----|
| Group 1 | 7 | 4 | 0 | 7 |
| Group 2 | 2 | 1 | 1 | 14 |

- 0: no leakage
1: leakage no deeper than half of length of cervical box
2: leakage along the entire length of cervical box
3: leakage along axial walls

Group 2 showed significantly higher microleakage score than Group 1 (Mann-Whitney test $p<0.05$). It was concluded that light-cured flowable composite (Tetric[®] Flow) with acid-etching and bonding is more effective in reducing microleakage under SONICSYS[®] inlays than self-cured resin-modified ionomer cement (Protec-CEM).

P-19 Biaxial Flexural Strength of Bovine Dentin and Castable Ceramics. H. TAKAHASHI*, F. NISHIMURA, T. INOUE, N. IWASAKI, H. KITAZAKI, F. NAKANO, K. TONAMI and M. YAN[†] (Tokyo Medical and Dental University, Tokyo, Japan and Chung Shan Medical & Dental College, Taichung, Taiwan[†])

Aesthetic restorations such as ceramics have been more popular because of increasing patient demands. The biaxial flexural strength (BFS) is commonly employed for evaluating mechanical properties of ceramics. However, the relation between the BFS of dentin and BFSs of ceramics have not been clearly confirmed. In this study, the BFS of dentin was measured in an effort to evaluate the BFSs of castable ceramics. Ten bovine dentin disks (12 mm/ diameter and 1.2 mm/ thickness) of the first mandibular incisor were prepared using an air-turbine with a diamond point and a low speed cutter. Ten disks (14 mm/ diameter and 1.2 mm/ thickness) of two castable ceramics (Crys-cera, Kyutai Denteram, Japan and OCC, Olympus, Japan) were prepared according to the manufacturers' instructions. The biaxial flexural test was performed using a universal test machine (1123, Instron, USA) at a crosshead speed of 1.0 mm/min, a piston diameter of 1.2 mm, and a support circle of 10.0 mm. Means \pm S.D.s of BFSs of dentin, Crys-cera and OCC were 185 ± 31 MPa, 176 ± 22 MPa and 224 ± 62 MPa, respectively. BFSs of castable ceramics were not significantly different from BFS of bovine dentin using Scheffe's multiple comparison test ($p<0.05$).

P-20 Effect of Tom Yum Soup on Color Stability of 7 Composite Filling Materials.

C. Wiwatwarapan*, N. Arethamsirikul, S. Meekaw (Chulalongkorn University, Bangkok, Thailand).

This study examined the effect of Tom Yum soup on color change in 5 visible-light-cured composite resins (Z250, P60, Herculite XRV, Metafil C, Spectrum) and 2 polyacid-modified composite resin (Dyract AP, F2000). 6 specimens (h 1.2 mm, \pm 2 cm.) of each product were stored in distilled water at 37°C for 24 hours before baseline measurement, then soaked in 7 cm³ Tom Yum soup (Takrai[®]) at 50 \pm 1 °C. Color measurement (L*, a*, b*) was made using a spectrophotometer after soaking time of 0, 6, 12, 24, 72, 168 and 336 hours. L*, a* and b* values were used to calculate ΔE . Mean values and standard deviation of ΔE in each time interval of each product were:

| Product | Time (Hours) | | | | |
|---------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | 0 | 12 | 24 | 168 | 336 |
| Z250 | 1.40 \pm 1.19 | 1.93 \pm 0.96 | 2.58 \pm 1.13 | 3.92 \pm 0.86 | 6.67 \pm 1.61 |
| P60 | 2.74 \pm 0.29 | 3.25 \pm 0.22 | 4.43 \pm 0.32 | 6.43 \pm 0.47 | 8.60 \pm 0.49 |
| Herculite XRV | 1.18 \pm 0.78 | 2.50 \pm 0.83 | 1.82 \pm 0.97 | 3.10 \pm 0.89 | 4.80 \pm 1.26 |
| Metafil C | 0.83 \pm 0.21 | 1.69 \pm 0.47 | 0.80 \pm 0.11 | 1.01 \pm 0.14 | 1.13 \pm 0.22 |
| Spectrum | 1.38 \pm 0.23 | 1.88 \pm 0.30 | 1.57 \pm 0.22 | 1.68 \pm 0.22 | 1.96 \pm 0.23 |
| Dyract AP | 0.61 \pm 0.25 | 0.57 \pm 0.14 | 0.76 \pm 0.25 | 1.26 \pm 0.42 | 4.22 \pm 0.93 |
| F2000 | 2.43 \pm 0.35 | 2.60 \pm 0.49 | 4.17 \pm 1.93 | 2.80 \pm 0.39 | 4.50 \pm 0.66 |

When the value of $\Delta E>3.5$, it was considered to be clinically unacceptable (Fan P.L. Color and Appearance. In: O' Brian W.J., editor, Dental materials and their selection, second edition, Carol Stream: Quintessence Publishing Co, 1997: 29). P60 and F2000 were discolored at 24 hrs., Z250 at 72 hrs., XRV and Dyract AP at 168 hrs., but it has no effect on Metafil C and Spectrum after 336 hrs. of TomYum exposure. Supported by Dental research project 1997 Faculty of Dentistry, Chulalongkorn University.

