"COMPARISON OF DENTAL AND SOFT TISSUE PARAMETERS AFTER ORTHODONTIC TREATMENT WITH MINI SCREW IMPLANTS AND TRADITIONAL ANCHORAGE IN PATIENTS WITH CLASS I BIMAXILLARY PROTRUSION- A RETROSPECTIVE CEPHALOMETRIC STUDY"

By

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REG. NO. II0219005

Dissertation

Submitted to

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MASTERS OF DENTAL SURGERY

IN

ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

(BRANCH – V)

Under the Guidance of

Dr K M KELUSKAR M.D.S. PhD

DEPARTMENT OF

ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

KLE VISHWANATH KATTI INSTITUTE OF DENTAL SCIENCES,

KAHER, BELAGAVI, KARNATAKA.

2019 – 2022

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Dr SANJYOT RODRIQUES

LIST OF ABBREVIATIONS

U1-LI	-	Interincisal Angle
U1-SN	-	Upper incisor proclination
U1 - X	-	Distance between Upper Incisor and X axis
U1 - Y	-	Distance between Upper Incisor and Y axis
U6 - X	-	Distance between Upper 1st Molar and X axis
U6 – Y	-	Distance between Upper 1st Molar and Y axis
G-Sn-Pg	-	Facial Convexity Angle
Cm-Sn-Ls	-	Nasolabial Angle
UL-X	-	Distance between Upper Lip and X axis
UL-Y	-	Distance between Upper Lip and Y axis
UL- E	-	Distance between Upper Lip and E-line

ABSTRACT

Introduction: Satisfactory orthodontic treatment outcomes and better smile appearance have attracted large number of adolescents and adults to seek orthodontic treatment. The present trend to treat bimaxillary protrusion is extraction of the 4 first premolars, followed by anterior tooth retraction to obtain the desired dental and soft-tissue profile changes. Anchorage design as a fundamental part in orthodontic treatment planning will influence the ultimate therapeutic effect including dental, skeletal and soft tissue changes. In clinical practice, orthodontists' concern is which anchorage type - traditional anchorage or the implant would be more effective.

Therefore, this study was undertaken:

- To evaluate soft tissue parameters after orthodontic treatment with mini screw implants in class I bimaxillary protrusion patients.
- To evaluate dental parameters after orthodontic treatment with mini screw implants in class I bimaxillary protrusion patients.
- To evaluate soft tissue parameters after orthodontic treatment with traditional anchorage in class I bimaxillary protrusion patients.
- To evaluate dental parameters after orthodontic treatment with traditional anchorage in class I bimaxillary protrusion patients.
- To compare dental and soft tissue parameters among the patients treated with mini screw implants and with traditional anchorage in class I bimaxillary protrusion patients.

Materials and methods: The study was a retrospective cross-sectional cephalometric study conducted on 2 groups with 31 samples in each group of class 1 bimaxillary protrusion malocclusions who were reported to the Department of Orthodontics and Dentofacial Orthopaedics, KLE Academy of Higher Education and Research, (KAHER) KLE V.K Institute of Dental Sciences, Belagavi. Pre-treatment lateral cephalogram of patients was traced manually, to evaluate and compare dental and soft tissue parameters in both the groups. Further, descriptive and inferential analysis was done to reach a final conclusion.

Results: Independent t-test was used to compare the treatment changes (t2-t1) between mini-implant and traditional implant patients and had statistically no significant difference in most of the variables under study except UL-X and U6-Y. U6-Y had a Mean difference of -0.39 with a standard deviation of 0.715 in Mini-Implant and a mean difference of 1.48 with a standard deviation of 0.300 in traditional implant patients with a p value less than 0.01. Whereas UL-X had a Mean difference of --0.10 with a standard deviation of 1.044 in Mini-Implant and a mean difference of -0.97 with a standard deviation of 0.706 in traditional implant patients with a p value less than 0.01

Conclusion: Anchorage using mini-implants and traditional anchorage were both equally effective to bring about dental and soft tissue changes. Based on the results of the study, Inter-incisal angle increased significantly in both the groups. Upper incisor inclination decreased significantly in both the groups. Facial convexity angle decreased and nasolabial angle increased in both the groups. Upper lip retracted in both the groups with more statistically significant in mini-implant group.

.

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INTRODUCTION

Satisfactory orthodontic treatment outcomes and better smile appearance have attracted large number of adolescents and adults to seek orthodontic treatment. Obtaining esthetically pleasant appearance with stable functional and occlusal outcomes within short time span are the present day goals of orthodontic practitioner and so as of patient too.

Bimaxillary protrusion is common in some ethnic groups. It is a commonly seen deformity in Asian populations[1]. This condition is characterized by protrusive and proclined upper and lower incisors and an increased procumbency of the lips. It is usually combined with lip incompetence, gummy smile, mentalis strain and anterior open bite[2]. Dentists often refer to this condition as just "bimaxillary protrusion," a simpler term but a misnomer, since it is not the jaws but the teeth that protrude.

The present trend to treat bimaxillary protrusion is extraction of the 4 first premolars, followed by anterior tooth retraction to obtain the desired dental and soft-tissue profile changes. It is very important to provide enough space for anterior teeth retraction in patients with bialveolar dental protrusion. In this situation, skeletal anchorage is required to retract the anterior teeth to improve facial profile. However, there is little scientific evidence on the treatment effects in patients with bialveolar dental protrusion using skeletal anchorage, with the few published studies demonstrating conflicting results[3].

Facial appearance after treatment is obviously of paramount importance to contemporary orthodontists. Whether viewed dynamically or statically, facial harmony and profile balance are determined by the interaction of the inherent

morphology of the soft tissues, the characteristics of the underlying skeletal foundation, and the positions and angulations of the teeth[5]. All these factors combine to provide the visual impact of each face. Much previous research about the response of soft tissues to tooth retraction has been done, but few authors have examined patients requiring minimal arch length deficiency correction and maximum anterior retraction. Even fewer have focused on patients who might benefit from skeletal anchorage but were treated conventionally[6].

Although much research regarding soft-tissue response to anterior tooth retraction has been performed, only a few studies have compared records of patients with minimal arch length deficiencies requiring maximum anterior retraction[7].

Anchorage, defined as a resistance to unwanted tooth movement, is prerequisite for the orthodontic treatment of dental and skeletal malocclusions. Anchorage design as a fundamental part in orthodontic treatment planning will influence the ultimate therapeutic effect including dental, skeletal and soft tissue changes[8].

To reinforce anchorage, various auxiliaries can be used, including a Nance holding arch, headgear, transpalatal arch, and others[9]. However, all these methods have inherent disadvantages, such as complicated designs, need for exceptional patient cooperation, and elaborate wire bending.

Various orthodontic techniques, such as sliding mechanics, frictionless loop mechanics; labial and lingual orthodontic appliances were described to retract the anterior teeth. Closing extraction spaces using sliding mechanics can be performed by separating canine retraction and closing extraction space in two steps rather than one, or by an en-masse retraction of anterior teeth with anchorage reinforcement[10].

