

**65** Fractographic investigations on human dentine  
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Restorative procedures that result in excessive dentine removal predispose tooth to fracture. Although causes of iatrogenic tooth fracture may be known, prevention of such fractures may be difficult. Further, a thorough understanding on the behavior of dentine to fracture is lacking. This study utilizes an accepted engineering failure analysis technique to investigate the dentine behavior to fractures. Ten freshly extracted lower central incisor teeth was collected and maintained in phosphate buffered saline medium. These teeth were randomly divided into two groups. In which, Group 1 was subjected to root canal cleaning and shaping procedure using hand instruments, while in Group 2, root canal preparation was performed using endosonic instrumentation. Initially the amount of dentine removed during cleaning and shaping procedures were ascertained by weight. Later these specimens were subjected to failure load analysis using an Instron testing machine. A linear relationship was observed between the amount of dentine removed and the load of fracture. It was found that the load of fracture decreased as more amount of dentine was removed. Finally a detailed Scanning Electron Microscopic Examination was carried out at the fracture sites to investigate the dentine material behavior to fracture. It was concluded from the fractographic analysis that dentine exhibited bi-phased behavior to fracture.

**66** Effect of light- and chemical-cured composites on microtensile bond strength of simplified-step adhesives. AME SANARES<sup>1\*</sup>, A. ITTHAGARUN<sup>1</sup>, NM KING<sup>1</sup>, FR TAY<sup>1</sup> and DH PASHLEY<sup>2</sup> (University of Hong Kong, HKSAR; <sup>2</sup>Medical College of Georgia, USA)  
Chemical-cured resin composites were anecdotally reported to bond poorly with the use of some simplified-step dentin adhesives. This *in-vitro* study examined the effect of two factors, adhesive types and composite curing modes on bonding to sound dentin. Twelve caries-free, human third molars were divided into six groups. A flat dentin surface devoid of occlusal enamel was created for each tooth. Acid-conditioned dentin surfaces were bonded with either one of the three adhesives: Prime & Bond NT (PBNT; Dentsply), One-Step (OS; Bisco) and Single Bond (SB; 3M). Resin composite buildups were then made with either a light-cured (LC) composite (Z-100, 3M) or a chemical-cured (CC) composite (BisFil 2B, Bisco). After storing in water at 37°C for 24 hours, the teeth were vertically sectioned into 0.9mm x 0.9mm composite-dentin beams. Two teeth from each group yielded between 38-48 beams for evaluation of tensile bond strength, using a Bencor Multi-T testing device adapted to an Instron universal tester. After initial classification of the failure modes with a stereoscopic microscope, four representative beams from each group were prepared for scanning electron microscopic examination. The pH of the three adhesives was also measured. Results: microtensile bond strength for PBNT-LC: 58.65±8.08 MPa; PBNT-CC: 7.83±4.97 MPa; OS-LC: 60.91±9.90 MPa; OS-CC: 25.14±12.69 MPa; SB-LC: 60.75±12.03 MPa; SB-CC: 14.75±8.26 MPa. A two-way ANOVA showed that the effect of adhesive types, composite curing modes, and the interaction between these two factors were all statistically significant (p<0.001). A post-hoc Tukey test further showed that bond strength of the three adhesives were not significantly different with the light-cured composite (p>0.05). However, they were significantly different from one another when used with the chemical-cured composite (p<0.01). The pH of the three adhesives were, PBNT:2.68; SB: 3.60; OS: 3.80. In PBNT-CC, failure predominantly occurred along the composite-adhesive interface, with the presence of large surface crater. Both adhesive and mixed failures were observed in the other groups. It is hypothesized that decrease in bond strength could be caused by porosities incorporated during mixing as well as reaction of acidic adhesive monomers with the tertiary amine catalyst in the chemical-cured composite.

