

2185 Properties characterization of Ti-Mn alloys. Y. TAKADA*, M. KIKUCHI, T. OKABE, O.OKUNO (Tohoku University, Japan; Baylor College of Dentistry-Texas A&M University System Health Science Center, Dallas, TX).

Many β titanium alloys have favorable mechanical properties for dental applications. This study examined the microstructures, hardness, and electrochemical behavior of binary β Ti-Mn alloys. Ti sponge (S90, Sumitomo Sinter) with 5, 10, 15, 20 and 30 mass% Mn were melted and cast into a mold with a phosphate-bonded investment (Bluevest, Tokuyama). A two-compartment/pressure casting unit (Castmatic, Iwatani) was used to produce 27mm x 8mm x 3mm castings. Information on cross-sectional Vicker's hardness profiles (n=5), anodic polarization (n=4) and rest potentials (n=3) in 0.9% NaCl was collected. Phases present were detected using XRD. In addition, data on cast pure Ti (control) was obtained. The phases identified, hardness at 20 μ m and 500 μ m from the surface and rest potentials are given below (mean/SD):

Mn (mass%)	5	10	15	20	30	Pure Ti
Phase	$\alpha+\beta$	β	β	β	β	α
VHN (20 μ m)	648/10	647/30	554/28	556/9	539/31	647/49
VHN (500 μ m)	309/13	388/15	368/5	392/3	469/11	182/17
Potential (mV vs. NHE)	186/1	186/1	186/0	186/1	186/0	186/2

Statistical analysis using ANOVA/SNK revealed that the bulk hardness of the cast pure Ti is significantly ($p<0.05$) lower than that of any alloys tested. Among the alloys with Mn \geq 10% (β alloys), the 15% Mn alloy exhibited the lowest bulk hardness ($p<0.05$). The surface hardness of the alloys with 15-30% Mn was significantly ($p<0.05$) lower than that of pure Ti and the other alloys. All the titanium tested exhibited similar electrochemical behavior. Alloying \geq 10% Mn in cast Ti stabilized the β phase. This solid-solution hardened alloy reacted less with the investment materials as was evidenced by the lower surface hardness compared to CP Ti. Partially supported by NIH/NIDCR grant DE11787.

2186 Strength and Porosity of EDC Dental Implants. D.R. DAWSON, J.T. DOMINICI, M.V. THOMAS, and R.J. MITCHELL* (University of Kentucky College of Dentistry, Lexington, KY, USA).

Electrodischarge compaction (EDC) can produce porous-surface implants that are potentially stronger than porous-coated implants. We tested the null hypotheses that porosity and strength of EDC implants are independent of site in the implant. Using the method of Qiu *et al.* (Biomaterials 1997 18:153-160) and commercially pure Ti powder, we made 13 x 4 mm (dia.) cylindrical EDC implants. We cut 1 mm thick disks from the top, middle, and bottom of 10 randomly selected implants. Using digitized 50 X images and an image analysis program (SigmaScan Pro 4.0; SPSS Inc.), we measured average, minimum, and maximum percent porosity as a function of distance from the center of each disk. Using the method of Lifland *et al.* (Clin Mater 1993 14:13-19), we measured the shear force to fracture the porous Ti along a circumference located approximately 0.54 mm inside the edge of each disk. Site significantly affected maximum porosity 0.54 mm from the edge (analysis of variance, $F = 5.72$; $P = 0.013$). Mean (± 1 std) maximum porosities were $46.9 \pm 4.5\%$ (bottom), $42.5 \pm 3.5\%$ (middle), and $43.8 \pm 2.9\%$ (top). The mean fracture force (208.1 ± 52.7 N) was not affected by position in the implant ($F = 0.00$; $P = 0.995$). The porosity in these EDC implants varies significantly from top to bottom but fracture force does not vary significantly with site.

2187 Retention of fluoride releasing resins as pits and fissure sealants. 30-months clinical trial. F. FORNIELES*, M. TOLEDANO, R. OSORIO, C. PONS, F. GARCIA-GODOY (Univ. Granada, Spain; UTHSC, San Antonio, TX, USA)

The aim of this study was to compare the retention of two fluoride releasing resins used as pits and fissure sealants. -Fluoroshield (Caulk/Dentsply) and Helioseal F (Ivoclar Vivadent)- to a conventional pits and fissures resin sealant delton (Johnson&Johnson). The children who participated in the study received a total of 797 sealants placed in permanent first molars. Each sealant was placed by one dentist, according to the manufacturers' directions. At base line, all sealed teeth were checked by the dentist for completeness of sealant coverage and retention in all susceptible pits and fissures. In each patient, Delton sealant and one of the two fluoride releasing resins were placed. 6-12-18-24 and 30 months clinical examination for retention were done by two examiners using the following criteria (no loss, partial loss, complete loss). Consensus was obtained at chairside before patient dismissal. The table shows the retention for the three fissure sealants materials (NL: No loss; PL: Partial loss; CL: Complete loss).