Skeletal anchorage systems, aiming for absolute anchorage, are used to prevent anchorage loss, including dental implants, mini-plates, microscrew and mini-screw implants. Among the above systems, micro-screw or mini-screw implants have the advantages of operational convenience, comfort and inexpensiveness. Additionally, immediate loading and long-term stabilization are possible in using micro-screw or mini-screw implants as anchorage reinforcement. Therefore, it is broadly welcomed by orthodontists all over.

With the emergence of mini-implant's applications, many studies have been performed to investigate the efficacy of them as anchorage source for en-masse retraction of anterior teeth[11]. Along with traditional anchorage still used as treatment modality in daily practice. But there is limited evidence-based answer to the question of the quality of the achieved results by traditional anchorage method compared to those obtained by retraction supported by mini-implants anchorage.

To achieve a harmonious profile with pleasant smile arc in Class I Bimaxillary protrusion adult cases has been a clinical challenge. Adequate retraction and intrusion of maxillary dentition as well as vertical control are the key factors to improve the smiling appearance and the facial profile. In clinical practice, orthodontists' concern is which anchorage type - traditional anchorage or the implant would be more effective.

The purpose of this study was to compare the differences in cephalometric parameters after active orthodontic treatment applying mini-screw implants and traditional anchorage in patients with class 1 bimaxillary protrusion who required extraction of premolars.

AIM OF THE STUDY:

AIM OF THE STUDY

- To evaluate and compare dental and soft tissue parameters after orthodontic treatment with mini screw implants and traditional anchorage in class I bimaxillary protrusion patients.

OBJECTIVES

- To evaluate soft tissue parameters after orthodontic treatment with mini screw implants in class I bimaxillary protrusion patients.
- To evaluate dental parameters after orthodontic treatment with mini screw implants in class I bimaxillary protrusion patients.
- To evaluate soft tissue parameters after orthodontic treatment with traditional anchorage in class I bimaxillary protrusion patients.
- To evaluate dental parameters after orthodontic treatment with traditional anchorage in class I bimaxillary protrusion patients.
- To compare dental and soft tissue parameters among the patients treated with mini screw implants and with traditional anchorage in class I bimaxillary protrusion patients.

REVIEW OF LITERATURE

- **Madhur Upadhyay *et al* (2007)[11]** – in their study Twenty-three patients (overjet 7 mm) were selected to examine the skeletal, dental, and soft tissue treatment effects ofdivision 1 female patients. Treatment mechanics consisted of retraction of anterior teeth by placing mini-implants in the interdental bone between the roots of the maxillary first molar and second premolar. A force of 150 g was applied, bilaterally. Treatment effects were analyzed by taking lateral cephalograms and study casts at T1 (before initiation of retraction) and at T2 (after complete space closure). They concluded that mini-implants provided absolute anchorage to bring about significant dental and soft tissue changes in moderate to severe Class II division 1 patients and can be considered as possible alternatives to orthognathic surgery in selected cases.

- **Y H LIU *et al* (2009)[12]** – in their study 34 chinese patients were treated with active orthodontic treatment applying mini screw implants in group 1 or transpalatal arches in group 2 as anchorage in adult patients with bialveolar dental protrusion. It was found that Mini-screw implants provide absolute anchorage in vertical and sagittal directions.

- **Salma Al-Sibaie *et al* (2013)[15] -** conducted randomized controlled trial to evaluate skeletal, dental, and soft tissue changes in class II division 1 malocclusion to compare treatment outcomes between the sliding en-masse retraction of upper anterior teeth supported by mini-implants and the two-step sliding retraction technique employing conventional anchorage devices in 80

patients who fulfilled inclusion criteria. They concluded that en-masse retraction based on mini-implants anchorage gave superior results compared to the two-step retraction based on conventional anchorage in terms of speed, dental changes, anchorage loss, and aesthetic outcomes.

- **Yanhua Xu *et al* (2017)[16]** - published systematic review article to compare the treatment effects of mini-implants as anchor units with conventional methods of anchorage reinforcement in maxillary dentoalveolar protrusion patients in terms of skeletal, dental, and soft tissue changes. Mini-implant anchorage was more effective in retracting the anterior teeth, produced less anchorage loss, and had a greater effect on SN-MP for the high-angle patients than did traditional anchorage.

- **Ah Young Lee *et al* (2011)[13]** - compared the amounts of anchorage loss in the upper first molar and of retraction of the upper central incisor in cases with Class I malocclusion between orthodontic mini-implants and conventional anchorage reinforcements in 40 female adult patients with Class I malocclusion that were treated with extraction of the first premolars and sliding mechanics. Although orthodontic mini-implants could not reduce the treatment duration, it could provide better maximum anchorage of upper first molar, greater retraction of upper central incisor, intrusion of U1 and U6 than conventional anchorage reinforcements.

- **Kenneth Lew (1989)[7] -** Thirty-two adult patients aged 18–26 years with bimaxillary protrusion were treated with the Begg appliance following extraction of four first premolars. A cephalometric study was undertaken to

determine the soft tissue changes in lip profile following treatment. Results showed that the nasolabial angle became more obtuse increasing from 80.7° to 90.7°. The upper lip and lower lip lengthened by 1.9 mm and 1.2 mm, respectively. The lower lip to 'E' line reduced from 7.5 mm to 3.7 mm. This study shows that the Begg appliance has the ability to significantly reduce bimaxillary protrusion and thereby improve facial aesthetics

- **Hyo-sang Park *et al* (2008)[20] -** purpose of this study were to quantify the treatment effects of titanium screws on en-masse retraction of 6 anterior teeth and to compare the anchorage potential of treatment with titanium screws with the Tweed-Merrifield technique, which requires patient compliance with a high-pull J-hook in 16 non- growing patients. Results suggested that titanium screws can provide acceptable and reliable anchorage

- **Abhita Malhotra *et al* (2021)[17] -** conducted this study with the aim of retracting the proclined maxillary anterior teeth and to check for efficient retraction, type of tooth movement during retraction, and amount of anchorage loss. 8 subjects in each group with extraction of first premolars were included in the study, where anchorage was taken with mini-implants in one group, and in the second group, conventional anchorage method of 1^{st} and 2^{nd} molar banding with TPA was chosen. The retraction in the implant group was more than in the conventional group. Anchorage loss was seen to be greater in conventional group than in the implant group. The implant group showed predominantly controlled tipping and the conventional group showed uncontrolled tipping movement.

- **Defne Kecik (2016)[14]** - compared the dental and skeletal effects of canine retraction using conventional anchorage reinforcement systems and comparing them with the usage of TADs. Total 50 patients with class 1 bidental protrusion divided in 2 groups as 25 each. Results showed that TADs are more convenient to provide absolute anchorage during maxillary canine retraction in contrast to transpalatal arch.

