Predictors Governing Extractions in Orthodontics at SDM College of Dental Sciences and Hospital in the Department of Orthodontics

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Background: To find out the Predictors governing extractions. Materials and Methods: 550 cases were selected retrospectively having detailed case history, complete set of records of facial photographs, lateral cephalogram, orthopantomographs and study models. Predictors governing extractions were evaluated which was obtained by case history, cephalometric analysis and study models of the patients from the pretreatments records collected. Results: Show that Bolton’s Discrepancy and lower incisor to LB values were statistically significant. Conclusions: Predictors governing extraction decision in the diagnosis and treatment planning out of chosen variables were Bolton’s Arch length Toothsize discrepancy and lower incisor to LB values, but these factors are not solely the decisive factors for the diagnosis and treatment planning and that depends on multifactorial causes and is interdependent on other cephalometric variables, dental casts and patient’s chief complaint too.

Keywords: Extraction, Predictors, Linear measurement.

INTRODUCTION

The most important goal of any orthodontic treatment is to achieve ideal occlusal relationship of teeth along with facial structures so that we achieve facial balance at the end of the treatment. The controversies regarding whether to extract or not that has been occurring for many years were often linked to personal preferences rather than scientific criteria. Extractions have been proven to support changes in the profile, helping in the alignment of teeth and in reducing lower facial height. The decision as to whether or not to extract requires a great deal of thoughtful application of diagnostic skills. Number of parameters related to maxillary and mandibular extractions includes the timing of extractions, effect of extractions on 3rd molar impactions, posterior interdigitation, and incisor imbrications. This study is to find out the predictors governing the extraction from a set of chosen variables from the patient’s pretreatment records such as case history study models and prêt raced lateral cephalograms.

AIMS AND OBJECTIVES

- To find out the predictors governing extraction in S.D.M. College of Dental Sciences and Hospital, Dharwad for 5 years from 2007 to 2012
- To find out the predictors governing the extraction within the class of malocclusion
- To find out the predictors governing the extraction from a set of chosen variables such as Age, Sex, Overjet, Overbite, Archlength Toothsize Discrepancy, Upper Incisor to NA, Lower Incisor to NB, Ar – Go, Ar – Ptm, N – Ptm, Go – Pg, ANS - PNS

METHODOLOGY

Materials and Methods

The records for this investigation were drawn retrospectively over a period of five years from S.D.M.
College of Dental Sciences and Hospital Sattur Dharwad, Karnataka, India from year 2007 to 2012

The records involved pretreatment study models and pretraced lateral cephalograms which were traced by the respective postgraduate to whom the case was allotted. The treatment plan was decided by the same head of the department for all the five years.

**Case selection was based on the following criteria**
- Patients without any history of orthodontic treatment
- Age range between 10 – 23 years
- None of the cases had congenital and dentofacial anomalies or significant facial asymmetries
- Cases involving surgical treatment were included

**Subject and Methods**

Based on inclusion criteria a total of 550 cases were selected having complete records. For all the cases a detailed case history was taken along with facial photographs lateral cephalograms, orthopentamographs, and study models. All cephalograms were obtained on the same cephalometric unit [PMHFCC proline with a cephalostat, manufactured by planmaca OY, Helsinki, FINLAND, with the same magnification of 1:1.09]. The cassette used was Kodak lanex – Omatic, USA.