Sealants	6 months		1 year		18 months		2 years		30 months	
	NL	PL	NL	PL	NL	PL	NL	PL	NL	PL
DELTON (n=380)	275	111	311	14	283	14	187	9	132	12
FLUROSHIELD (n=128)	101	2	111	6	99	10	54	4	45	6
HELIOSEAL (n=239)	202	13	201	7	138	9	82	12	56	5
TOTAL (n=797)	578	26	623	27	520	33	323	25	233	23

A Kruskal-Wallis 1-way ANOVA test indicated no significant differences in retention among the three different materials ($P>0.05$) or between maxillary and mandibular teeth ($P>0.05$). Sealants complete retention after 30 months is near 90%. Supported by Spanish Government. Plan I+D. Grant #MAT985-0937-C02.

2188 Bonded amalgam sealants: Five year clinical results. M. STANNIC*, N. ARTIGA, S.A. GANSKY, W.S. EAKLE, G.W. MARSHALL (University of California, San Francisco, CA, USA)

Amalgam can be bonded to enamel with bond strength approaching that of composite resin. Bonding results in less leakage, greater retention, and reinforcement of the tooth. Pit and fissure sealing with resin is well-documented and efficacious for preventing occlusal caries. However, the unfilled or lightly filled resins wear rapidly, needing replacement every few years. The aim of the present study was to examine the efficacy of amalgam bonded into unprepared pits and fissures as a sealant and compare this technique to conventional resin sealants. 114 permanent teeth in 26 patients were randomly assigned in pairs to be sealed with either amalgam bonded with All-Bond 2 with Liner F (Bisco) or a resin sealant (Bisco). After 0, 5, 1, 2, 3, 4, and 5yrs, clinical examination for retention was done by 2 trained examiners using modified USPH criteria. 97 teeth were included in the 5 yr analysis. Cumulative results by 5yr recall:

	Amalgam sealants	Resin sealants
Alfa - no loss	26%	27%
Bravo - slight loss	33%	34%
Charlie - repair required	40%	40%

Logistic, ordinal logistic and discrete time-to-event models accounting for clustering of teeth within patients indicated no significant difference between the two techniques. The odds ratio of failure for amalgam:resin was 1.05 ($p = .91$; 95% confidence interval 0.42, 2.62) Amalgam bonding may be useful for sealing pits and fissures near restorations as well, analogous to the preventive resin restoration. Bonded amalgam can be used to seal unprepared pits and fissures and is as effective as resin sealant at five years.

2189 Improved Sealant Retention Using Bonding Agents: A 5-Year Clinical Study. FEIGAL RJ*, MUSERURE P, GILLESPIE B, LEVY-POLLACK M, QUELHAS I, HEBLING J (Univ. of Michigan, Ann Arbor, Michigan).

The purpose of this work was to confirm, with a long-term clinical study, findings of *in vitro* work suggesting that adding a bonding agent layer between sealant and contaminated enamel allows adequate bond strength and retention of resin sealants. In this 5-Yr clinical study of over 600 occlusal (OC) and over 440 buccal/lingual (B/L) sealants, we treated molars judged difficult to seal using a split-mouth design, with half receiving sealant alone and half receiving bonding agent plus sealant. Treatment effects and potential risk factors for sealant failure were tested using a Cox regression model. Sealants were scored by clinical criteria, and risk factors relating to patient (age, behavior), tooth (decay, salivary control, stage of eruption, enamel condition), and treatment (sealant only or bonding agent plus sealant) were analyzed for their hazard ratios. Three bonding agent groups were analyzed for treatment effect: AG 1 (Tenure primer), AG 2 (3M primer) and AG 3 (single bottle dentin bonding agents). AG 3 was successful in reducing risk of failure with a hazard ratio (HR) of 0.53 ($p=0.014$) for OC and 0.35 ($p=0.006$) for B/L sealants. AG 2 was detrimental to sealant success with a HR of 2.96 ($p=0.0003$) for OC and 1.12 ($p=0.61$) for B/L sealants. AG 1 was neutral, showing HRs equal to that of the control sealants. Variables affecting success differed between OC and B/L sealants suggesting failures of these two types of sealant are dependent upon differing factors. Mandibular failed less often than maxillary sealants (HR=0.77, $p=0.038$ in OC and HR=0.65, $p=0.009$ in B/L). Early eruption was a significant risk factor for both types of sealant (HR=2.91, $p=0.00001$, OC and HR=1.52, $p=0.015$, B/L). Behavior (HR=1.96, $p=0.0007$) and salivary problems (HR=1.73, $p=0.003$) were significant risk factors for OC only. Enamel problems related to increased risk of OC failure (HR=1.51, $p=0.018$). In addition to detailed analyses of risk factors for sealant survival, data from this study show that the new single bottle dentin bonding agents are protective for sealant survival when used as an intermediate layer between enamel and sealant, yielding 1/2 the usual risk of failure for OC sealants and 1/3 the usual risk of failure for B/L sealants.

