The effect of dietary Omega-3 polyunsaturated fatty acids on experimental periodontitis lesions in the mouse

A research report submitted to the University of Adelaide in partial fulfilment of the requirements for the Degree of Doctor of Clinical Dentistry (Periodontics)

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THE UNIVERSITY OF ADELAIDE
Faculty of Health Sciences – School of Dentistry

Statement by Research Supervisor of DClinDent Thesis or Research Report(s)

Candidate: Andrzej Bendyk

Thesis / Report Title(s):
1. Diet, nutrition and periodontal disease
2. The effect of dietary Omega-3 polyunsaturated fatty acids on experimental periodontitis lesions in the mouse

Department / School: Dentistry

Research Supervisor(s): Professor Mark Bartold

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Professor Mark Bartold   Dated:       /       /2007
DECLARATION

I, Andrzej Bendyk, of 25 Royal Avenue, Adelaide, do solemnly and sincerely declare that the work presented in the Research Project is, to the best of my knowledge and belief original; except as acknowledged in the text. It has not been accepted in part or full for another degree.

Although the articles contained are multi-authored and contribution was greatly appreciated, their input was mainly advisory and I carried out all of the laboratory procedures and bulk of the writing.

Signed by:  

Andrzej Bendyk

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Witnessed by:  

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ACKNOWLEDGEMENTS

This study was supported by a grant from the Australian Dental Research Foundation. Materials for this project were kindly donated by NuMega® Australia. I would like to give my greatest thanks to the supervisor of this project Professor Mark Bartold, who has been a constant source of support and wisdom throughout my Doctor of Clinical Dentistry degree. I would like to recognise for their invaluable assistance Victor Marino, Peter Zilm, Teck Tang, Ruth McGrath and Ben Bendyk whose help and expertise in the laboratory and animal house made sure all things ran smoothly. I would also like to thank Dr Neil O’Brien-Simpson from the University of Melbourne for his help in developing the experimental murine periodontitis model. Professor Peter Howe, Alison Morris, Kate Boyd and Jon Buckley were all a fantastic source of advice and should be thanked for their excellent support work in conducting the fatty acid analyses and acquiring materials for the project.

I would like to thank all of the staff at the IMVS animal house for their efforts and Angus Netting from Adelaide Microscopy for his expertise.

Toby Hughes was of great assistance in performing the statistical analyses. I would like to give special votes of thanks to Professor Tom Van Dyke from Boston University for his guidance when formulating the experimental protocols, and my dental assistant Carol Ann Lane, who has been a wonderful person to work along side for three years and has always done far more than could be expected to help in any way possible. Finally I would like to thank my family, Ben, Judi, Marissa and Marek Bendyk, and my fiancée Barbara Plutzer for all their help and patience over the years.
ABSTRACT

Periodontitis is an infective disease caused predominantly by gram negative anaerobic bacteria. However it is apparent that alveolar bone loss, which characterises periodontitis, is a result of the host inflammatory response to pathogenic bacteria, not the infectious agents directly. Omega-3 polyunsaturated fatty acids (O-3 PUFAs) are recognised, and used widely, for their anti-inflammatory effects. Evidence is emerging that their oxygenated derivatives are key chemical mediators in the resolution of inflammation. We hypothesised that dietary supplementation with fish oil rich in the O-3 PUFA docosahexaenoic acid would modify inflammatory reactions within the periodontium and thus reduce alveolar bone loss in mice infected with periodontopathic bacteria.

Eighty mice were fed experimental diets containing either 10% tuna oil (40) or a sunola oil (40) which contained no traceable O-3 PUFAs for 57 days. After two weeks each dietary set was split into four groups of ten mice, with these groups being inoculated with either

a) Porphyromas gingivalis
b) P. gingivalis and Fusobacterium nucleatum (combined inoculum)
c) Carboxymethylcellulose (control) or
d) No inoculations (control).

Of the twenty mice which received no inoculations, half were sacrificed after fifteen days and half at the end of the experiment to enable comparative fatty acid analysis of the oral soft tissues. Results demonstrated that eicosapentoic acid and docosahexaenoic acid were found in significantly higher proportions in the oral soft tissues of mice fed a tuna oil diet, and that animals receiving this diet exhibited an average of 54 - 72% less alveolar bone resorption in response to the different bacterial infections. Irrespective of diet, the combined inoculum resulted in slightly more alveolar resorption than P. gingivalis alone. The findings of this study suggest that fish oil dietary supplementation may have potential benefits as a host modulatory agent in the adjunctive management of periodontitis. Given its advantages in terms of safety, cost effectiveness and widespread availability, this dietary supplement warrants further research in human trials to assess its ability to modulate alveolar bone loss in individuals with periodontitis.