- **Jungkil Lee *et al* (2014)[16] -** compared the treatment duration and dentoskeletal changes between two different anchorage systems used to treat maxillary dentoalveolar protrusion and to examine the effectiveness of en-masse retraction using two miniscrews placed in the midpalatal suture. Study concluded that mini-screws achieve better dentoskeletal control than does the conventional anchorage method, thereby improving the quality of the treatment results.

- **S S Chopra *et al* (2017)[19] -** 50 subjects between the ages of 13 and 17 years having bimaxillary dentoalveolar protrusion were included in the study. The patients were divided into two groups. Group 'I' received the Nance button and lingual arch as anchorage reinforcement in the upper and lower arches, respectively. Subjects of Group 'II' received self-drilling titanium OI for anchorage reinforcement. They concluded, Implants as anchorage, for en masse retraction, can be incorporated into orthodontic practice. The use of orthodontic implants for anchorage is a viable alternative to conventional molar anchorage.

- **Kyoko Mukaida *et al* (2018)[18] -** article reports the treatment of an adult with severe high-angle bimaxillary protrusion. To correct the protrusion of the anterior teeth, orthodontic anchor screws were used to provide absolute anchorage during anterior retraction. Acceptable occlusion, facial profile, and balance were achieved. Orthodontic anchor screws appear to be very useful for treatment of severe bimaxillary protrusion in adults.

- **Shih-Ying Lin *et al* (2019)[20] –** case report of 19 year old female patient treated using two miniscrews placed into the infrazygomatic crest of the maxilla and one was inserted in the sub-apical region of maxillary incisors for retraction, intrusion, and torque control of anterior teeth. Bimaxillary protrusion was improved and a stable occlusal relationship was established after treatment. The total treatment duration was 24 months. Cephalometric analysis showed significant intrusion and retraction of maxillary incisors.

- **Rui Liu *et al* (2021)[21] –** case report of a 31-year-old woman with severe protrusive profile and gummy smile. She was treated using micro-implants and a self-made four-curvature torquing auxiliary which allowed for maximal en masse anterior tooth retraction. Esthetically, the patient's lip protrusion was significantly decreased and the results remained stable throughout the 2-year follow up.

MATERIALS AND ARMAMENTARIUM

- Pre-treatment and post-treatment lateral cephalograms
- Acetate matte sheets
- Lead pencil (0.35 mm)
- Scale
- Protractor
- Set-squares
- View box

STUDY DESIGN:

Retrospective cross-sectional cephalometric study

SOURCE OF DATA:

- The study was done on pre-treatment and post-treatment lateral cephalograms of patients who were treated in the Department of Orthodontics and Dentofacial Orthopaedics, KLE Academy of Higher Education & Research, KLE VK Institute of Dental Sciences, Belagavi.

METHOD OF COLLECTION OF DATA:

All the participants met the following criteria

INCLUSION CRITERIA:

Patients with the following criteria were included:

- Class I bimaxillary protrusion patients
- Age above 18 yrs
- No previous history of orthodontic treatment
- Extraction of premolars
- Traditional anchorage group treated with MBT technique
- Both males and females

EXCLUSION CRITERIA:

Patients with the following criteria were excluded:

- History of extracted or missing permanent molars
- Congenitally missing maxillary incisors
- Presence of any developmental anomalies or severe facial deformities
- Patients with class II malocclusions.
- Patients with class III malocclusions.

PERMISSIONS TAKEN:

- Institutional ethical clearance

SAMPLE SIZE ESTIMATION

- Sample size estimation calculated was 31 in each group based on parameters used to estimate difference between two treatment groups.
- Sample size
- based on UL-Y measurements
- Standard deviation in the Ist group S1 = 2.089
- Standard deviation in the IInd group S2 = 1.54

- Mean difference between Ist and IInd sample = 1.50
- Effect size = 0.826674014880132
- Alpha Error (%) = 5
- Power (%)= 90
- sided = 2
- **Number needed (n) = 31 in each group +10% extra**
- Alpha Error(%) Power(%) Sample Size(n)

1	**80**	**35**
	90	**45**
5	80	24
	90	31

FORMULA

- $n = \frac{2(S_1/2 + S_2/2)^2 (Z_{\alpha +} Z\beta)^2}{d^2}$
- $d = x_1 - x_2 = 1.50$
- $z_\alpha = 1.96$ at 5% α error
- $z_\beta = 1.282$ at 90% power
- So the estimated sample size was 31 per group which made the sample size 62 in total.

METHODOLOGY

Records of class I bimaxillary protrusion cases treated with premolar extractions

↓

Standardized pre and post treatment lateral cephalograms were taken in natural head position, with teeth in centric occlusion and lips in relaxed position were collected

↓

Patients were categorized in 2 groups :

- Treated with mini screw implants as anchorage
- Treated with traditional anchorage

↓

Acetate sheet was placed on top of the radiograph and the dental and soft tissue landmarks were traced on the sheet.

↓

The following measurements were made on lateral cephalograms :

- Angular measurements
- Linear measurements

- **REFRENCE PLANES:**

X- axis - Frankfort horizontal plane (constructed by subtracting7º from the sella nasion line)

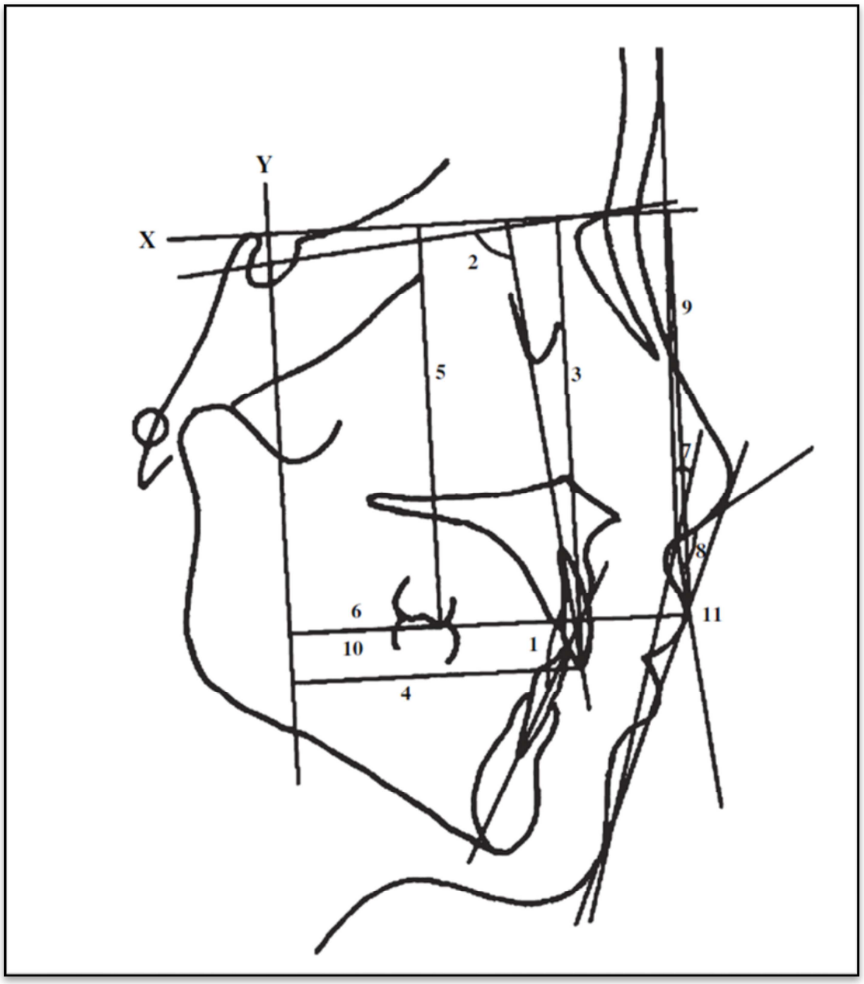
Y- axis - line perpendicular to X-axis through sella.