All cephalograms were hand traced by the respective postgraduate on an acetate mattracing paper with 2H LEAD PENSIL. The following cephalometric analysis: Steiner’s, Downs, Tweeds, Wits and Holdaway analysis and cephalometric analysis for Orthognathic surgery were performed.

| Upper incisor to NA | It is the linear measurement between the labial surface of upper central incisor and the line joining Nasion to point A. |
|---------------------|-----------------------------------------------------------------------------------------------------------------|
| Lower incisor to NB | It is the linear measurement between the labial surface of lower central incisor and the line joining Nasion to point B. |
| Ar – Go             | It is the linear measurement between Articulare and Gonion.                                                        |
| Ar-Ptm[Parallel to FHP] | It is the linear measurement between articular and Pterygo – maxillare point parallel to Frankfurt Horizontal Plane. |
| N – Ptm [Parallel to FHP] | It is the linear measurement between Nasion and Pterygo – maxillare point parallel to Frankfurt Horizontal Plane. |
| Go - Pg             | It is the linear measurement between Gonion and Pogonion.                                                           |
| PNS-ANS             | It is the linear measurement Between Anterior Nasal Spine And Posterior Nasal Spine.                                 |

Model analysis used for treatment planning included Carey’s analysis, Arch perimeter analysis, Bolton’s index analysis, and Ashley Howe’s analysis and cephalometrics for Orthognathic surgery [COGS]. The treatment planning also involved Steiner’s work values which determined the post treatment position of the upper and lower incisors.

Measurements obtained from the pretreatment study models included Overjet and Overbite. Carey’s analysis had been performed on the pretreatment study models to determine the Tooth size Archlength discrepancy.

Overjet was defined as the horizontal distance between the labial surface of the maxillary and mandibular central incisors with the teeth in centric occlusion.

Overbite was defined as the distance along a vertical plane between the incisal edges of the maxillary and mandibular central incisors with the teeth in centric occlusion.

The Archlength Toothsize discrepancy was recorded as per the method described by Carey. The measurement is compared with the recorded measurement of the required linear arch dimension.

- If the discrepancy is 0 – 2.5 mm it indicates minimal tooth excess. In such cases proximal stripping can be carried out to reduce the tooth material.
- If the discrepancy 2.5 to 5 mm it indicates the need to extract the second premolars.
- If the discrepancy is more than 5 mm it indicates the need to extract the first premolars.

Cephalometric measurements included in the study from the above cephalometric analysis involved 7 linear measurements were: Upper incisor to NA, Lower incisor to NB, Ar – Go, Ar-Ptm, N – Ptm Go – Pg, PNS-ANS.

**STATISTICAL ANALYSIS**

Statistical analysis was done using the SSPS software [SPSS for windows XP version 13, SSPS inc, Chicago]. First the independent test was done to compare the eleven cephalometric parameters. Then a diagnostic regression analysis was done to find out the predictors governing extraction.

**RESULTS**

An Independent sample T test was applied to get the mean of 10 variables of the entire samples for extraction and nonextraction.

The mean Overjet = 4.22 mm, Overbite = 3.07 mm, Toothsize arch length discrepancy = -1.24 mm,
Upper incisor to NA = 8.28 mm, Lower incisor to NB=8.20 mm, Ar – Go =45.35, Ar-Ptm = 33.14, N – Ptm = 69.89, Go – Pg= 70.83, PNS-ANS= 58.84.

Clinical characteristics of the variables for extraction and nonextraction

**Overjet**
The mean Overjet for the extraction was +4.65 +/-3.13 whereas the nonextraction group the mean Overjet was +3.58 +/-3.0. When comparing the Overjet within two groups it was found to e very highly significant (p=0.001).

**Overbite**
The mean Overbite for the extraction group was +2.97 +/-1.97 whereas for the nonextraction was +3.22 +/-2.13 on comparing the overbite within these two groups it was found not to be significant (p=0.163).

**Tooth size arch length discrepancy**
The mean Tooth size archlength discrepancy for the extraction group was -2.27 +/-3.41 where as for the nonextraction group the mean Overjet was +.28 +/-4.13. When comparing the tooth size arch length discrepancy within these two groups it was found to be highly significant (p=0.001)

**Upper incisor to NA**
The mean Upper incisor to NA for the extraction group was +8.95 +/-2.92 where as for the nonextraction group the mean Upper incisor to NA was +7.27 +/-3.24. On comparing the Upper incisor to NA within these two groups, it was found to be highly significant (p=0.001).

