25th IADR SEA Division Annual Scientific Meeting
22nd SEADE Annual Meeting

28 - 30 October 2011 | Grand Copthorne Waterfront, Singapore

Abstracts & Proceedings

Advances in Biomedical Technology and Devices
- Their impact on Oro-Dental Research

Organised by:

COLLEGE OF DENTAL SURGEONS,
SINGAPORE
LOCAL ORGANISING COMMITTEE

ANNUAL SCIENTIFIC MEETING

25th IADR SEA Division Meeting
22nd Annual Meeting of SEAADE

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**South-East Asian Division, IADR-SEA Council (2009-2011)**

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### South-East Asia Association for Dental Education
**SEAADE Council (2010 – 2012)**

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## IADR-SEA ORAL PRESENTATION SCHEDULE

### ORAL COMMUNICATION SESSION 3

Date: 29 October 2011      Time: 1330 – 1530      Venue: Riverfront II

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Collagen Type I In Direct Pulp Capping Using Chitosan

W. PRANANINGRUM1, A. YULIATI2, and S. KUNARTI3

1 Material Science and Technology, Faculty of Dentistry, Hang Tuah University, Surabaya, Indonesia
2 Material Science and Technology, Faculty of Dentistry, Airlangga University, Surabaya, Indonesia,
3 Dental Conservation, Faculty of Dentistry, Airlangga University, Surabaya, Indonesia

Abstract

Objective: The objective of this study was to determine the increasing of synthesis collagen type I in direct pulp capping using chitosan on Rattus norvegicus for seventh and fourteenth day. Methods: Sample were molars of male Rattus norvegicus strain wistar, aged between 8-16 weeks, divided into two treatment groups, namely group I which given chitosan and group II as a control which given Ca (OH)2. Those Rattus norvegicus' occlusal molar teeth were prepared with class I cavity and then chitosan and Ca (OH)2 were each applied as the pulp capping material followed by glass ionomer cement type IX used as the restoration material. Each group then divided in two sub group i.e seven days treatment and fourteen days treatment. The teeth and jaw were then cut on the seventh day and fourteenth day followed by immunohistochemical examination which carried out to observe the synthesis of collagen type I. All data were then analyzed by t-test (α = 0.05). Result: The results showed no significant difference of synthesis collagen type I on seventh day observation (p=0.387) and there is significant difference of synthesis collagen type I on fourteenth day observation (p=0.000). Conclusion: The synthesis of collagen type I in direct pulp capping using chitosan on rattus norvegicus is higher than the one using Ca(OH)2 for fourteen days.

Key words: chitosan, calcium hydroxide, direct pulp capping, Collagen type I

Introduction

Pulpal perforation care in the case of reversible pulpitis due to mechanical trauma of direct pulp capping was performed with direct pulp capping material in order to prevent the entry of bacteria and initiate soft tissue wound healing and tissue repair dentin in an open area so it does not progress to irreversible pulpitis which eventually led to the death of the pulp (Mistiaid, 2004). Calcium Hydroxide (Ca(OH)2) is a standard material for direct pulp capping treatment. This material has disadvantages, it could cause necrosis of the superficial layer of pulp, because Ca (OH)2 becomes ionized Ca+ and OH- which will form an alkaline medium or strong alkali (Bergenholtz, 2003). This properties may increase the risk of pulpal abnormality and apical lesions. Because of the disadvantages, we developed biomaterial chitosan that is safe (not toxic), biocompatible and biodegradable, accelerate wound healing activity, adsorption and anti infective. In this study used chitosan derived from shrimp white shells with 88.957% degree of deacylation. Chitosan is a polycationic complex
carbohydrate capable of facilitating the migration and proliferation of progenitor cells pulp (Pang et al, 2005).

The objective of this study was to determine the increasing of synthesis collagen type I in direct pulp capping using self produced chitosan from white shrimp shell (Penaeus merguiensis) waste on Rattus norvegicus for seventh and fourteenth day.

Material and Methods.

Preparation of chitosan. Chitosan is derived from the extraction of the shell white shrimp (Penaeus merguiensis) are taken from the waste stripping coastal shrimp populations located in areas Kenjeran. Shell shrimp shell used is contained in the head and tail until the segment is separated from the flesh. Isolation of chitosan include stage washing of shrimp, simmered in boiling water (+ 100 ° C) for 15 minutes, dried under the sun, crushed and done sifting the size of 60 mesh, then performed deproteinisasi, demineralization, depigmentation, and extraction of chitosan (Tania, 2009). Further determination of the degree of deacetylation of chitosan by FTIR spectrophotometer method and obtained results of chitosan with DD 88.975%. Chitosan was dissolved in 1 g of chitosan powder in 100 ml of 0.75% acetic acid, then neutralized to pH 7.4 (Matsunaga et al, 2005).

This study was experimental laboratories, with the design of completely randomized design, using a sample of molars Rattus norvegicus strain wistar male, weighing 200-250 g and aged between 8-16 mg. The sample was divided into 2 treatment groups namely group I and group II were given chitosan as a control given the Ca (OH)2 that both treatments were observed for 7 and 14 days by the number of each group of 8. Those Rattus norvegicus' occlusal molar teeth were prepared with low-speed diamond burs round tapered as class I cavity and perforated by the end of the sonde.

Pulp capping material chitosan and Ca (OH)2 was applied as much as 0.01 grams in the cavity, then it covered with glass ionomer cement type IX. Rattus Norvegicus sacrificed at 7 and 14 days. Their jaws teeth All samples, rattus norvegicus' teeth and jaws were immersed in fixation solution for 48 hours, then decalcified until soft. Planted in paraffin blocks, immunohistochemical examination used anti-rat collagen type I monoclonal antibody with avidin biotin staining method to observe the type I collagen synthesis. All data were then analyzed by t-test (α = 0.05).

Result

![Collagen type I in groups of chitosan](image1)
![Collagen type I in groups of Ca(OH)2](image2)
Results of statistical analysis show that the average and standard deviations of the synthesis of collagen type I in a group of chitosan is higher than that of Ca (OH) 2. The results of t test comparison between chitosan and Ca (OH) 2 after the treatment of type I collagen showed no showed no significant difference of synthesis collagen type I on seventh day observation \((p=0.387)\) and there is significant difference of synthesis collagen type I on fourteenth day observation \((p=0.000)\).

**Discussion**

Chitosan with high deacetylation degree capable of stimulating transforming growth factors (TGF \( \beta \)). TGF \( \beta \) increasing the proliferation of fibroblasts which are cells responsible for collagen synthesis and deposits. Increased synthesis of collagen is associated with the increasing number of fibroblast cells that are active in synthesizing collagen formation. Secretion of growth factors including TGF \( \beta \), cytokines, and inflammatory mediators will be stimulated by macrophage activation.

Chitosan activates macrophages via the mannose receptor bond which is the major macrophage receptor for this polysaccharide, chitosan biodegraded by lysozyme enzyme into N-acetyl-D-glucosamine. The active chitosan forms cross-linked with glycosaminoglycan and glycoprotein. It will activate growth factors such as transforming growth factor \( \beta \) (TGF \( \beta \)). TGF \( \beta \) stimulates proliferation and differentiation of fibroblast (Muzzarelli et al, 1999). Fibroblasts form collagen between 5 and 20 days after injury (Nanci, 2008). Results showed significant difference in fibroblast expressing collagen type I count on group of chitosan between 7 and 14 days treatment.

It can be concluded that the number of collagen type I in direct pulp capping using chitosan on rattus norvegicus is higher than the one using Ca(OH)2 for fourteen days.

**Bibliography**