Dental measurements :

1. ANGULAR
    - UI-LI - Angle between long axis of upper incisor and long axis of lower incisor
    - UI-SN - Angle between long axis of upper incisor and SN plane
2. LINEAR
    - UI-X - Distance between tip of upper incisor to X-axis
    - UI-Y - Distance between tip of upper incisor to Y-axis
    - U6-X - Distance between upper 1st molar to X-axis
    - U6-Y - Distance between upper 1st molar to Y-axis

Soft tissue measurements:

1. ANGULAR
    - G-Sn-Pog - Facial convexity angle
    - Nasolabial angle
2. LINEAR
    - UL-X - Distance between upper lip and X-axis
    - UL-Y - Distance between upper lip and Y-axis
    - UL- E - Distance between upper lip and E line



Dental and soft-tissue measurements:

1 - UI-LI; 2- UI-SN; 3-UI-X; 4-UI-Y; 5-U6-X; 6-U6-Y;

7 - G-Sn-Pog (facial convexity angle); 8 Cm-Sn-Ls -nasolabial angle; 9- UL-X; 10-UL-Y; 11-UL-E

RESULTS

- This study was done to evaluate and compare dental and soft tissue changes after orthodontic treatment with mini screw implants and traditional anchorage in class I bimaxillary protrusion patients of age 18 and above.

- Divided into 2 groups with sample size of 31 retrospective cases in each group.

Table 1: Comparison of pre-treatment of mini-implant and traditional anchorage patients

Group	Mini-Implant			Traditional			P-value	Significance
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
U1-L1	113.97	4.135	0.743	115.00	5.158	0.926	0.193	NS
U1-SN	116.97	3.860	0.693	114.42	5.644	1.014	0.017*	
U1-X	72.16	1.416	0.254	71.77	1.283	0.231	0.504	NS
U1-Y	69.74	2.944	0.529	64.35	5.161	0.927	0.000 [a]	
U6-X	60.94	1.413	0.254	61.06	1.340	0.241	0.745	NS
U6-Y	39.26	3.559	0.639	39.81	3.833	0.688	0.687	NS
G-Sn-Pg	19.26	1.548	0.278	18.61	1.892	0.340	0.143	NS
Cm-Sn-Ls	82.29	9.655	1.734	87.26	7.554	1.357	0.152	NS
UL-X	60.29	2.003	0.360	59.97	2.025	0.364	0.799	NS
UL-Y	79.87	2.247	0.404	74.94	5.609	1.007	0.000[a]	
UL-E	0.29	2.003	0.360	0.06	2.190	0.393	0.465	NS

NS, not significant; *P < 0.05; [a]P< 0.01.

Independent t-test was used to compare the pre-treatment of mini-implant patients and traditional implant patients and had no statistically significant difference in most of the variables studied except U1-SN(116.97±3.86, 114.42±5.644), U1-Y(69.74±2.94, 64.35±5.161), UL-Y (79.87±2.247, 74.94±5.609), with a p value of 0.017, <0.01 and <0.01 respectively. This implies that at the time of pre-treatment, there is no difference in the majority of the variables between the mini-implant patients and traditional implant patients.

Table 2: Comparison of pre-treatment and post-treatment of mini-implants anchorage patients

Group	Pre Test		Post Test		P-value
	Mean	Std. Deviation	Mean	Std. Deviation	
U1-L1	113.97	4.135	131.87	3.685	0.000*
U1-SN	116.97	3.860	104.74	3.286	0.000*
U1-X	72.16	1.416	68.48	1.930	0.000*
U1-Y	69.74	2.944	62.61	3.073	0.000*
U6-X	60.94	1.413	59.13	1.500	0.000*
U6-Y	39.26	3.559	38.87	3.490	0.005*
G-Sn-Pg	19.26	1.548	17.48	1.546	0.000*
Cm-Sn-Ls	82.29	9.655	97.45	9.058	0.000*
UL-X	60.29	2.003	60.19	2.400	0.610
UL-Y	79.87	2.247	75.00	2.352	0.000*
UL-E	0.29	2.003	-1.39	1.706	0.000*

NS, not significant; *P < 0.01.

Paired t-test was used to compare that pre-treatment and post treatment of mini-implant patients and had a statistically significant difference almost every variable except UL-X. U1-L1 had a significant difference between pre and post treatment with a pvalue less than 0.01 when comparing the pretest mean value of 113.97 with its standard deviation of 4.135 with to the post test mean value of 131.87 with its standard deviation of 3.685. There was a significant increase in the values after treatment.The variables U1-SN, U1-X, U1-Y, U6-X, U6-Y, G-Sn-Pg, UL-Y, UL-E also had a significant decrease in the pre-treatment and post treatment with a pvalue less than 0.01. However the variable Cm-Sn-Ls had a significant increase with a mean value from 82.29 with a variance of 9.655 in pre-treatment to a mean value of 97.45 along with a standard deviation of 9.058.

Table 3: Comparison of pre-treatment and post-treatment of traditional anchorage patients

Group	Pre Test		Post Test		P-value
	Mean	Std. Deviation	Mean	Std. Deviation	
U1-L1	115.00	5.158	129.81	4.840	0.000*
U1-SN	114.42	5.644	101.35	6.844	0.000*
U1-X	71.77	1.283	69.65	2.259	0.000*
U1-Y	64.35	5.161	59.87	5.482	0.000*
U6-X	61.06	1.340	62.03	1.560	0.000*
U6-Y	39.81	3.833	41.29	3.840	0.000*
G-Sn-Pg	18.61	1.892	17.65	2.153	0.000*
Cm-Sn-Ls	87.26	7.554	104.00	7.929	0.000*
UL-X	59.97	2.025	59.00	2.066	0.000*
UL-Y	74.94	5.609	70.87	5.451	0.000*
UL-E	0.06	2.190	-0.74	1.999	0.000*

*P < 0.01.

