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Original Research Article

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

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Abstract

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 cephalomatric 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 articulare 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 linier 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 where as 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 archlength 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 where as for the nonextraction was +53.12 +/-2.12 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).

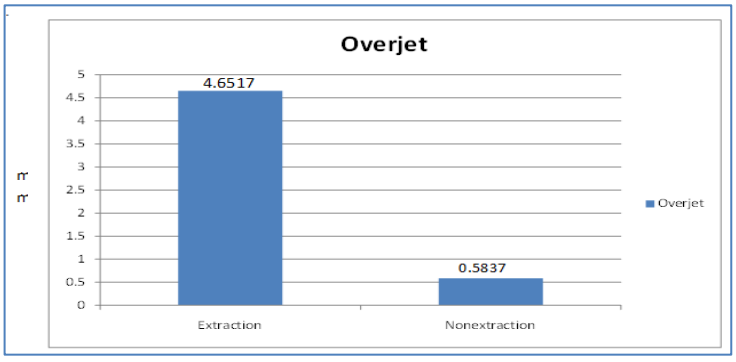
PNS-ANS

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

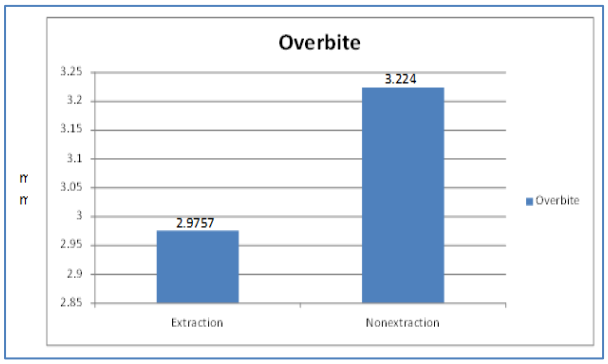
Overjet

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 over bite is considered as 2-4mm. The English variation e3xtends towar4dws 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 2-4m



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 ofr orthodontic treatment were evaluated independently by five experienced clinicians. Crowding was cited as the first reason in 49% of decisions to e3xtract, 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.

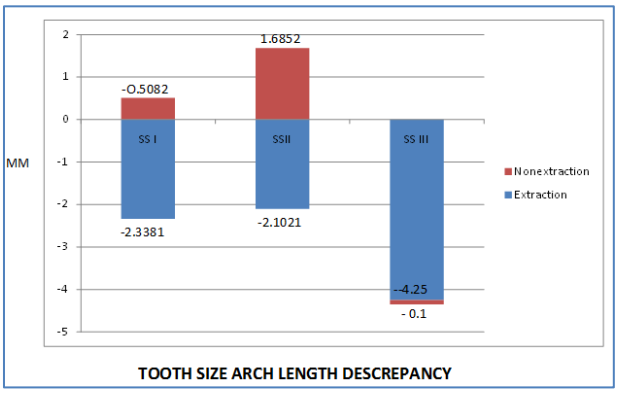
On comparing the tooth size arch length discrepancy according to Carey's analysis in the lower arch between class 1 extraction subgroup and class 1 non extraction sub group the difference was -2.84mm which was very highly significant (p=0.001). This was because the class 1 extraction subgroup had more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

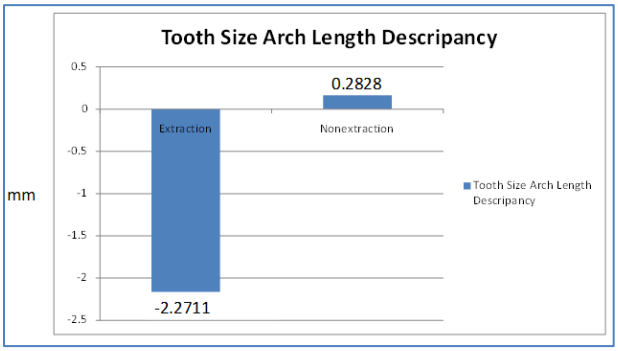
On comparing the class 1 extraction subgroup with Class 2 nonextraction subgroup the difference was -2.35 mm which was very highly significant (p=0.001). This was also because the Class 1 extraction subgroup had more crowding compared to the class 2 non extraction subgroup.

On comparing the Class 1 non 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 nonextraction 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.