**67** In-vitro Microleakage Around Class II Resin Restorations Lined With Flowable Composite. DUONG T.H.X\* (Faculty of Odonto-Stomatology, Ho Chi Minh City, Viet Nam).  
The aim of this study was to evaluate microleakage around Class II composite resin restorations (Ariston pHc) lined with a flowable composite (Tetric® Flow) compared to restorations performed with the same material according to the manufacturer's instructions. Forty Class II cavities were prepared in caries-free, human premolars and molars and divided randomly into two groups. Twenty cavities (group 1) were restored with Ariston Liner/Ariston pHc. The other (group 2) were restored with Syntac® Sprint™ / Tetric® Flow / Ariston pHc. All specimens were stored in physiological saline at 37°C for 24h and thermocycled 100 times between 5°C and 60°C, prior to 12-hour immersion in 2% methylene blue dye. After embedding and sectioning, the specimens were examined under stereo microscope (X30). Microleakage was assessed 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	
					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 1	0	1	3	16	
Group 2	11	7	1	1	

Ariston Liner / Ariston pHc group had significantly higher microleakage formation ( Mann Whitney test . p < 0.0005) than Syntac® Sprint™ / Tetric® Flow / Ariston pHc group. It is concluded that conventional bonding and lining with a flowable composite (Tetric® Flow) can significantly reduce in vitro microleakage around Class II restorations with Ariston pHc.

**68** In-Vitro Comparison of Apical Transportation when using the ProFile® and K-file. J. SUCHITRA\* and K. PATHAWEE (Dept. of Restorative Dentistry, University of Chiangmai, Thailand)

During the instrument of narrow curved canals the maintenance of original canal curvature becomes a challenge. The main purpose of this study was to compare the degree of apical transportation which occurs when ProFile® .04 taper Series 29 rotary nickel-titanium instruments and stainless steel K-file are used in the preparation of curved canals. Thirty canals in extracted human molar teeth were divided into 2 groups (n=15 in each group). The first group was instrumented using rotary ProFile® .04 taper instruments and the second group was prepared by stainless steel K-file using a crown-down pressureless preparation technique. Pre- and postoperative radiographs were used to determine changes in canal curvature. Apical transportation resulting from the two instrumentation techniques was evaluated by the computer analysis of Indiana University, School of Dentistry (IUSD Software). Apical transportation (measured in degrees) for the ProFile® was 1.8 ± 0.6331 and for the K-file was 6.8 ± 1.6114. Statistically significant differences were found for apical transportation (X ± SD, P<0.01). There was statistically less deviation of apical canal curvatures with ProFile® when compared with the K-files (P<0.01). It was concluded that during the mechanical instrument of curved root canals ProFile® .04 taper Series 29 rotary instruments created less apical transportation than K-files used with a crown-down pressureless techniques.

**69** A Comparison of Two Root Canal Preparation Techniques For Molars. PHAM V.K.\* and BUI Q.D. (Faculty of Odonto-Stomatology, HCM City, Vietnam).

This study was conducted in order to evaluate the efficacy of the engine-driven Ni-Ti Maillefer Profile® technique in root canal preparation, compared to the conventional hand instrument technique. Forty extracted molars with intact crowns and mature root apices were randomly divided into two groups, with similar curvature of the mesial root of lower molars and mesio-buccal root of upper molars. In group 1, root canals were instrumented using K-Flexofile. In group 2, root canals were prepared using Ni-Ti Maillefer Profile® instruments according to the manufacturer's instructions. Instrumentation time was recorded. Preoperative and postoperative double-exposed radiographs were taken facially with instruments in place, in order to assess canal deviation. The roots were then cross-sectioned at 2, 5 and 9 mm from the apex. Cross-sections were evaluated as round, oval or irregular. The following results were observed:

Cross-section Level	K-Flexofile (group 1)			Maillefer Profile® (group 2)		
	Round	Oval	Irregular	Round	Oval	Irregular
2 mm	13	4	1	8	10	1
5 mm	13	1	4	14	2	3
9 mm	14	1	3	13	1	5

65% of specimens in group 1 and 85% of specimens in group 2 exhibited no apical transportation. The average instrumentation times were 533 and 326 seconds for group 1 and group 2 respectively. The results showed no statistically significant differences in the quality of canal preparation between both techniques (Mann-Whitney test), with instrumentation time significantly reduced when using Maillefer Profile® (t-test).