Paired t-test was used to compare that pre-treatment and post treatment of traditional patients and had a statistically significant difference in every variable. U1-L1 had a significant difference between pre and post treatment with a pvalue less than 0.01 when comparing the pre-treatment mean value of 115.00 with its standard deviation of 5.158 with to the post test mean value of 129.81 with its standard deviation of 4.840. There was a significant increase in the values after treatment. The variables U6-X, U6-Y, Cm-Sn-Ls also had significant increase when comparing the pre-treatment mean value to the post treatment. All the other variables had a significant decrease in their values when comparing pre-treatment and post treatment.

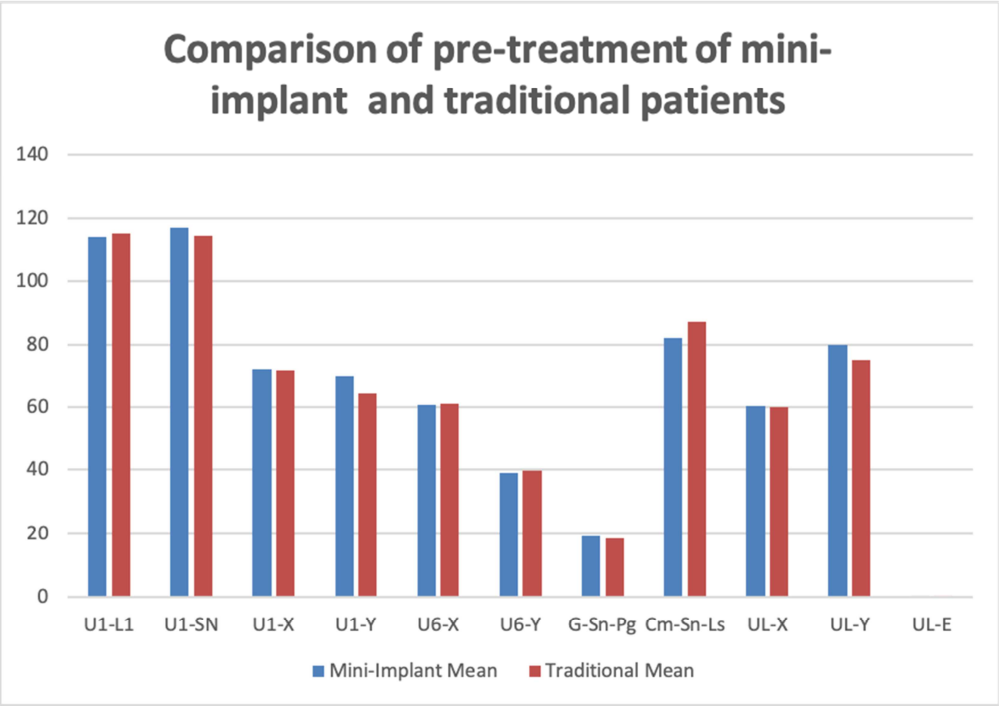
Table 4: Comparison of treatment changes (t2-t1) between mini-implants and traditional anchorage patients

Group	Mini-Implant			Traditional			P-value	Significance
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
U1-L1	17.90	4.549	0.817	14.81	4.453	0.800	0.859	NS
U1-SN	-12.23	2.872	0.516	-13.06	2.394	0.430	0.490	NS
U1-X	-3.68	2.006	0.360	-2.13	2.291	0.412	0.485	NS
U1-Y	-7.13	1.688	0.303	-4.48	1.180	0.212	0.516	NS
U6-X	-1.81	0.833	0.150	0.97	0.752	0.135	0.505	NS
U6-Y	-0.39	0.715	0.128	1.48	1.671	0.300	0.003	
G-Sn-Pg	-1.77	0.884	0.159	-0.97	0.836	0.150	0.618	NS
Cm-Sn-Ls	15.16	3.839	0.690	16.74	3.000	0.539	0.794	NS
UL-X	-0.10	1.044	0.188	-0.97	0.706	0.127	0.004	
UL-Y	-4.87	1.765	0.317	-4.06	1.340	0.241	0.129	NS
UL-E	-1.68	0.871	0.156	-0.81	0.873	0.157	0.670	NS

*P < 0.01.

Independent t-test was used to compare the treatment changes (t2-t1) between mini-implant and traditional implant patients and had statistically no significant difference in most of the variables under study except UL-X and U6-Y. U6-Y had a Mean difference of -0.39 with a standard deviation of 0.715 in Mini-Implant and a mean difference of 1.48 with a standard deviation of 0.300 in traditional implant patients with a p value less than 0.01. Whereas UL-X had a Mean difference of --0.10 with a standard deviation of 1.044 in Mini-Implant and a mean difference of -0.97 with a standard deviation of 0.706 in traditional implant patients with a p value less than 0.01.

Graph Number 1:



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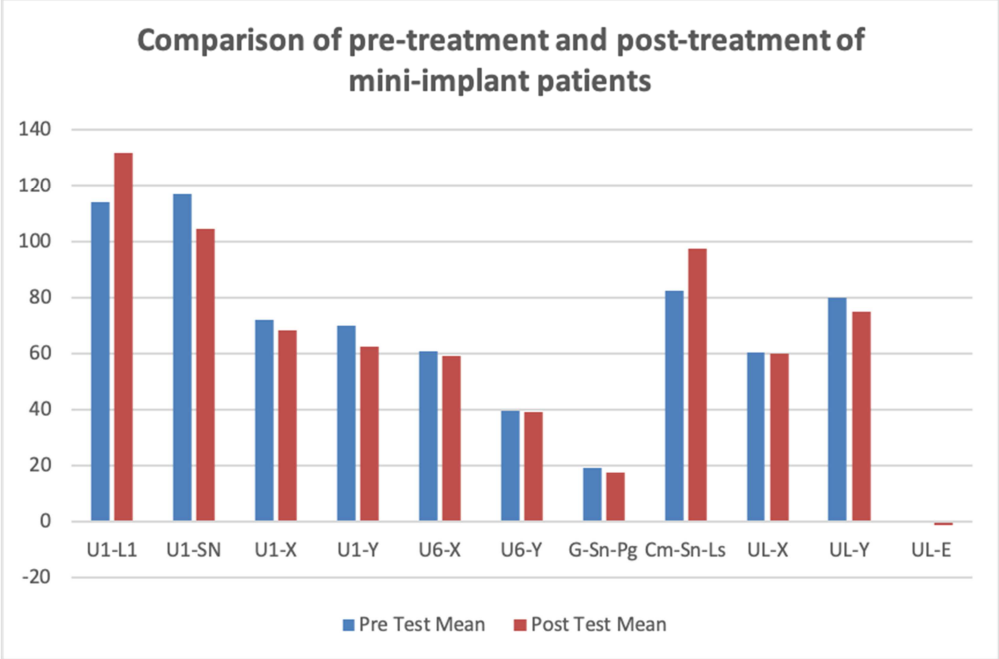