**Lower incisor to NB**
The mean lower incisor to NB for the extraction group was +6.50 +/-3.11 where as for the nonextraction group the mean lower incisor to NB was +6.50 +/-3.13. When comparing the lower incisor to NB within two groups it was found to be very highly significant (p=0.001).

**Ar –Go**
The mean Ar –Go for the extraction was 47.90 +/-3.09 whereas the nonextraction group the mean Ar – Go was +48.22 +/-3.0. When comparing the Ar – Go within two groups it was found to e very highly significant (p=0.001).

**Ar-Ptm [Parallel to FHP]**
The mean Ar-Ptm for the extraction group was + 33.46 +/-2.97 where as for the nonextraction was 34.22 +/-2.13 on comparing the Ar-Ptm within these two groups it was found to e very highly significant (p=0.001).

**N – Ptm [Parallel to FHP]**
The mean N – Ptm for the extraction group was +51.56 +/-2.40 whereas for the nonextraction was +53.12 +/-3.22 on comparing the N – Ptm within these two groups it was found to e very highly significant (p=0.001).

**Go – Pg**
The mean Go – Pg for the extraction was +75.65 +/-3.40 whereas the nonextraction group the mean Overjet was +76.58 +/-3.22. When comparing the Go – Po within two groups it was found to e very highly significant (p=0.001).

**PNS-ANS**
The mean PNS-ANS for the extraction group was + 58.84/-2.17 where as for the nonextraction was + 59.23 +/-2.13 on comparing the PNS-ANS Within these two groups it was found to e very highly significant (p=0.001).

**DISCUSSION**

**Overjet**
Burden did a retrospective study and investigated the outcomes achieved in 212 consecutively completed patients with Class 2 division 1 malocclusion (overjet>6mm). The results revealed that in patients with large overjets an excellent outcome can only be predicted if the upper incisors are very proclined. Every 2mm increase in overjet (above 4mm) required approximately 5 degrees increase in incisor proclination to achieve an excellent outcome. This study showed a mean overjet of 4.22mm which includes Class 1(330), Class 2(231) and Class 3(16) groups.
Overbite

Kinaan There have been no widely used criteria and methods of measurement for evaluating the incisor relationship in terms of overjet and overbite and, therefore, no widely accepted definition of their normal values. The normal range of overjet and overbite is considered as 2-4mm. The English variation extends towards increased overjet and overbite, while the Iraqi variation tends towards lower values for both parameters. Significant correlation is seen between overjet and overbite at 1 percent level in both samples. In this study a mean overbite of 3.08mm was obtained for the entire sample containing Class1, Class 2, Class 3 groups, which was in the normal range of 2-4mm.

Tooth size arch length Discrepancy

Baumrind et al. [9]. In a recently reported study, the pre-treatment records of each subject in a randomized clinical trial of 148 patients with Class1 and Class 2 malocclusions presenting for orthodontic treatment were evaluated independently by five experienced clinicians. Crowding was cited as the first reason in 49% of decisions to extract, followed by incisor protrusion (14%), need for profile correction (8%), Class 2 severity (5%), and achievement of a stable result (5%).

This study showed an overall mean tooth size arch length discrepancy of -1.22mm, showing an overall crowding since patients with severe crowding (tooth size arch length deficiency) for extraction and spacing (tooth size arch length excess) for nonextraction were among the Class1, Class 2 and Class 3 groups.

On comparing the tooth size arch length discrepancy according to Carey’s analysis in the lower arch between class 1 extraction subgroup and class 1 non extraction sub group the difference was -2.84mm which was very highly significant (p=0.001). This was because the class 1 extraction subgroup had more crowding compared to the class 1 non extraction subgroup.

