THE EXTRACTION OF PERMANENT SECOND MOLARS AND ITS EFFECT ON THE DENTO-FACIAL COMPLEX. A FOLLOW-UP STUDY.

Doctor of Clinical Dentistry (Orthodontics)

Student: Firhat Nabi
Supervisors: Professor Wayne Sampson
            Professor Lindsay Richards

Orthodontic Unit
Dental School
Faculty of Health Science
The University of Adelaide
South Australia
AUSTRALIA
2006
Table of Contents

List of Tables .................................................................................................................. 5
List of Figures .................................................................................................................. 7
1 Acknowledgements ........................................................................................................ 9
2 Statement ..................................................................................................................... 10
3 Introduction .................................................................................................................. 11
4 Literature Review ........................................................................................................ 12
4.1 Advantages and Indications for the Extraction of Second Molars ....................... 12
4.2 Disadvantages and Contraindications for the Extraction of Second Molars .... 13
4.3 The Effects of Lower Second Molar Extraction on Lower Incisor Crowding .... 14
4.4 The Effects of Second Molar Extraction on the Buccal Occlusion ....................... 15
4.5 The Effects of the Lower Third Molar following Lower Second Molar Extraction .................................................................................................................. 16
4.6 The Effect of Second Molar Extractions on Upper Third Molars ....................... 19
4.7 Timing for the Extraction of Lower Second Molars ............................................. 20
4.8 Extraction of Second Molars and the Effects on the Soft Tissue Profile ............ 21
4.9 The Effect of Second Molar Extractions on the Duration and Complexity of Orthodontic Treatment ......................................................................................... 22
4.10 The Effect on Overbite Following Extraction of Second Molars ...................... 23
5 Aims ............................................................................................................................... 24
6 Hypothesis .................................................................................................................... 25
7 Material and Methods ................................................................................................ 26
7.1 Sample ....................................................................................................................... 26
7.2 Radiographic technique .......................................................................................... 28
7.3 Tracing technique ..................................................................................................... 29
7.4 Cephalometric landmarks ....................................................................................... 29
7.5 Superimposition technique ..................................................................................... 32
7.6 Digitisation technique ............................................................................................ 34
7.7 Model analysis ......................................................................................................... 36
7.8 Orthopantomogram analysis ................................................................................. 43
7.9 Statistical analyses .................................................................................................. 46
7.10 Errors of the method ............................................................................................. 47

The extraction of permanent second molars and its effect on the dentofacial complex. A follow-up study.
8 Results...........................................................................................................49
8.1 Age and treatment time for radiographic sample.......................................49
8.2 Age and treatment time for study model sample.........................................50
8.3 Error of the method...................................................................................51
8.3.1 Cephalometric measurements...............................................................51
8.3.2 Study model measurements...................................................................52
8.3.3 Orthopantomogram measurements.........................................................53
8.4 Cephalometric descriptive statistics...........................................................53
8.4.1 Pre-treatment variables..........................................................................54
8.4.2 Post-treatment variables.........................................................................54
8.4.3 Five-years post-retention variables.........................................................55
8.4.4 Male treatment changes.........................................................................56
8.4.5 Male five-years post-retention changes..................................................56
8.4.6 Male overall treatment changes...............................................................57
8.4.7 Female treatment changes......................................................................57
8.4.8 Female five-years post-retention changes...............................................58
8.4.9 Female overall treatment changes...........................................................59
8.4.10 Sex comparisons of treatment changes.................................................59
8.4.11 Sex comparisons of five-years post-retention changes..........................60
8.4.12 Sex comparisons of overall changes......................................................60
8.4.13 Sample comparison with longitudinal standards.....................................62
8.5 Study model descriptive statistics.............................................................64
8.5.1 Pre-treatment variables..........................................................................65
8.5.2 Post-treatment variables.........................................................................65
8.5.3 Five-years post-retention variables.........................................................65
8.5.4 Treatment changes in males....................................................................65
8.5.5 Male five-years post-retention changes..................................................66
8.5.6 Male overall treatment changes...............................................................66
8.5.7 Treatment changes in females.................................................................66
8.5.8 Female five-years post-retention changes...............................................66
8.5.9 Female overall treatment changes...........................................................67
8.5.10 Sex comparisons of treatment changes.................................................67
8.5.11 Sex comparisons of five-years post-retention changes..........................67
8.5.12 Sex comparisons of overall changes......................................................67

