Multilevel analysis of periodontal treatment response

M.C.M. Wong*, L.J. Jin, G. Koshy, E.F. Corbet, W.K. Leung (Faculty of Dentistry, The University of Hong Kong)

INTRODUCTION

• Hierarchical data (or clustered data) are common in dental research as adults may have up to 32 teeth and measurements taken from different teeth of the same individual are possibly correlated or clustered.

• Conventional statistical methods, which assume observations being independent, are not appropriate in analyzing clustered data. Thus a special statistical analysis is required when data have a hierarchical structure.

• ‘Multilevel modelling’ (Goldstein, 1995) or equivalently ‘hierarchical linear modelling’ (Bryk and Raudenbush, 1992) is a class of techniques developed to analyze hierarchical data. Several studies using multilevel modelling in analyzing dental data have been published.

• In order to account for the hierarchical structure of periodontal disease measures, i.e. sites measurements clustered around teeth and then teeth clustered within subjects, analyses using a multilevel approach were adopted in this study (Gillhaus et al., 2000).

OBJECTIVE

• To investigate baseline factors which may predict non-surgical periodontal treatment response using multilevel multiple regression.

MATERIALS AND METHODS

• 32 non-smoking, chronic periodontitis patients participated in a single-blinded, randomized controlled clinical trial of non-surgical periodontal treatment response.

• Reductions in probing pocket depth (PPD) at 1-month, 3-months and 6-months were measured. Conventional statistical methods, which assume observations being independent, are not appropriate in analyzing clustered data. Thus a special statistical analysis is required when data have a hierarchical structure.

• Multilevel analysis appears to be a powerful statistical tool for the analysis of periodontal data.

RESULTS

• Altogether, 4836 sites distributed on 816 teeth (not including 3rd molars) in these 32 subjects were included for the analyses of reduction in PPD at 1-, 3- and 6-months. Since 1 subject in the treatment group of one-stage full-mouth mechanical debridement & full-mouth disinfection did not attend the 6 months review, only 4830 sites were analyzed. The total variance of the final models were reduced markedly with the inclusion of the significant variables. The total variance of the final models were reduced by 37%, 46% and 46% respectively for reduction in PPD at 1-, 3- and 6-months (p<0.05). Sites with the presence of plaque at baseline had significantly lower reduction in PPD at 1- and 3-months (p<0.05) but not for the reduction in PPD at 6-months. Sites from females subjects or subjects with higher % BOP at baseline were associated with greater reduction in PPD at 3- and 6-months.

• From the final regression models, it was found that there was no difference in the reduction in PPD at 1-, 3- and 6-months between the two treatment groups.

• The variations at each level were reduced markedly with the inclusion of the significant variables. The total variance of the final models were reduced by 37%, 46% and 46% respectively for reduction in PPD at 1-, 3- and 6-months, when compared to the corresponding variance predictors models.

CONCLUSIONS

• The use of multilevel analysis enables researchers to incorporate in the same model predictor variables measured at different levels.

• Multilevel analysis appears to be a powerful statistical tool for the analysis of periodontal data.