TISSUE ENGINEERING: Part A
Volume 17, Numbers 3 and 4, 2011
(Special issue: BioStar 2010 - Science in Exchange : 4th Congress on Regenerative Biology and Medicine, October 13-15, 2010, Stuttgart, Germany : Meeting Abstracts)
DOI: 10.1089/ten.tea.2010.1502

Biomaterials and Interfaces

PP 34 (D001) Morphology analysis of bonding interface of tooth tissue and restoration materials using SEM

Antra Ragauska[1], Liga Berzina-Cimdina[2], Peteris Apse[1]

[1]Riga Stradins University, Department of Prosthodontics, Dzirciema 20, 1007 Riga, Latvia
antraragauska@inbox.lv
[2]Riga Technical University, Riga Biomaterial Innovation and Development Center, Latvia

Introduction: An important role for success rate of restorations plays bonding interface with tooth structure. Marginal leakage of restoration leads to secondary caries and replacement of restoration. It is important to achieve good bonding of dental materials with tooth structure.

Purpose: The aim of this study was to examine morphology of two esthetic dental restorative materials and their bonding with tooth tissues using SEM.

Material and Methods: Ten caries-free, sound human premolars, were selected and stored in 0.9% NaCl at room temperature. The teeth were randomly divided into 2 groups of 5 teeth in each group: I- MOD cavities restored with indirect leucite reinforced glass ceramic inlays (Finesse: Dentsply, Ceramco), II- MOD cavities restored with direct high viscosity hybrid composite fillings (Filtek P60: 3 M, ESPE). The restorations in both groups were bonded using same hydrophilic adhesive resin (Adper Single Bond 2: 3 M, ESPE). Ceramic inlays were cemented with resin luting agent (RelyX Adhesive Resin Cement: 3 M, ESPE).

For SEM analysis teeth were embedded in epoxy resin (Epoxide: Buhler) cilinders and left for 12 h setting. The teeth were sectioned vertically in a anterior-posterior aspect. Surfaces of sectioned teeth were polished with 20, 5, 3, 1 and 0.25 μm fine particles diamond pastes (Metadi: Buhler) and cleaned in distilled water for 10 min. The specimens were submited to demineralisation with 50% phosphoric acid for 4 min, followed by 10 min ultrasonication in distilled water and dried in a desiccator containing silica gel for 12 h. The surfaces were sputter-coated with a gold layer of 7 nm thick during 2 min with 25 mA pressure.

Results: Morphology of tooth tissues: dentin and enamel and morphology of ceramic material, resin luting agent and composite filling material were examined. Bonding between adhesive restoration material and tooth tissues was evaluated. The samples showed good adaptation of ceramic inlays, composite fillings with tooth tissues. In cases of composite fillings, hybrid layer was seen with demineralized dentin and resin tags. The average width of the adhesive layer on dentin was 5 μm. Examining proximal adaptation of filling, the filling material was observed to extend beyond cavity borders.

Pictures with ceramic materials, composite cement and tooth tissue morphology, and their bonding were obtained in ceramic inlay group. The average width of the adhesive layer on dentin was 5 μm, similar to composite group, the average width of cement layer was 100 μm. The cement layer width in proximal adaptation area was 100–200 μm.

Conclusion: SEM structure analysis shows good bonding of materials with enamel and dentin in both composite filling and porcelain inlay groups.