On comparing Class 1 extraction subgroup with Class 2 extraction subgroup the difference was +2.61mm which was very highly significant (p=0.001). This was because the class 2 extraction subgroup had more crowding compared to the Class 1 non extraction subgroup.

On comparing Class 1 non extraction subgroup with Class 3 extraction subgroup the difference was 4.75mm which was significant (p=0.03), since four of the Class 3 extraction subjects had severe crowding with blocked out first or second premolars and the lower first permanent molars had come forward establishing the Class 3 molar relation.

On comparing Class 2 extraction with Class 2 nonextraction the difference was 2.11 mm which was very highly significant (p=0.001). Since Class 2 extraction subgroup had more crowding than Class 2 nonextraction subgroup.

Upper Incisor -NA

Ceylan et al. [4] Showed that there were statistically significant differences in measurements of maxillary anterior alveolar basal height (mm), Maxillary Posterior alveolar basal height (mm), and angles 1-NA, 1-1-, 1-SN, 1-SN, 1-MP, and SN-AB among the overjet groups. In addition, significant
correlation coefficients were found between overjet and Maxillary anterior alveolar basal height (mm), 1-NA (mm), and angles 1-1, 1-SN, 1-SN, 1-MP and Sn-AB. The evaluation of dentoalveolar compensation in different overjet patterns may be useful in treatment planning and treatment success.

Steiner 1953 the upper incisor to NA mm for Caucasians norms is 4mm. According to Valiathan 1991 Indian norms, the horizontal distance for upper incisor to NA should be within 7 mm. This study gives a mean upper incisor to NA of 8.28mm which is well above the Indian norms. This is because most of the patients came to the orthodontic clinic complaint of proclined front teeth.

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**Ar –Go**

The mean Ar –Go for the extraction was 47.90 +/-3.09 whereas the nonextraction group the mean Ar – Go was +48.22 +/-3.0. Significant correlation coefficients were found between overjet and Maxillary anterior alveolar basal height (mm), 1-NA (mm), and angles 1-1, 1-SN, 1-SN, 1-MP and Sn-AB. The evaluation of dentoalveolar compensation in different overjet patterns may be useful in treatment planning and treatment success. Variation in ramal length can be a causative factor for the skeletal openbite or deep bite.

**Ar-Ptm [Parallel to FHP]**

The mean Ar-Ptm for the extraction group was + 33.46 +/-2.97 where as for the nonextraction was 34.22 +/-2.13. According to burstone the mean ar – ptm value for female is 32.1+/- 1.9mm and for males ir is 37.1+/-.2.8mm. In this retrospective study the values showing within the range. but posterior cranial base is also very important in diagnosis and treatment planning.
N – Ptm [Parallel to FHP]

The mean N – Ptm for the extraction group was +51.56 +/-2.40 where as for the nonextraction was +53.12 +/-2.12. The mean Ar – Ptm value for female is 50.9+/-mm and for males it is 52.8+/-4.1mm. Anterior cranial base is the first for cessation of growth during the growth period of an individual and various other cephalometric values can be compared and for Indians this value is higher than Caucasian population. In this study this value is within the normal range.

Go – Pg

The mean Ar-Ptm for the extraction group was +71.7670 +/-2.97 where as for the nonextraction was 69.8942 +/-2.13. The mean go-pg value for female is 74.3+/5.8-mm and for males it is 83.7+/-4.6mm. This study gives a mean go-pg of 70.83 mm which is well above the Indian norms. This is because most of the patients came to the orthodontic clinic complaint of proclined front teeth. Mandibular body length is the linear distance between Gonion and Pogonion. Increase in length denotes the skeletal class iii and decrease in skeletal length signifies the skeletal class II

PNS-ANS

The mean PNS-ANS for the extraction group was + 58.84+/-2.17 where as for the nonextraction was + 59.23 +/-2.13. The mean go-pg value for female is 52.5+/-3.5-mm and for males it is 57.5+/-2.5mm. ANS to PNS are projected on horizontal plane and the distance between these two points gives us total effective maxillary length.