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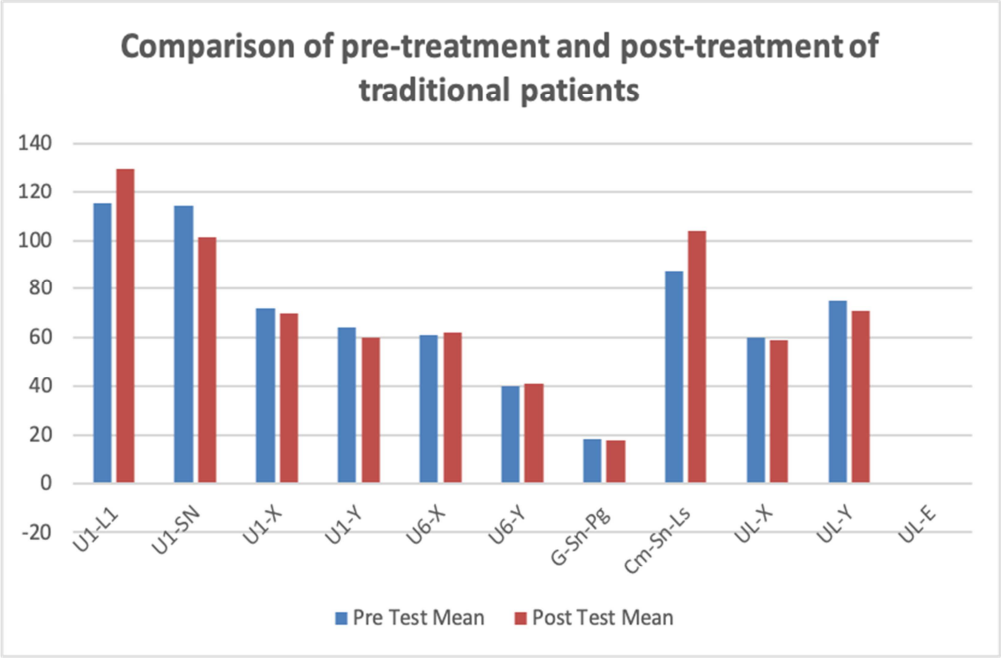

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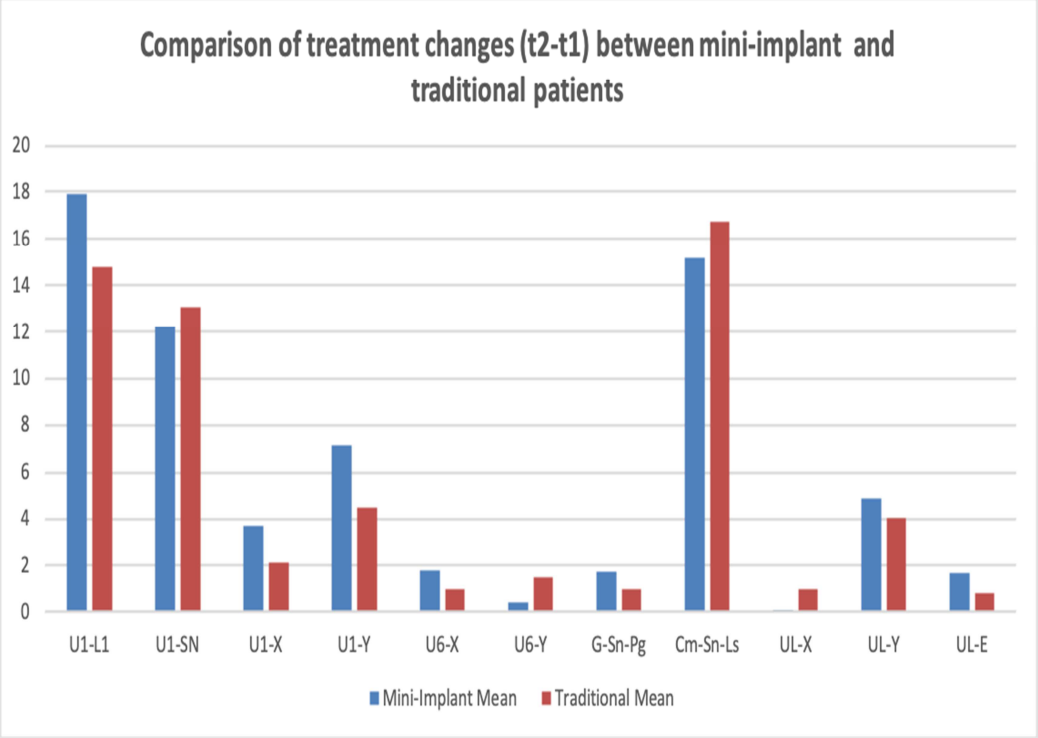

DISCUSSION

Esthetic correction of facial profile is a common desire expressed by patients with bimaxillary protrusion. Lip protrusion, chin morphology, and mentolabial sulcus depth are considered the key parameters correlated to facial esthetics. As for patients with bimaxillary protrusion, the more extraction that space is used for the retraction of anterior teeth, the better the facial profile would be. Therefore, this study was conducted to evaluate and compare dental and soft tissue changes after treatment with mini-implant as anchorage and using traditional anchorage.

The two primary reasons for extraction of permanent teeth are to correct a discrepancy between tooth size and arch length, and to reduce bimaxillary protrusion. In addition, the desire to control the vertical dimension can also be a reason to extract permanent teeth. This rationale for extraction is sometimes referred to as the "wedge hypothesis[22]," which essentially suggests that orthodontic forward movement of posterior teeth after mandibular and maxillary premolar extraction leads to reduction in the vertical dimension.

Most orthodontic force applications tend to cause extrusion of the molars. According to Staggers[23], even though the molar moves forward in premolar extraction patients, the vertical dimension of the face is maintained by extrusion of the posterior teeth. A similar concept was stated by Cusimano et al[24], that occlusal movement of the posterior teeth tends to keep pace with the increase in anterior facial height, thus maintaining the mandibular plane angle and nullifying the bite-closing effect of posterior protraction.

In terms of soft tissues changes, it has been suggested that the way of anchorage management determines the magnitude of anterior dental retraction and the resulting change in lip position (Burstone, 1982). However, as noted by Zierhut et al, lip tension can vary between subjects and even from time to time in 1 subject. Since the upper incisors moved more distally in both groups, upper and lower lips were retracted and the nasolabial angle increased to a greater extent.

Lo and Hunter[25], who suggested that the soft-tissue profile followed closely the underlying skeletal framework. Oliver found that patients with thin lips or high lip strain had a significant correlation between incisor retraction and lip retraction, but patients with thick lips or low lip strain had no such correlation. It was also reported that lip response, as a proportion of incisor retraction, decreases as the amount of incisor retraction increases, indicating that the lips have some inherent support. The mobile and flexible lip texture can also produce large variations of lip position on the lateral cephalogram, even when patients are asked to keep their lips relaxed and their teeth in occlusion. The more regional effect of incisor retraction should be expected because, even with orthognathic surgery, soft-tissue changes decrease as the distance from the surgical site increases.