P-21 The Study of Tear Resistance of Silicone with Lipid Absorption. N. Thamrongananskul*, L. Boontham, W. Panichkriangkai and P. Phankosol (Department of Prosthodontic, Faculty of Dentistry, Chulalongkorn university, Thailand)

Silicone has been widely used as a maxillofacial prosthetic material since its properties simulate human soft tissues. However, skin contact and lipid absorption from skin might shorten the longevity of the material. This study was designed to evaluate the change of tear resistance of the silicone after lipid absorption. Four groups of 30 silicone specimens, 25 mm. X75 mm. X 1.5 mm. In size according to ASTM-D 1938-92. The groups included an untreated control group while the other three groups were immersed in lipid extracts from pigs, cattle and soybeans. All of them were incubated at 37 °C for 720 hrs. The specimens were tested for tear resistance as mean load. The data were collected and analyzed statistically by one way analysis of variance at $\alpha=0.05$. The results showed that specimens immersed in cattle oil extract had significantly decreased tear resistance compared to control and pig oil extract groups. Soybean oil seemed to reduce tear resistance with no statistical difference. However, pig oil did not have any effect on tear resistance at all. The study was supported by a grant from Dental research project, Faculty of Dentistry, Chulalongkorn University 1999.

P-22 The parameters of laser welding apparatus on penetration depth of cast c.p. titanium. C.C. Hsu, C.C. Hong*, M.S. Huang and H.H. Huang (Institute of Dental Materials, Chung Shan Medical & Dental College; Chungtai Institute of Health Sciences and Technology, Taichung, Taiwan.)

The purpose of this study was to determine optimal laser power parameters on cast c.p. titanium welding. Observation of the penetration depth and microstructure structure were evaluated under SEM. Three rectangular patterns 10 mm \times 10 mm \times 3 mm were prepared from hard pink base plate wax (Moyco Industries Inc., Philadelphia, PA) for each parameter. CP titanium (Grade II Ti, Pure Ti A. J. Morita Co., Osaka, Japan) was casted by using titanium casting machine (Cyclar II, J. Morita Co., Osaka, Japan). Before welding, the specimens were sandblasted with 50 micron Al₂O₃ to create dull surfaces. A Nd:YAG laser welding apparatus (LaserStar, Bego Co.) was used for welding procedures and all of the laser welding procedures were done in an argon atmosphere. The conditions such as input voltage (290 ~400 Voltage), pulse duration (9~20 ms) and beam diameter (0.3 and 0.5 mm) were evaluated. Observation of the penetration depth, width and microstructure structure were examined under metallurgical microscope. A three-way ANOVA followed by a Student-Neuman-Keuls was used to analyze the data. There was statistically significant difference of welding depth and width between 0.3 mm and 0.8 mm beam diameter ($p<0.05$). On 0.3 mm beam, there were statistically significant deeper penetration ($p<0.05$) whenever input voltage was 320, 330 and 350 V under 9 ms. However, there were more voids created when input voltage was 350 V. On 0.8 mm beam, 400 V and 10 ms show significantly deeper penetration (1.4 ± 0.03 mm) than other parameters ($p<0.05$). It is concluded that adequate parameter selection is necessary during the laser welding procedure to create adequate penetration depth and eliminate voids.

P-23 Finite element analysis of four thread-form configurations in a stepped screw implant. J.P. Geng*, K.B.C. Tan, G.R. Liu and S.H. Teoh (National University of Singapore, Singapore)

An experimental stepped screw osseointegrated dental implant was designed for investigation and biomechanical optimization. The purpose of this study was to determine the optimal thread form configuration for an experimental stepped screw implant using two-dimensional finite element (FE) analysis. Four different thread form configurations were compared: v-thread (V), thin-thread (T), and two square-thread forms of 0.24 mm (S1) and 0.36 mm (S2) thread width. Four two-dimensional single stepped screw implants were modeled with similar conditions of thread number, position, height and pitch, in a standard two-dimensional cross-section of the posterior human mandible. The stepped screw implant was modeled in Unigraphics 2.0 and component geometry exported to MSC/PATRAN 8.5 for FEA meshing into 4-noded quadrilateral elements. In ABAQUS/Standard, an oblique load of 141 N at 45 degrees angle was applied to the top of the transmuscular abutment. Maximum von Mises stresses at cortical bone level and trabecular bone-implant interface were:

| Max von Mises Stress (Mpa) | V | T | S1 | S2 |
|-----------------------------------|------|------|------|------|
| Cortical Bone | 70.4 | 79.0 | 76.9 | 76.3 |
| Trabecular Bone-Implant Interface | 37.1 | 47.3 | 39.1 | 39.0 |

Only the thin-thread (T) model demonstrated significantly different stress distribution from the other 3 models. Maximum stresses of approximately 20% higher in trabecular bone-implant interface compared to the other three implant models was seen. Stress distribution in cortical bone does not seem to be greatly influenced by thread form configuration. It can be concluded that both v-thread (V) and square thread form (S1 & S2) configurations appear to suitable for use in a stepped screw implant design but thin thread forms should be avoided.