Oral Health Dent Manag 2015, 14:4
http://dx.doi.org/10.4172/2247-2452.S1.013

OMICS International
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4th Asia Pacific Congress & Expo on
Dental and Oral Health
July 27-29, 2015 Brisbane, Australia

Influence of veneering technique and coping-veneer ratio on fracture toughness of zirconia crowns

Fahim Vohra[2], Mohsin Ali[2] Ikmal Hisham Bin Ismail[1] and **Mohamed Ibrahim Abu Hasan[1]**
[1]Universiti Teknologi MARA, Malaysia
[2]University of Texas, USA
[3]King Saud University, Saudi Arabia

Objectives: To investigate the influence of veneering technique and coping-veneer (C/V) ratio on the fracture toughness of implant retained zirconia crowns (ZrC).

Materials & Methods: 32 Zirconia copings were divided into 0.5 mm and 1 mm thickness. Half of the 0.5 mm and 1 mm copings were veneered with an overall thickness of 3 mm and 4 mm. Half of all zirconia copings were veneered using build up (BU) and the remaining half using hot press (PR) method. Four metal ceramic crowns (MCC) with C/V ratio of 0.5/2.5mm and an overall thickness of 3 mm were used as controls. All specimens were cemented to titanium implant abutments and tested using micro indenter. Crack length, hardness and surface roughness for all specimens was evaluated which was then utilized to calculate fracture toughness. ANOVA was utilized to analyze the results.

Results: C/V ratios of 0.5/2.5 and 1/3.5 showed significantly better (p=0.001) fracture toughness as compared to C/V ratios of 1/2 and 1/3 for the bilayered implant retained ZrC. MCC (0.5/2.5) showed significantly higher fracture toughness (p= 0.01) as compared to ZrC of similar C/V ratio. Fracture toughness (KIC) values for PR and BU veneers on zirconia copings of compatible C/V ratios were statistically comparable (p=0.409). The mean surface roughness (sa) of all specimens was statistically similar (0.2290 ±0.0372).

Conclusion: Within the limitations of this study, fracture toughness of bilayered implant retained ZRC and MCC was improved by increasing thickness of veneering ceramic. Ceramic veneering technique did not influence fracture toughness of bilayered ZRC crowns.

fahimvohra@yahoo.com

Clinical applications of gingival stem cell derived extracellular matrix

Yi-Hao Huang
National Taiwan University Hospital, Taiwan

Mesenchymal stem cells (MSCs) are defined as undifferentiated cells that are capable of self- renewal and differentiate into several cell types such as chondrocyte, adipocyte, osteocyte, myocyte, hepatocyte and neuron-like cells. Moreover, MSCs express several extracellular matrix (ECM) molecules such as collagen, fibronectin, laminin, and proteoglycans. Our research team aims to accelerate the translation of laboratory research from stem cell and molecular biology into the clinical regenerative medicine. It is the first time that a novel injectable bio-graft which composed of MSCs (gingival stem cells), bone cement (calcium sulfate powder) and stem cell bone bioliquid was developed for the applications of bone regeneration. In the animal model, we can engineer a scaled-up ossified tissue with features of a "bone organ," including physiologically cortical bone, mature vasculature and a hematopoietic compartment by using the injectable bio-graft. This work provides a model helpful for the applications of translational bone regeneration on the alveolar bone augmentation in dental implant surgery. The ECM from the stem cells act as cell languages that can signal the resident cells to behalf the way we want it to be. In the most updated data, no stem cells are needed to do tissue engineering. Stem cell derived ECM alone can work efficiently as regenerative medicine. Without using stem cell directly in regenerative surgeries, the ECM can be manufactured in industrialized scale and used by general public.

yih.perio@msa.hinet.net