

Scanning Electron Microscope Observation of Dental Root Canal After Irrigated by Chitosan Tiger Shrimp Shell (*Penaeus monodon*) Waste Solution



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P3-9

Biomechanical preparation (cleaning and shaping the root canal) which is part of endodontic treatment may produce smear layer. The excessive causes poor bonding between the filling materials and the root canal wall, and it facilitates bacterial penetration into deeper tissues. It is removed by root canal irrigation agents, such as NaOCl. Although NaOCl is the most effective as irrigation agent, it causes erosion, decreases microhardness, and causes toxicity in root canal tissue.

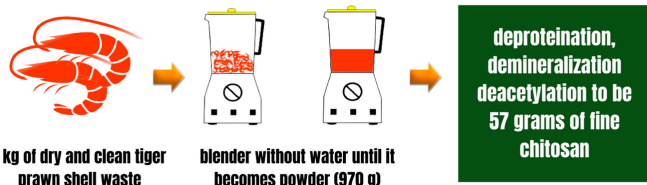
Indonesia is the largest producer of tiger prawns, however every 2 kg of fresh tiger prawns will produce 36.5% (0.73 kg) of tiger prawn waste. Tiger shrimp waste contains chitosan which is often used as a food preservative, an absorbent material to reduce Cu and raw material of polymers. 10% Chitosan of tiger shrimp waste inhibited the growth of *Streptococcus mutans*. Root canals irrigated by 5% chitosan of tiger shrimp waste showed the microhardness values of root canals as same as irrigated by 6.25% NaOCl.

THE AIM OF STUDY

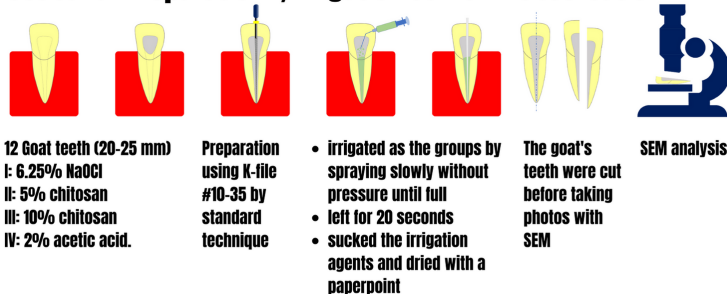
to know effect of the chitosan of tiger prawn waste as root canal irrigation solution in cleaning the smear layer using SEM analysis.

MATERIALS & METHODS

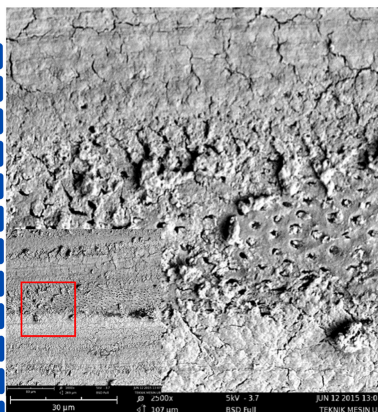
Chitosan Preparation



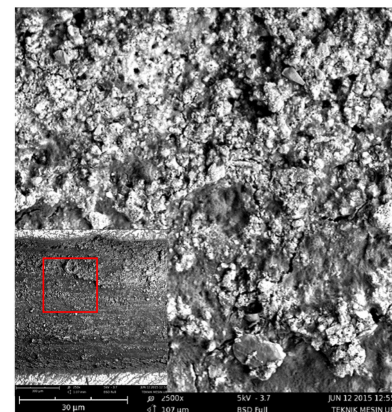
Root Canal Preparation, Irrigation dan SEM Observation



- SCORE**
- 0: No smear layer. The dentinal tubules were exposed and the root canal dentin was clean.
 - 1.: a small smear layer. The dentinal tubules are exposed and the root canal dentin is 50-75% clean.
 - 2.: many smear layers. The dentinal tubules are exposed and the root canal dentin is 25-50% clean.
 - 3.: a smear layer. The dentinal tubules and root canal dentin are not visible at all.
 - 4.: a smear layer. The smear layer formed lumps, the dentinal tubules appeared to be shrinking, and the root canal dentin was not visible.
 - 5.: a smear layer. The smear layer formed lumps, the dentinal tubules were not visible, and the root canal dentin was not visible.



10% chitosan, a bit of debris on the field of SEM image. Dentin tubules was open and root canal dentin was clean as much as 50-75%.



2% acetic acid, debris on the entire field of SEM image. Debris formed clots; dentin tubules looked smaller; the root canal was not visible.

DISCUSSION

The highest root canal wall cleaning score was 6.25% NaOCl which meant 6.25% NaOCl was not able to clean root canal dentin debris. It revealed that NaOCl was only effective as an antimicrobial and a solvent for pulp tissue. Therefore, 10% chitosan was able to clean root canal walls due to its chelation ability. The chelation process occurs when calcium ions bind to amino groups in chitosan. Chitosan in acetic acid solvent will dissociate into a positive charge, namely the acetyl and amino groups and a negative charge, namely the hydroxyl group. Positively charged chitosan will actively damage bacterial cell walls and lipopolysaccharide tooth tissue, this causes many cells to be damaged, one of which is Ca ion. The positive charge of chitosan in addition to damaging the cell wall will also affect all cell organelles, one of which is to degrade the nucleolus. These unbound negative charges are then called free radicals and seek bonds. Ca ions free from hydroxyapatite will bind to the negative charge of chitosan. The chitosan bond with the Ca ion will undergo a precipitation process or be precipitated. In addition to this, 2% acetic acid, which is a solvent for chitosan, has a low surface tension, which makes it easier for chitosan to come into contact with dentin. When chitosan is in contact with root canal dentin, chelation will occur, while acetic acid will dissolve and drain debris out of the root canal.

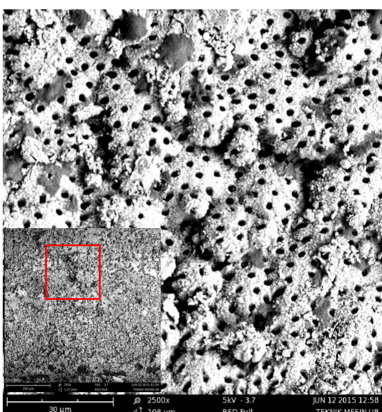
CONCLUSION

10% chitosan solution of tiger prawn shell waste (*Penaeus monodon*) was able to clean root canal debris and had the cleanest SEM image compared to 6.25% NaOCl solution, 5% chitosan, and 2% acetic acid.

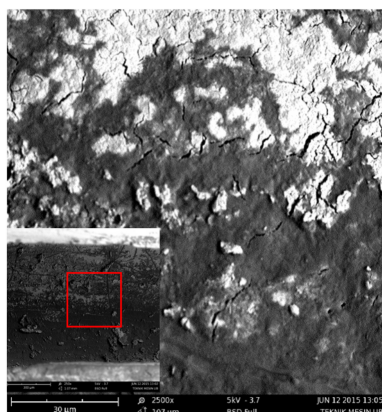
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RESULT



6.25% NaOCl with debris on the entire field of SEM image. Debris formed clots, dentin tubules looked smaller, and dentin of the root canal was not visible.



5% chitosan, debris on the entire field of SEM image. Dentin tubules and dentin of the root canal was not visible.