2190 A 36 months follow-up of glass ionomer and resin sealants. R. S. VTEIRA*, I.C.S. ALMEIDA, C. MARTINHON, C. O. RODRIGUES, S.F.T. FREITAS* (Federal University of Santa Catarina, Florianópolis-SC, Brazil)

Several new dental materials with adhesive properties have been used as a pit and fissure sealant and the glass ionomer cements is one of them. In a previous study (J. Dent. Res. 70: 1022,1998) we compared intra-individually the clinical retention and caries preventive properties of a glass ionomer cement (Vitremere-3M) used as an occlusal sealant and a photo-cured bisGMA resin sealant (FluroShield- Dentsply) at 18 months, in 84 teeth from 26 patients. Both were a releasing fluoride and photo-cured materials. All teeth were pumice and acid etched, the glass ionomer group with a 10% polyacrylic acid and the bisGMA group with a 37% phosphoric acid. All sealants were applied under rubber dam isolation. The results demonstrated that the FluroShield group significantly ($p<0.0001$) showed better retention rates. Meanwhile no recurrent caries were observed in both groups. After 36 months, 18 patients and 56 teeth were available for clinical and radiographic examination. In the Vitremere group 05 (17.9%) sealants were totally present, 17 (60.7%) sealants were partially retained and 06 (21.4%) were totally lost. 11 (39.3%) caries lesions were recorded in this group. In the FluroShield group 15 (53.6%) were totally present, 12 (42.9%) were partially lost and only one (3.5%) was missing. 03 caries lesions were recorded in this group. The results obtained indicated that the resin sealant group (FluroShield) was more effective on bonding to the occlusal enamel (Wilcoxon test, $p<0.0001$) and more effective in the reduction of developing caries ($p=0.013$) than the glass ionomer group (Vitremere).

2191 Factors affecting survival of ART restorations in Chinese pre-school children. E.C.M. LO*, C.J. HOLMGREN (Faculty of Dentistry, University of Hong Kong)

The objectives of this study were to provide ART restorations to kindergarten children in China under field conditions and to investigate factors that might influence the survival of the restorations. A total of 509 ART restorations were placed in 239 children aged 3.9 \pm 0.3 years, by four middle-level dentists in two kindergartens. Standard instruments and procedures for ART were used. The restorative material used was a high-strength glass-ionomer (Ketac-Molar*, ESPE). In one of the kindergartens, a daily toothbrushing with fluoride toothpaste programme was in place while in the other no organized prevention programme was available. After placement the restorations were evaluated six-monthly by two calibrated independent examiners using explorers and mouth-mirrors. The evaluation criteria were success (restoration present and not needing replacement) and failure (restoration dislodged or in need of replacement). Results: 76% of the restorations were followed for 24 months. Results of a logistic regression analysis on the success of the restorations at the 24-month examination showed that baseline dmft score, caries increment, operator and access to a prevention programme all had no statistically significant effect ($p>0.05$). Success of the restoration, however, varied with the class type. The cumulative 24-month survival rates for class 1 and 5 restorations were 69% and 78% respectively. The survival rates for class 2 and 3 restorations were much lower (35% and 21% respectively) with more than half having dislodged within the first year. In this study, survival of the ART restorations was related to the class type but not to the other factors studied. This study was supported by a grant from ESPE Dental-Medizin GMBH & Co.

2192 Six-month Clinical Evaluation of ART Glass-ionomer Fissure Sealants. L.H. de S. GONZAGA, M.F. de L. NAVARRO*, E.M. de SOUZA, A.H. OLIVEIRA. (Bauru Dental School - University of São Paulo - Brazil).

The aim of this study was to evaluate a high viscosity glass-ionomer cement Ketac Molar (ESPE) as a pit and fissure sealant within an Atraumatic Restorative Treatment (ART) programme. Four-hundred ninety-eight first permanent molar sealants were performed in a selected 7 to 10 years old children population. Each sealant was placed by same dentist using the "press finger" technique. At the baseline and at 6 months recall transparencies of all sealants were taken (1.5 magnification) for indirect evaluation. All sealed teeth were indirectly checked by two calibrated dentists using the following criteria: 0- Completely present, no caries; 1- Partly present, no caries; 2- Completely loss, no caries; 3- Partly present, with caries; 4- Replaced by an other treatment; 5- Lost, with caries. Consensus was obtained between the examiners. The observed scores after six months were: 0- 4.01%; 1- 63.65%; 2- 17.90%; 3- 8.63%; 4- 0.40%; 5- 5.42%. Glass-ionomer ART sealants represent a valid procedure for community caries prevention (85.56% of molars evaluated were caries-free). Supported by ESPE Dental-Medizin GMBH & Co.