Table-1: Overall predictors (biologic regression analysis)

| VARIABLES  | SIG  | R    |
|------------|------|------|
| AGE        | 6183 | 0000 |
| OJ         | 5844 | 0000 |
| SEX        | 0678 | 0425 |
| OB         | 4659 | 0000 |
| TSALD      | 0001 | 3023 |
| UINA       | 1495 | 0102 |
| LINB       | 0000 | 1530 |
| Ar – Go    | 0848 | 0192 |
| Ar – Ptm   | 3493 | 0238 |
| N – Ptm    | 4820 | 1360 |
| Go – Pg    | 2048 | 0338 |
| ANS - PNS  | 2542 | 0492 |
SUMMARY AND CONCLUSIONS

Predictors governing extraction decision in the diagnosis and treatment planning out of chosen variables were Bolton’s Arch length Toothsize discrepancy and lower incisor to LB values and It plays a very important role in diagnosis and treatment planning of the patient. From the multiple comparisons among each predictor it was found that almost all the significant subgroup comparisons occurred when extraction subgroup was compared to nonextraction subgroup. But the comparison of Class 3 extraction and Class 3 non extraction were no significant among any of the predictors due to its small sample size. Confirming that these predictors are very important factors in treatment planning, but again since few of the extraction to non extraction subgroup comparisons were not significant, it proves that these factors are solely the decisive factors for treatment planning and that treatment planning depends on multifactorial causes and is interdependent on other cephalometric variables, dental casts and patient’s chief complaint.

Obtained different results. Secondly the values obtained for each variable is not precise since the values were obtained based on pretraced lateral cephalograms from more than 10 postgraduates who may have identified the points differently and the treatment plan was based on those values obtained.

REFERENCES

1 Dewel, B. F. (1964). The Case-Dewey-Cryer extraction debate: a commentary. American Journal of Orthodontics, 50(11), 862-864.
2 Tweed, C. H. (1944). Indications for the extraction of teeth in orthodontic procedure. American journal of orthodontics and oral surgery, 30(8), 405-428.
3 Begg, P. R. (1954). Stone Age man’s dentition: with reference to anatomically correct occlusion, the etiology of malocclusion, and a technique for its treatment. American Journal of Orthodontics and Dentofacial Orthopedics, 40(4), 298-312.
4 Ceylan, I., Yavuz, I., & Arslan, F. (2003). The effects of overjet on dentoalveolar compensation. The European Journal of Orthodontics, 25(3), 325-330.
5 Abu Alhaija, E. S., & Al-Khateeb, S. N. (2005). Attractiveness ratings of anterior open bites and reverse overjets using the aesthetic component of

Table 2: Variables

| Variables | Line of Treatment | N  | Mean  | Total Mean | SD    | Sig.   |
|-----------|-------------------|----|-------|-----------|-------|--------|
| AGE       | EXTRACTION        | 329| 17.8571 | 18.11     | .192ns|
|           | NON EXTRACTION    | 221| 18.3665 |           |       |        |
| SEX       | EXTRACTION        | 329| 4.6517  | 4.12      | .31269| .001vhs|
|           | NON EXTRACTION    | 221| 3.5837  |           |       |        |
| OJ        | EXTRACTION        | 329| 2.9757  | 3.09      | 2.0453| .163ns |
|           | NON EXTRACTION    | 221| 3.2240  |           |       |        |
| OB        | EXTRACTION        | 329| -2.2711 | -1.2449   | 3.9222| .001vhs|
|           | NON EXTRACTION    | 221| 2.828   |           |       |        |
| TSALD     | EXTRACTION        | 329| 8.9552  | 8.10      | 3.1663| .001vhs|
|           | NON EXTRACTION    | 221| 7.2760  |           |       |        |
| UINA      | EXTRACTION        | 329| 9.3389  | 7.92      | .4151 | .001vhs|
|           | NON EXTRACTION    | 221| 6.5045  |           |       |        |
| LINB      | EXTRACTION        | 329| 45.9824 | 45.35     | 2.08  | .001vhs|
|           | NON EXTRACTION    | 221| 44.7230 |           |       |        |
| Ar – Go   | EXTRACTION        | 329| 33.6256 | 33.14     | 2.21  | .001vhs|
|           | NON EXTRACTION    | 221| 32.6542 |           |       |        |
| N – Ptm   | EXTRACTION        | 329| 70.5142 | 69.89     | 1.06  | .001vhs|
|           | NON EXTRACTION    | 221| 69.2786 |           |       |        |
| Go – Pg   | EXTRACTION        | 329| 71.7670 | 70.83     | 0.90  | .001vhs|
|           | NON EXTRACTION    | 221| 69.8942 |           |       |        |
| ANS-PNS   | EXTRACTION        | 329| 61.5668 | 58.84     | 2.30  | .001vhs|
|           | NON EXTRACTION    | 221| 56.1120 |           |       |        |

