G-1

The Role of Basic Science in Clinical Dental Research. G. EMBERY (Univ. of Wales Dental School, Cardiff, UK)

A number of Dental Schools worldwide have invested in oral biology/basic dental science as a specialist discipline to support teaching and research within the clinical training programmes. The research elements range from biomaterials science, odontogenesis, craniofacial development to physiology, microbiology and anatomy. Such Units allow the development of career structures for essentially, although not exclusively, non-clinical staff with the ability to devote more time to laboratory-based research compared with clinical colleagues. Successful Units have interactive programmes with clinical groups allowing a greater understanding of each others problems and the ability to acquire joint funding from both State, Research Council and industrial sources. Although sharing and exchange of specialist apparatus with Medical Schools is more common, the acquisition of a stand-alone apparatus base is vital to everyday functioning and ability to fulfil postgraduate research obligations. The support of the Dental School is vital to maintain the morale and future vision of basic dental science which has done much to raise the profile of clinical dentistry as an academic discipline. Western societies have active programmes in this area – Eastern Europe and other developing regions less so. Other parts of the worldwide offer a mixture of scenarios, e.g. non-clinical colleagues attached to clinical units. Even amongst Western countries not all have Oral Biology Departments. Clearly there are many structures for involving oral biology and an overview of the successes and difficulties apparent will be presented.

G-2

Designing and Implementing Clinical Research in Dentistry. J. W. Stamm (University of North Carolina, Chapel Hill, NC, USA 27514)

Clinical research plays a more critical role than ever, providing the vital end-stage of the contemporary basic-translational-clinical research process that provides for the advancement of the oral health sciences. In addition, clinical research is central to the formulation of dental public health policy and practice, and is the foundation on which modern evidence-based dental practice is being built. High quality clinical research requires the investigator (1) to know what clinical research is, what its components are, and (2) to know how to use clinical research methods, or simply to know how to do it. Hulley and Cummings (1988) speak of the ***anatomy*** and the ***physiology*** of applied clinical research. Clinical research will often involve the application of several theory-laden disciplines (e.g. behavioral science, epidemiology, clinical decision theory, biostatistics), but at its most basic, clinical research links methods of clinical observation or intervention with methods of analysis and interpretation that lead to valid conclusions. This presentation will offer an outline of key components involved in conceptualizing, designing and conducting clinical research in dentistry.

G-3

Educational Research in Dentistry.

MA Boyd* (Faculty of Dentistry, University of British Columbia, Vancouver, BC, CANADA)

Over the years, educational research in dental schools has not received significant attention, recognition, respect or reward. Yet such research can be critical to the efficient and effective academic enterprise of teaching and for the establishment and maintenance of continuing competence of future dental practitioners. Interest and acknowledgement in the last decade or so has brought educational research into a more "respectable" community of research initiatives. Venues for publication of investigations and outcomes has increased. New methodological approaches have spawned renewed efforts of investigation, difficult though they may be. Still new investigators need to be encouraged to undertake the study of important issues related to dental education and its delivery. This paper will explore those issues as well as what should or might be investigated, their potential contribution and how a focus for educational research can be fostered for the good of students, the faculty and the profession.

G-4

Structure-Function-Property Relationships in the Dentoalveolar Complex. C.P. Lin* (School of Dentistry, College of Medicine, National Taiwan University, Taipei, Taiwan, R.O.C.).

The human masticatory apparatus plays a largely biomechanical role in the preparation of food for the final absorption by the alimentary tract. Mastication itself is a complex process which involves the integration of a number of subsystems within or related to the oral cavity, such as the TMJ (tempomandibular joint), the corpus of the mandible, salivary system, soft tissues and the dentoalveolar complex. Within the dentoalveolar complex the dentition *per se* provides the comminuting surfaces for the particulate reduction of food, as well as the medium through which stress trajectories are transferred across the various hard tissues interfaces and into the bony cortices of the mandible and maxilla. Enamel and dentin are optimized for different roles in responding to stress, and what appears to succeed is not enamel and dentin separately but enamel and dentin acting as an integrated biomechanical complex. The periodontium is the supporting attachment of the tooth and consists of cementum, periodontal ligament, alveolar bone (cortical and cancellous bone), and a portion of gingiva. No current hypothesis is close to providing a unitary concept that will explain the roles and the functions of the periodontium. The challenge for the future is to develop a comprehensive biologic, mechanical, and mathematical conceptualization of dentoalveolar complex.