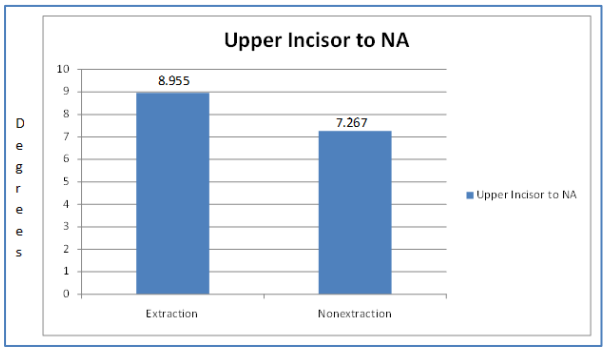


Upper Incisor -NA

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.



Lower Incisor – NB mm

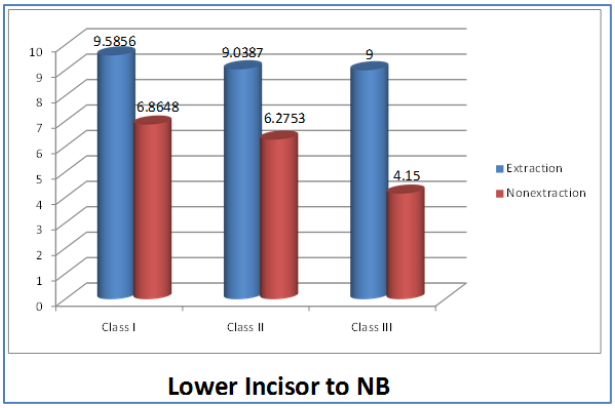
According to Steiner 1953 the upper incisor to NA mm for Caucasians norms is 4mm. The Indian norm by Valiathan 1991 for Lower Incisor – NB in mm is 8.9mm which is why Indians have more protrusive incisors. The present study shows a mean value of 8.2mm showing lower incisor protrusion.

For Lower Incisor to NB

On comparing the lower incisor to NB between Class 1 extraction subgroup and Class 1 nonextraction. Class 2 non extraction, Class 3 non extraction subgroups the mean difference was 2.72mm, +3.31mm, +5.43mm which were very highly significant (p=0.001). Since Class 1 non extraction subgroup had more proclined lower incisor than the Class 2 extraction subgroups.

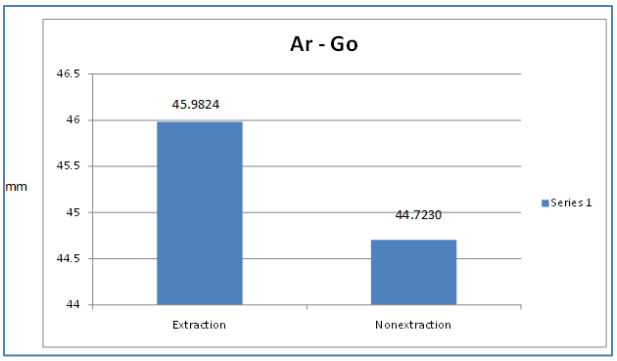
On comparing class 2 extraction subgroup with Class 2 and class 3 non extraction the mean difference was +2.76mm and +4.88mm which was very highly significant (p=0.001). Since the Class 2 extraction subgroup had more proclined lower incisors than the Class 2 and Class 3 non extraction subgroups.

On comparing class 3 extraction with class 3 non extraction the mean difference was +4.85mm which was significant (p=0.039) again showing more proclined lower incisor for class 3 non extraction subgroups.



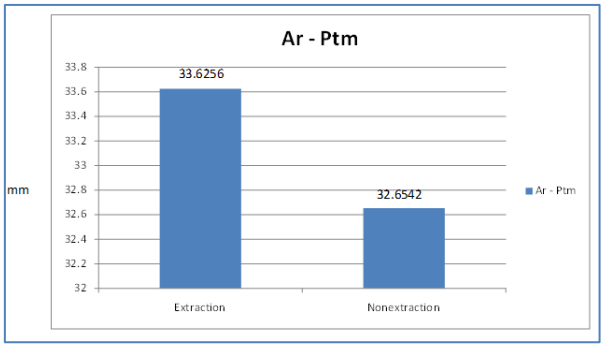
Ar –Go

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.



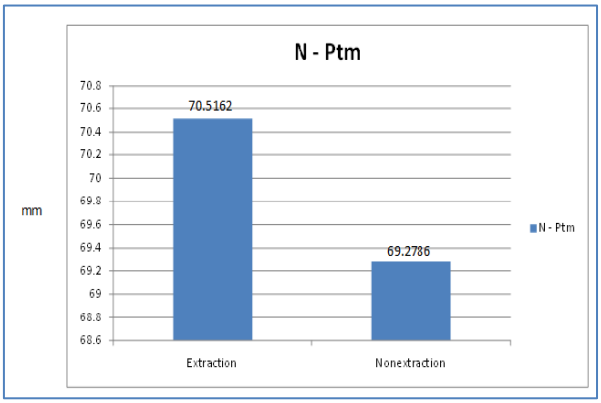
Ar-Ptm [Parallel to FHP]

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.