Table 3: Mean of variables

| OJ       | OB       | TSALD    | VI-NA    | LI-NB    | Ar-Go   | Ar-Ptm   | N-Ptm    | Go-Pg    | ANS-PNS |
|----------|----------|----------|----------|----------|---------|----------|----------|----------|---------|
| N        | 550      | 550      | 550      | 550      | 550     | 550      | 550      | 550      | 550     |
| MEAN     | 4.1250   | 3.0955   | 3.2449   | 8.1005   | 7.9200  | 45.35    | 33.1476  | 69.8926  | 70.83   |
| DEVIATION| 3.1269   | 2.0453   | 3.9222   | 3.1663   | 0.4151  | 2.0869   | 2.2128   | 1.0646   | 0.9058  |

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the Index of Orthodontic Treatment Need. *The European Journal of Orthodontics*, 27(2), 134-139.

6. Squire, D., Best, A. M., Lindauer, S. J., & Laskin, D. M. (2006). Determining the limits of orthodontic treatment of overbite, overjet, and transverse discrepancy: a pilot study. *American journal of orthodontics and dentofacial orthopedics*, 129(6), 804-808.

7. Popowich, K., Nebbe, B., Heo, G., Glover, K. E., & Major, P. W. (2005). Predictors for Class II treatment duration. *American journal of orthodontics and dentofacial orthopedics*, 127(3), 293-300.

8. Türkakrahman, H., & Sayin, M. (2004). Relationship between mandibular anterior crowding and lateral dentofacial morphology in the early mixed dentition. *The Angle Orthodontist*, 74(6), 759-764.

9. Baydas, B., Yavuz, I., Dagsuyu, I. M., Bolukbasi, B., & Ceylan, I. (2004). An investigation of maxillary and mandibular morphology in different overjet groups. *Australian orthodontic journal*, 20(1), 11.

10. Ceylan, I., Baydas, B., Bolakbhasib, B. (2002). Longitudinal Cephalometric changes in incisor position, overjet, overbite between 10-14 years of age. *Angle Orthod*, 72(3), 246-250.

11. Darendellier, N., Taner –Sarisoys, L. (2001). The influence of orthodontic extraction treatment on dental structures: A two – Factor Evaluation. *Eur J Orthod*, 23(3):295-303.

12. Ceylan, I., Baydas, B., & Bölikbasi, B. (2002). Longitudinal cephalometric changes in incisor position, overjet, and overbite between 10 and 14 years of age. *The Angle Orthodontist*, 72(3), 246-250.

13. Burden, D. J., McGuinness, N., Stevenson, M., & McNamara, T. (1999). Predictors of outcome among patients with Class II Division 1 malocclusion treated with fixed appliances in the permanent dentition. *American journal of orthodontics and dentofacial orthopedics*, 116(4), 452-459.