**70** Biting force evaluation for myofascial pain patients S.C. Wen, C.W.Kao\*, C.C Peng and Y.Y. Shiau. Graduate Institute of Clinical Dentistry, National Taiwan University, Taipei, Taiwan

The purpose of this study was to investigate the difference in bite performance on standardized test foods with know hardness between myofascial pain (MPD) patients and healthy subjects. Twenty young female patients with myofascial pain having complete dentition and no dental prosthesis were compared with twenty healthy female controls of similar age group. Pain at facial muscles was evaluated with an Algometer. Two type of known hardness standardized testfoods were developed for the evaluation of biting performance. They were tablets of 13mm in diameter and 5mm in thickness. The hardness of the testfoods were 61.44±3.02kg and 20.03±1.29kg. The subjects were asked to break the test foods with the first molars of the habitual side and chew five times. Total muscle contraction activity (TMA), contraction duration (D) and mean voluntary contraction (MVC) of the bilateral anterior temporalis, masseter, and sternocleidomastoid muscles (SCM) were recorded with a jaw tracing system. It was found that harder foods required more muscle activity (P<0.05) and jaw lateral movement in both groups. Patients had longer D (P<0.05) and lower MVC (P<0.05), but TMA was not significantly higher (P>0.05). The side of chewing habit, food hardness, body height and weight also influenced the bite performance significantly (P<0.05). No coactivation of temporalis and/or SCM was found when the masseter muscle is painful. Based on the findings, it can be concluded that pain causes weakness of the jaw closing muscle and when a hard food is to be broken, longer contraction time is required instead of exerting more contraction force. (The study was supported by a Grant of NSC-87-2314-B002-129)

**71** Microglial Response Induced by Formalin Injection into the Rat Face. H.P. LIU\*, J.F. YEO, and S.K. LEONG (Dept. of Oral & Maxillofacial Surgery, Dept. of Anatomy, NUS)

This study investigated the response of microglia in the caudal spinal trigeminal nucleus (cSTN) to subcutaneous injection of 0.5ml of 4% formalin into the lateral face of Wistar rats. The animals were perfused 2 hours and 4 to 60 days after injection. Rats injected with physiological saline and perfused 7 hours later were used as control. Immunohistochemistry was performed to detect the possible activation of microglia in the cSTN, using OX-42, OX-18 and OX-6 antibodies as markers. The expression of c-fos which indicates nociception was also detected, using Fos antibodies. The results showed that a large number of Fos positive nuclei were detected in the superficial laminae of the ipsilateral cSTN 2 hours after formalin stimulation, in agreement with our previous study. Four days after stimulation, OX-42 and OX-18 immunoreactivity in the same region were moderately increased, compared with that in the contralateral nucleus. A few OX-6 immunoreactive microglia were also detected in the ipsilateral nucleus. Seven days after stimulation, there was a marked increase in OX-42 and OX-18 immunoreactivity. The number of OX-6 reactive microglia was also greatly increased. None or only a few of them were found in the contralateral nucleus. At 60 days after stimulation, the staining intensity of OX-42 and OX-18 in the ipsilateral side almost return to that of the contralateral side. However, a number of OX-6 stained microglia were found in the deeper laminae of the nucleus. It is concluded that the activated microglia may bring about phagocytosis of any degenerating profiles resulting from formalin injection. The sustained response of microglia may also play some roles in hyperalgesia as it has been reported that their secretions IL-1 and IL-6, may cause pain. This work is supported by grant RP940320 and RP3982346 from the NUS.

**72** Mandibular Fractures in Helmeted Motorcyclists - A Preliminary Survey. W.K.S. Tan, C.H. Kau\* and O. Chan (Department of Oral and Maxillofacial Surgery, NUS, Singapore). (Dental Division, SAF, Singapore). (Department of Mathematics, NUS, Singapore).

Previous research in the National University Hospital has shown that a large proportion of mandibular fractures arise from road traffic accidents which involve helmeted motorcyclists. The aims of this study were to determine whether a specific pattern of fractures exists for motorcyclists, as well as to assess the influence of accident-related data on fracture pattern. Fifteen motorcyclists who sustained mandibular fractures in road traffic accidents while wearing open-faced helmets were interviewed. Driving experience, types of motorcycle, crash patterns, speed, location and time of accident were the accident-related data collected. Mandibular fracture location, race, gender and age were also obtained. Accident-related data was compared against locations of mandibular fractures. These patterns were also compared with the fracture patterns from other etiologies. Analysis was carried out with Chi-Square tests. Accident-related data did not influence fracture patterns in motorcyclists. The fractures were also not significantly different to those caused by other etiologies. However, majority of fractures (60%) involved the parasymphseal regions of the mandible. Limitations of the study and possible zones of facial injury in helmeted motorcyclists will also be discussed. In conclusion, compared to other groups, mandibular fracture patterns are not significantly dissimilar in motorcyclists. Preliminary findings indicate that variables related to the accident have no apparent influence on fracture pattern.