The extraction of permanent second molars and its effect on the dentofacial complex, A follow-up study.
8.5.13 Sample comparison with longitudinal standards .................................. 68
8.6 Orthopantomogram descriptive statistics ............................................. 70
9 Discussion ............................................................................................... 71
  9.1.1 Radiographic Error .......................................................................... 71
  9.1.2 Superimposition Error .................................................................... 72
  9.1.3 Radiographic Error Results ............................................................. 74
  9.1.4 Study Cast Measurement Error Results ......................................... 75
  9.1.5 Orthopantomogram Measurements Error Results ......................... 76
9.2 Sample Characteristics .......................................................................... 77
  9.2.1 Sample Size .................................................................................... 77
  9.2.2 Sample Age .................................................................................... 78
  9.2.3 Treatment Time ............................................................................. 79
9.3 Cephalometric Differences between Sexes ............................................ 80
  9.3.1 Pre-treatment ................................................................................ 80
  9.3.2 Post-treatment ............................................................................... 81
  9.3.3 Five-years post-retention variables ............................................... 82
  9.3.4 Treatment changes within the sexes .............................................. 83
  9.3.5 Five-years post-retention changes within the sexes ....................... 87
  9.3.6 Overall treatment changes within the sexes ................................... 89
  9.3.7 Sex comparisons of treatment changes ......................................... 91
  9.3.8 Sex comparisons of five-years post-retention changes .................. 91
  9.3.9 Sex comparisons of overall treatment changes ............................. 93
  9.3.10 Comparisons with Longitudinal Growth Data .............................. 93
9.4 Study model differences between sexes ................................................ 97
  9.4.1 Pre-treatment ................................................................................ 98
  9.4.2 Post-treatment ............................................................................... 99
  9.4.3 Five-years post-retention .............................................................. 99
  9.4.4 Treatment changes ....................................................................... 100
  9.4.5 Five-years post-retention changes ................................................. 101
  9.4.6 Overall treatment changes ............................................................. 102
  9.4.7 Sex comparisons of treatment changes ......................................... 103
  9.4.8 Sex comparisons of five-years post-retention changes .................. 103
  9.4.9 Sex comparisons of overall changes ............................................. 103
  9.4.10 Sample comparison with longitudinal standards ......................... 103

The extraction of permanent second molars and its effect on the dentofacial complex: A follow-up study.
10 Principal findings ................................................................. 108
11 Conclusions ........................................................................ 111
12 Summary ............................................................................... 112
13 Appendices ............................................................................ 113
  Appendix I: The cephalometric landmarks (in order of digitization) 113
  Appendix II: Definitions of the angular and linear variables .... 117
  Appendix III: Tables of Results ............................................. 122
14 References ............................................................................ 172
3 Introduction

Over the years studies have indicated both advantages and disadvantages to extracting second molars as part of orthodontic treatment planning. It has been suggested that treatment times may be reduced, stability of lower incisors is improved and the need for third molar removal may be avoided.\(^1\)

However, third molars may erupt into unpredictable positions and may require a second course of treatment to upright.\(^{2,3}\)

In 1999 an observational cohort study was carried out\(^4\) drawing on forty-five patients treated in a private orthodontic practice after diagnosis and treatment planning by the one experienced operator; all subjects having had four permanent second molars extracted and fixed appliance therapy.

The data were drawn from:

- patient written records;
- pre- and post-treatment lateral cephalograms;
- pre- and post-treatment dental study casts.

The current study intends to augment the previous report by using five-year post-retention records, including lateral cephalograms, orthopantomograms and study casts. Position of third molars, changes in arch dimension and stability of incisors will be studied.