14. Bishara, S.E.(1998). Mandibular changes in persons with untreated and treated class II div 1 malocclusion. Am J Orthod Jun, 113(6):661-73.

15. Han, U.K., Kim, Y.H. (1998). Determination of class II and class III skeletal patterns: Receiver operating characteristics (ROC) analysis on various cephalometric measurements. Am J Orthod May, 133(5):538-45.

16. Bodevik, O. (1998). Changes in occlusion between 23 and 34 years. Angle Orthod, Feb:68(1):75-80.

17. Otoyemi, O. D. (1996). Variability in upper lip posture to overjet in 12 year old Nigerian children. Afr Dent J,10: 33-6.

18. Otoyemi, O.D. (1993). Variability in lower lip posture to overjet in 12 year old Nigerian children. Afr Dent J. 7:27-37.

19. Tulloch, C., Phillips, C. (1993). Dann 4th. Cephalometric measures as indicators of facial attractiveness. Int J Adult Orthodontorthgan Surg, 3:171-9.

20. Haynes, S. (1977). Prevalence of upper lip posture and incisor overjet. Community Dept Oral Epidemiology, 5(2):87-90.

21. Kiman, B.K. (1986). Overjet and overbite distribution and correlation: Comparative epidemiological English – Iraq Study. Br J Orthod, 13(2):79-86.

22. Johnson, G., Valarelli, F.P., Henrique’s J.F., De Freits, M.R., Cancado. R.H.(2003). Stability of anterior bite treatment in permanent dentition. Am J Orthod Dentofacial Orthop, Sep:124(3):265-76.

23. Bascifici, F.A., Usumez, S. (2003). Effects of Extraction and Non Extraction treatment on class I and class II subjects. Angle Orthod, 73(1):36-42.

24. Janson, G., Graciano, J.T., Henrique, J.F., De Freits, M.R, Pinzan, A.(2006). Pinzan – Vercelino Cr. Occlusal and cephalometric Class II Division 1 Malocclusion severity in patients treated with and without extraction of 2 maxillary premolars. Am J Orthod Jun, 129(6):759-67.

25. Rabie, A.B., GUY.(2000). Diagnostic Criteria For Pseudo Class III Malocclusion. Am J Orthod Dentofacial Orthop, 117(1):1-9.

26. Baumrind, S., Korn, E.L, Boyd, R.L., Maxwell, R. (1996). The decision to extract: part 2. Analysis of Clinicians stated reasons for extractions. Am J Orthod, 109(4):393-402.

27. Li, Q., Zheng, Z., Bai, D., Pang, G.(1999). A retrospective study of morphologic basis for the extraction decision in class I malocclusion. Hau Xi Kou Qiang Yi Xue Za Zhi, 17(4):341-3.

28. Bishara, S.E., Jakobsen Hession, T. J. (1998). Soft tissue profile changes from 5 to 45 years of age. Am J Orthod Dentofacial Orthop, 114(6):698-706.

29. Paquette, D. E., Beattie, J. R., & Johnston Jr, L. E. (1992). A long-term comparison of nonextraction and premolar extraction edgewise therapy in “borderline” Class II patients. *American Journal of Orthodontics and Dentofacial Orthopedics*, 102(1), 1-14.

30. Holdaway, R. A. (1983). A soft-tissue cephalometric analysis and its use in orthodontic treatment planning. Part I. *American journal of orthodontics*, 84(1), 1-28.

31. Bishara, S. E., Zaher, A. R., Cummins, D. M., & Jakobsen, J. R. (1992). Effects of orthodontic treatment on Caucasian patients. *The Angle Orthodontist*, 64(3), 221-230.

32. Bowman, S. J., & Johnston Jr, L. E. (2000). The esthetic impact of extraction and nonextraction treatments on Caucasian patients. *The Angle Orthodontist*, 70(1), 3-10.