It seems to be that en-masse retraction with mini-implants not only eases the biomechanics involved but also controls the antero-posterior and vertical movements of the anterior and posterior teeth due to the possibility of passing the force axis close to the centre of resistance of the maxillary anterior teeth. Avoidance of disto-palatal rotations and distal tipping of retracted canines, and eliminating the appearance of unsightly spaces distal to the lateral incisors following canine retraction make the en-masse retraction more favourable than the two-step retraction approach to both

orthodontists and patients. Treatment with mini-implants enables the orthodontist to avoid using molar bands and replace them with molar tubes, and saves the time required for laboratory work to fabricate the TPAs.

Facial appearance after treatment is obviously of paramount importance to contemporary orthodontists. Whether viewed dynamically or statically, facial harmony and profile balance are determined by the interaction of the inherent morphology of the soft tissues, the characteristics of the underlying skeletal foundation, and the positions and angulations of the teeth. All these factors combine to provide the visual impact of each face. Much previous research about the response of soft tissues to tooth retraction has been done, but few authors have examined patients requiring minimal arch length deficiency correction and maximum anterior retraction. Even fewer have focused on patients who might benefit from skeletal anchorage but were treated conventionally.

Interincisal Angle (U1-L1) :

U1-L1 had a significant difference between pre and post treatment with a p value less than 0.01 in both groups. This study confirms that there is a positive correlation between incisor retraction and soft tissue profile seen from changes in inter incisor angle affecting soft tissue profile.

Upper Incisor proclination (U1-SN) Angle :

Upper incisor inclination is the paramount distinctive feature of bimaxillary protrusion patients. In this study U1-SN was decreased and had a significant difference between pre and post treatment in both the groups.

Retraction and Intrusion of upper incisor :

Retraction of upper teeth has a positive or negative impact on patient's profile. Here in the maxillary incisor movement, significant retraction was detected in both the groups. Incisor intrusion was more with mini-impant group compared to traditional anchorage group.

Changes in upper first molar :

Upper first molar was slightly mesialized in traditional anchorage group compared to mini-implant group. No any significant difference was seen with molar intrusion or extrusion in both the groups.

Facial Convexity angle :

G1 and in G2 with no significant difference between the two groups.

Nasolabial angle :

Extractions often have a strong positive impact on factors like Nasolabial angle. In this study Nasolabial angle (Cm-Sn-Ls) was increased in G1 and in G2 with no significant difference between two groups.

Upper lip changes :

Kasai (1998)[25] stated that 4.3 mm of upper incisor retraction caused the upper lip to retreat by 1.9 mm. Heagler et al (1998)[26] stated that due to maxillary incisor retraction the upper lip retreated 2mm. Comparison of the upper incisor tooth retraction against retraction of the upper lip is 4.3: 1.9 mm. Every 1 mm of maxillary incisor tip retraction would produce a 0.38 mm retraction of the lower lip. Kocadereli

(2002) and Geagler et al (1998)[27] stated that the removal of premolar teeth followed by retraction of canines and incisor teeth reduced lip curvature. In present study upper lip was retracted and intruded in both the groups with more statistically significant in mini-implant group. .

LIMITATIONS OF THE STUDY :

- Various treatment modalities were used broadly under traditional anchorage group and compared with single mini-implant group.
- Lower arch evaluation in terms of dental and soft tissue changes was not done in this study.
- More qualified Randomized Controlled Trials are required to make reliable recommendations about the anchorage capacity of mini-implant v/s traditional anchorage on patients with bimaxillary protrusion, especially soft tissue effects.

CONCLUSION

A retrospective study was done in Class I Bimaxillary protrusion samples which evaluated and compared dental and soft tissue changes using specific parameters.

The following conclusions can be drawn from the present study:

- Anchorage using mini-implants and traditional anchorage both demonstrated nearly equal amount of effectiveness to bring about dental and soft tissue changes.
- Based on the results of the study, Inter-incisal angle increased significantly in both the groups.
- Upper incisor inclination decreased significantly in both the groups with more statistically significant in mini-implant group. .
- Facial convexity angle decreased and nasolabial angle increased in both the groups.
- Upper lip retracted in both the groups with more statistically significant in mini-implant group.

APPLICATIONS OF THE STUDY :

- Orthodontic diagnosis and treatment planning are largely dependent on cephalometric analysis. Dental and soft tissue changes after treatment in bialveolar dental protrusion patients using different mechanics largely impacts overall facial appearance. So this study helps orthodontist in deciding treatment mechanics depending on the necessary changes required in dental arrangement and soft tissue profile.
- Changes evaluated using specific parameters can be applied for special considerations with respect to prevent anchorage loss.

FUTURE SCOPE:

- Randomized controlled trials using different anchorage protocols in class I bimaxillary protrusion cases can be conducted.
- Dental and soft tissue changes in relation with lower arch can be evaluated after retraction in extraction cases.

SUMMARY

The purpose of this study was to evaluate and compare dental and soft tissue changes using specific parameters after orthodontic treatment with mini screw implants and traditional anchorage in class I bimaxillary protrusion patients. Total 124 cephalograms were analyzed which was divided into 2 groups with sample size of 31 retrospective cases in each group. Statistical analyses were performed for the different parameters to obtain mean values for each of the two groups, and their comparison was conducted. Based on the results of the study, Inter incisal angle presented a significant increase in both the groups. Upper incisor inclination was decreased significantly in both groups. Retraction and intrusion of upper incisor was seen in both groups with more significant in mini-impant group. Facial convexity angle was decreased and nasolabial angle was increased in both the groups.

Upper lip was retracted in both the groups with more statistically significant in mini-implant group. Therefore this study helps orthodontist or clinician in deciding treatment mechanics depending on the necessary changes required in dental arrangement and soft tissue profile.

BIBLIOGRAPHY

1. Daskalogiannakis J. Glossary of orthodontic terms. Leipzig: Quintessence Publishing Co.; 2000.
2. Mclaughlin RP, Bennett JC. Anchorage control during leveling and aligning with a preadjusted appliance system. J Clin Orthod. 1991;25:687–696.
3. Zablocki HL, McNamara JA Jr, Franchi L, Baccettic T. Effect of the transpalatal arch during extraction treatment. Am J Orthod Dentofacial Orthop. 2008;133:852–860.
4. Mclaughlin RP, Bennett JC. The transition from standard edgewise to preadjusted appliance systems. J Clin Orthod. 1989;23:142–153.
5. Douglass JB, Killiany DM. Dental implants used as orthodontic anchorage. J Oral Implant. 1987;13:28–38.
6. Nagasaka H, Sugawara J, Kawamura H, Kasahara T, Umemori M, Mitani H. A clinical evaluation on the efficacy of titanium miniplates as orthodontic anchorage. Orthod Waves. 1999; 58:136–147.
7. Park HS. The skeletal cortical anchorage using titanium miniscrew implants. Korean J Orthod. 1999;29:699–706.
8. Papadopoulos MA, Tarawneh F. The use of mini-screw implants for temporary skeletal anchorage in orthodontics: A comprehensive review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;103
9. Farrow AL, Zarrinnia K, Azizi K. Bimaxillary protrusion in black Americans: an esthetic evaluation and the treatment considerations. Am J Orthod Dentofacial Orthop. 1993; 104:240–250.