O-1

TEM and STEM/EDX study of an all-in-one adhesive containing pre-reacted glass ionomer fillers. *Tay FR[1]; Sano H[2]; Tagami J[3]; Hashimoto M[2]; Moulding KM[4], Pashley DH[5] ([1]Univ. of Hong Kong, [2]Hokkaido Univ., [3]Tokyo Medical & Dental, [4]HKUST, [5]Medical College of Georgia)

Reactmer Bond (Shofu Inc., Kyoto, Japan), is a novel fluoride releasing, tri-curable adhesive that utilizes Pre-Reacted Glass Ionomer (PRG) technology. It utilizes both unreacted, as well as fully-reacted glass ionomer particles (F-PRG) as fillers. This study examined the ultrastructure and elemental composition of resin-dentin interfaces that were treated with this single-step adhesive. Dentin disks prepared from human third molars were abraded with either 600- or 60-grit SiC paper to create smear layers of different thickness. They were bonded using Reactmer Bond and further laminated into disk-pairs. Two strips were prepared from each disk-pair, one of which was completely demineralized. Both undemineralized (U) and demineralized (D) specimens were processed for TEM and examined both stained and unstained. Unstained sections were further coated with carbon for STEM/EDX analysis. Results: Stained "D" sections revealed the presence of a 0.5-0.8 μm thick hybrid layer in the 600-grit specimens. The hybrid layer was reduced in thickness and only partially present in the 60-grit specimens. The overlying resin layer exhibited completely different ultrastructural features in unstained "U" and "D" sections. In "U" sections, the conventional glass ionomer filler was characterized by an electron-dense glass core that was surrounded by a hydrogel layer. The F-PRG filler contained numerous spherical, electron-dense "seeds" within the pre-reacted hydrogel. The predominant elements present were Si, Al, La, F and Ca. In the 600-grit specimens, an inhibition zone could be seen along the partially demineralized dentin surface that contained increased levels of Ca, P and F. In "D" sections, numerous artifactual, electron-dense dendritic deposits, rich in Ca, P and La, were evident within the resin matrix and inside both types of glass fillers. The resin matrix was also phase-separated into filler-free domains The presence of a fluorine-containing inhibition zone, and the appearance of dendritic depositions after laboratory demineralization suggest that continuous ion exchange is possible within the polymerized resin matrix of Reactmer Bond. This probably accounts for its fluoride releasing and recharging potential.

O-2

Effect of different conditioning protocols on adhesion of a high strength GIC to dentin. FR Tay[1], *SHY Wei[1] H Ngo[2], RJ Smales[2], DH Pashley[3] ([1]The University of Hong Kong; [2]TheUniversity of Adelaide, Australia; [3]Medical College of Georgia, USA)

This study examined the microtensile bond strength (μTBS) and ultrastructure of ChemFlex (Dentsply De Trey. Konstanz. Germany), a highly viscous restorative glass ionomer cement (GIC). to sound dentin that was conditioned with various techniques. Mesial and distal enamel of extracted. human third molars were removed Dentin surfaces were abraded with 180-grit SiC paper to create standardized smear layers for placement of the GIC. Three teeth were prepared for each conditioning protocol: **[C]** - no polyacrylic acid (PAA) treatment (control); II. **[P]** - 10% PAA for 10s. no rinsing; **[R]** - 10% PAA for 10s. rinsed; **[K]** - 25% PAA for 25s. rinsed; and **[H]** - 10% phosphoric acid for 15s. rinsed. A 0.5mm layer of a less viscous GIC mixture was initially used to enable better adapation to the moist. etched dentin. This was followed by GIC buildups using the recommended liquid-powder ratio. After being stored at 100% humidity for 24h. the teeth were vertically sectioned into 0.9 x 0.9mm beams for μTBS evaluation. using the "non-trimming" technique. Beams stressed to failure were examined with SEM. Additional untested beams from each group were prepared for TEM examination. Both demineralized and undemineralized specimens were examined. Results of μTBS evaluation: **[C]** 7.2"1.7 MPa. **[P]** 14.0"3.7 MPa. **[R]** 14.0"3.4 MPa, **[K]** 15.0"2.4 MPa. **[H]** 15.3"3.2 MPa. Kruskal-Wallis ANOVA and Dunn's multiple comparison tests showed that [C] has a statistically lower μTBS ($p<0.05$). SEM fractographic analysis revealed exclusive adhesive failures along the surface of dentin in **[C]**. Apparent adhesive failures in the other groups were actually mixed failures. TEM examination revealed the presence of interaction layers (IL) in all groups. In **[C]**. the IL was restricted to the smear layer. In the other groups. IL of varying thickness could be seen in the intertubular dentin. GIC particles could be seen within dentinal tubules in **[K]** and **[P]**. It is concluded that the low μTBS observed in [C] reflects the weakness of the smear layer attachment to dentin. Similar μTBS seen in the other groups suggests that such values represent more of the cohesive strength of GIC under tension, rather than true adhesive strength to dentin.