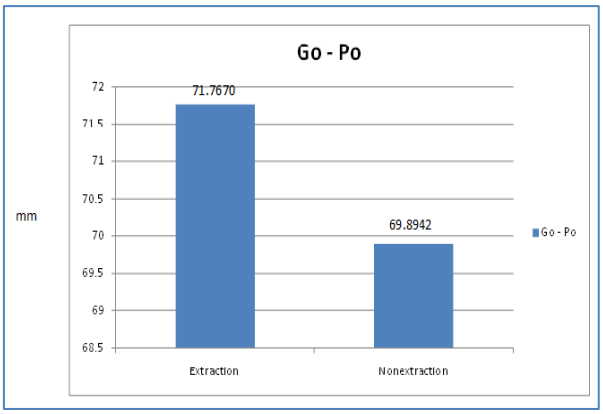
N – Ptm [Parallel to FHP]

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.



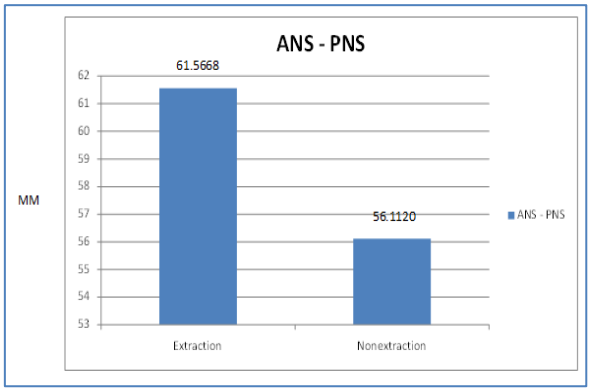
Go – Pg

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 linier 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.



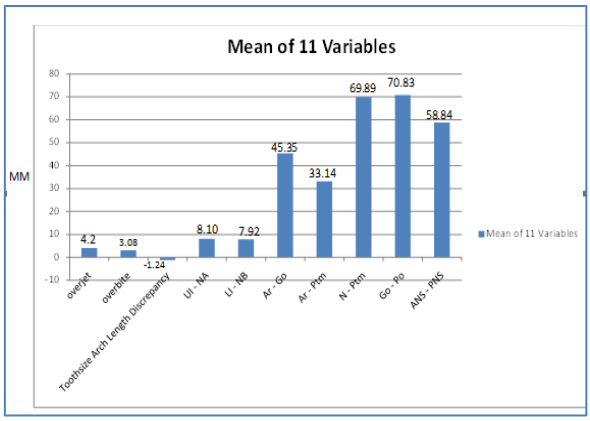


Table-1: Overall predictors (biologic regression analysis

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

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				.007hs
	NON EXTRACTION	221				
OJ	EXTRACTION	329	4.6517	4.12	3.1269	.001vhs
	NON EXTRACTION	221	3.5837			
OB	EXTRACTION	329	2.9757	3.09	2.0453	.163ns
	NON EXTRACTION	221	3.2240			
TSALD	EXTRACTION	329	-2.2711	-1.2449	3.9222	.001vhs
	NON EXTRACTION	221	.2828			
UINA	EXTRACTION	329	8.9552	8.10	3.1663	.001vhs
	NON EXTRACTION	221	7.2760			
LINB	EXTRACTION	329	9.3389	7.92	.4151	.001vhs
	NON EXTRACTION	221	6.5045			
Ar –Go	EXTRACTION	329	45.9824	45.35	2.08	.001vhs
	NON EXTRACTION	221	44.7230			
.Ar-Ptm	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	UI-NA	LI-NB	Ar-Go	Ar-Ptm	N-Ptm	Go-Pg	ANS-PNS
N	550	550	550	550	550	550	550	550	550	550
	0	0	0	0	0	0	0	0	0	0
MEAN	4.1250	3.0955	-.2449	8.1005	7.9200	45.35	33.1476	69.8926	70.83	58.84
DEVIATION	3.1269	2.0453	3.9222	3.1663	.4151	2.0869	2.2128	1.0646	0.9058	2.3046

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.

Short comings of the study

Firstly the patient's treatment plan was based on a single professor which may have introduced some bias. Another clinician or group of clinicians may have 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.

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