10. Dandajena TC, Nanda RS. Bialveolar protrusion in a Zimbabwean sample. Am J Orthod Dentofacial Orthop. 2003;123: 133–137.
11. Upadhyay M, Yadav S, Nagaraj K, Patil S. Treatment effects of mini implants for en-masse retraction of anterior teeth in bialveolar dental protrusion patients: a randomized controlled trial. Am J Orthod Dentofacial Orthop. 2008;134:18–29.
12. Lai EH, Yao CC, Chang JZ, Chen I, Chen YJ. Three dimensional dental model analysis of treatment outcomes for protrusive maxillary dentition: comparison of headgear, mini-screw, and miniplate skeletal anchorage. Am J Orthod Dentofacial Orthop. 2008;134:636–645.
13. Yao CC, Lai EH, Chang JZ, Chen I, Chen YJ. Comparison of treatment outcomes between skeletal anchorage and extraoral anchorage in adults with maxillary dentoalveolar protrusion. Am J Orthod Dentofacial Orthop. 2008;134:615–624.
14. Huang LH, Shotwell JL, Wang HL. Dental implants for orthodontic anchorage. Am J Orthod Dentofacial Orthop. 2005;127:713–722.
15. Bjo¨rk A. The Face in profile. Lund: Svensk Tandla¨k; 1947.
16. Janssen KI, Raghoebar GM, Vissink A, Sandham A. Skeletal anchorage in orthodontics: a review of various systems in animal and human studies. Int J Oral Maxillofac Implants. 2008;23:75–88.
17. Feldmann I, Bondemark L. Anchorage capacity of osseointegrated and conventional anchorage systems: a randomized controlled trial. Am J Orthod Dentofacial Orthop. 2008; 133: 339. e19-28.

18. Kojima Y, Fukui H. Effects of transpalatal arch on molar movement produced by mesial force: a finite element simulation. Am J Orthod Dentofacial Orthop. 2008;134:335. e1-7.

19. Heo W, Nahm DS, Baek SH. En-masse retraction and two step retraction of maxillary anterior teeth in adult Class I women. Angle Orthod. 2007;77:973–978.

20. Park HS, Kwon TG. Sliding mechanics with microscrew implant anchorage. Angle Orthod. 2004;74:703–710.

21. Yamaguchi K, Nanda RS. The effects of extraction and nonextraction treatment on the mandibular position. Am J Orthod Dentofacial Orthop. 1991;100:443–452.

22. Stewart CM, Chaconas SJ, Caputo AA. Effects of intermaxillary elastic traction on orthodontic tooth movement. J Oral Rehabil. 1978;5:159–166.

23. Ohnishi H, Yagi T, Yasuda Y, Takada K. A mini-implant for orthodontic anchorage in a deep overbite case. Angle Orthod. 2005;75:444–452

24. Oliver BM. The influence of lip thickness and strain on upper lip response to incisor retraction. Am J Orthod 1982;82:141-9.

25. Lo FD, Hunter WS. Changes in nasolabial angle related to maxillary incisor retraction. Am J Orthod 1982;82:384-91.

26. Wisth J. Soft tissue response to upper incisor retraction in boys. Br J Orthod 1974;1:199-204.

27. Hillesund E, Fjeld D, Zachrisson BU. Reliability of soft-tissue profile in cephalometrics. Am J Orthod 1978;74:537-50.

ANNEXURE – I

ETHICAL CLEARANCE CERTIFICATE

Research and Ethics Committee
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CERTIFICATE

This is to Certify that the synopsis titled

COMPARISON OF DENTAL AND SOFT TISSUE PARAMETRS AFTER ORTHODONTIC TREATMENT WITH MINI SCREW IMPLANTS AND TRADITIONAL ANCHORAGE IN PATIENTS WITH CLASS I BIMAXILLARY PROTRUSION - RETROSPECTIVE CEPHALOMETRIC STUDY

Submitted by Dr. SANJYOT. RODRIGUES *P. G. Student / Staff, Guided by* DR. K.M. KELUSKAR *from Department of* ORTHODONTICS & DENTOFACIAL ORTHOPAEDICS *has been critically evaluated by committee members and granted ethical clearance to conduct the above mentioned study*

Date :

Member Secretary
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

Chairman
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

ANNEXURE – II

BIOSTATISTIC CLEARANCE CERTIFICATE

KLE V.K. Institute of Dental Sciences
(A Constituent unit of KLE Academy of Higher Education & Research
Deemed-to-be-University u/s 3 of the UGC Act, 1956)
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Biostatistics Clearance Certificate

This is to certify that the Biostatistics aspect of the Dissertation / Research work of **Dr.Sanjyot Rodriques** entitled **"Comparison of dental and soft tissue parameters after orthodontic treatment with miniscrew implants and traditional anchorage in patients with class I bimaxillary protrusion: a retrospective cephalometric study"** has been done under my guidance and considered satisfactory.

Place : Belagavi
Date : 27/12/2021

Name & Signature of Biostatistician

ANNEXURE – III

PLAGIARISM CHECK CERTIFICATE

Scientific Correspondence and Review Committee

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Date : 31.12.2021 Serial No. : 081

PLAGIARISM CHECK REPORT

Name of the Applicant : DR. SANJYOT RODRIGUES
UG / PG / Ph.D / Staff : POSTGRADUATE
Batch & Year : 2019-22
Department : ORTHODONTICS AND DENTOFACIAL ORTHOPEDIC

The soft copy of Research Work / Manuscript by DR. SANJYOT RODRIGUES entitled "COMPARISON OF DENTAL AND SOFT TISSUE PARAMETERS AFTER ORTHODONTIC TREATMENT WITH MINISCREW IMPLANTS AND TRADITIONAL ANCHORAGE IN PATIENTS WITH CLASS I BIMAXILLARY PROTRUSION - A RETROSPECITVE CEPHALOMETRIC STUDY

under the guidance of DR. K. M. KELLUSKAR has been submitted for Anti-Plagiarism check to the Scientific Correspondence & Review Committee of KLE VK Institute of Dental Sciences using "Turn-it-in" software.

The scan has been carried out and the scanned output reveals a Similarity Index of 7%, which is **within** / **not within** the acceptable limits of 10% as per the UGC guidelines.

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