O-3

Clinical Evaluation of a Compomer in the Restoration of Class I and II Cavities in Permanent Posterior Teeth: 1-year results C.G TOH*, NH ABU-KASIM (Dept of Conservative Dentistry, Faculty of Dentistry, University of Malaya, MALAYSIA)

The clinical performances of a compomer (Dyract AP[#]) in combination with a non-rinse conditioner (K-0100[#]) and self-priming adhesive (K-0107[#]) were compared with a hybrid composite resin (Spectrum TPH[#]) in combination with a 36% phosphoric acid conditioner (DeTrey Conditioner[#]) and self-priming adhesive (K-0107[#]) in a randomized controlled split-mouth model. 23 patients with bilateral occlusal and/or interproximal caries had their teeth restored with Dyract AP in one quadrant and Spectrum TPH in the opposite quadrant by either one of the 2 evaluators. Removal of tooth structure was as dictated by caries and access. All non-carious fissures were sealed with either a compomer pit and fissure sealant (K-0093[#]) for compomer restorations or an opaque resin sealant (Delton DDS[#]). All enamel and dentin were treated with conditioner prior to application of 1 layer of self-priming adhesive. A total of 42 compomer restorations (12 with fissure sealants and 18 complex) and 35 composite resin restorations (13 with fissure sealants and 15 complex) were evaluated at baseline, 6 months and 1 year using the USPHS criteria for retention, colour match, marginal discolouration and integrity, secondary caries, anatomical form, occlusal and proximal contacts, surface texture and hypersensitivity. Two evaluators compared the epoxy resin casts of the restorations with models of the Leinfelder clinical wear standards. All clinical parameters were rated alpha except for fissure sealant with 2 bravo and 1 charlie for compomer restorations and 1 bravo for composite restoration at 6 months and 1 year. Two Class I restorations (1 Dyract AP and 1 Spectrum TPH) from same patient were rated bravo for marginal integrity and one large Class II compomer restoration was bravo for hypersensitivity. No detectable wear was observed except for 1 compomer and 2 composite restorations that exhibited wear of 25μm. There was no significant difference in all parameters measured between compomer and composite restorations (Fisher's Exact Test $p<0.01$). The clinical results indicate that compomer (Dyract AP) in combination with a non-rinse conditioner and self-priming adhesive can be used for restoring posterior teeth with good clinical response at 1 year.

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O-4

Resin Coating: Does it Improve the Internal Adaptation of Composite Resin Inlays? P.R JAYASOORIYA*, P.N PEREIRA[1], T.NIKAIDO. J.TAGAMI.(Cariology and Operative Dentistry. Tokyo Medical and Dental University. Japan;[1]University of North Carolina)

The aim of the study was to evaluate the ability of a "resin coating" to improve the internal adaptation of composite resin inlays (CRI). Ten Class II MOD cavities with gingival margins located above and below the cemento-enamel junction were prepared in extracted premolars. A "resin coating" consisting of a bonding system (Clearfil SE Bond, Kuraray Co; Japan) and a low viscosity resin composite (Protect Liner F, Kuraray Co;) was applied on half of the prepared teeth according to the manufacturer's instructions while the remaining teeth served as the control. CRI (Estenia, Kuraray Co;) were fabricated by the indirect method and cemented (Panavia F, Kuraray Co;). The teeth were thermal cycled (400), cut in half, polished and observed with confocal laser scanning microscope. The results are expressed as a percentage of gap scores (length of interface with gap formation) relative to enamel and dentin segments of the internal tooth restoration interface. The results were analyzed with one-way ANOVA and Fisher's PLSD test ($p< 0.05$) Mean ± SD, n=10. The gap scores at the internal dentin-restoration interface for resin coated teeth (7.2 ± 3.5) were significantly less compared to the non coated teeth (85.7 ± 6.7). However, there was no statistically significant difference of gap scores at gingival enamel between coated (0.7 ± 2.3) and non coated teeth (1.3 ± 4.1). The "resin coating" technique has been shown to improve the internal adaptation of CRI in dentin though in enamel it does not provide any additional benefit.