Original Research Article

TO EVALUATE SIMULTANEOUS INTRUSION AND RETRACTION OF MAXILLARY ANTERIOR TEETH WITH K-SIR ARCH –A CLINICAL STUDY

ABSTRACT

INTRODUCTION: Simultaneous intrusion and retraction results in correction of proclination of incisors, reduction in overjet and overbite with closure of space. This can be achieved by K-SIR arch. **AIMS AND OBJECTIVES:** To evaluate the skeletal, dental, soft tissue changes and amount of anchor loss during simultaneous intrusion and retraction with K-SIR arch. **MATERIALS AND METHODS:** Total 20 subjects were selected from the patients visiting department of orthodontics. Simultaneous intrusion and retraction was carried out using K-SIR arch. Two lateral cephalograms were taken one, at the beginning of the treatment (T1) and other at the completion of the retraction and intrusion (T2). **RESULTS:** There was significant amount of intrusion and retraction was seen. **CONCLUSION:** The K-SIR arch showed significant amount of retraction and intrusion of upper incisors and showed some amount of extrusion of molars, change in FMA and anchor loss.

KEYWORDS: K-SIR arch, Retraction, Intrusion

INTRODUCTION

Extraction closure is a particularly interesting aspect of orthodontic treatment.[1] Space closure can be achieved either by en-masse retraction of anterior teeth or by individual canine retraction followed by retraction of incisors.[2] However in cases with increased inclination of incisors and increased overbite we need to intrude and retract the incisors simultaneously. One of the available methods for simultaneous intrusion and retraction of incisor is Kalra simultaneous intrusion and retraction arch. The archwires reduces the treatment time as the intrusion of anterior teeth occurs simultaneously with retraction.[3] Orthodontic tooth movement is result of appropriate forces applied to the teeth, while the reactive forces could result in reciprocal tooth movement which is likely to compromise the treatment outcomes.

Though in literature, various studies have been done on simultaneous intrusion and retraction but there are limited clinical studies to evaluate simultaneous intrusion and retraction by using K-SIR arch. Thus, the aim of the present study was to evaluate the treatment effects on the skeletal, dental, soft tissues and amount of anchor loss by using K-SIR arch.

MATERIALS AND METHODS:

The present study was done in the Department of Orthodontics and Dentofacial Orthopaedics. 20 patients who wanted to receive dental treatment in the orthodontics department were incorporated in the study. Informed consent was taken from the patient, parent or guardian. This study received ethical approval from the Institutional research ethical committee.

The following inclusion and exclusion criteria:-

INCLUSION CRITERIA:

1. Angle's Class I or Class II Div. 1 malocclusion with orthognathic maxilla.
2. Age of the patient 13years or more.

3. Overjet/overbite of greater than 4mm.
4. Extraction of first premolars.
5. Except for the third molars no other teeth should be congenitally missing.

EXCLUSION CRITERIA:

1. Patient with trauma or craniofacial anomalies.
2. Missing or impacted teeth in the anterior segment.
3. Cleft lip and cleft palate patient.
4. Subjects with severe anterior discrepancies.

Methodology:

All patients were treated with MBT system (0.022”X0.028”). After the extraction of first premolars, TPA was given to reinforce the anchorage. Initial leveling and alignment were done and 0.019”X0.025” stainless steel arch wire were placed. To ensure that the wires were passive, they were left in place for at least 4 weeks before starting retraction and intrusion mechanics in both the groups.

Fabrication of K-SIR arch[3]:

K-SIR arch is continuous 0.019" X 0.025" TMA archwire with closed 7mm X 2mm U-loops. The straight wire was first made into an arch form and U-loops were then made in the archwire in extraction space using bird beak plier. To obtain bodily movement, 90° V-bend was placed in the archwire at the level of each U-loop. This V-bend creates two equal and opposite moments to counter the moments caused by the activation forces of the closing loops. A 60° V-bend located posterior to the centre of the interbracket distance which provides molar anchorage.20°

antirotation bend is placed in the archwire just distal to each U-loop to prevent mesiolingual rolling of the buccal segments.

A trial activation was performed outside the mouth which releases the stresses built up from bending the wire.Posterior units were stabilized using 0.019”X0.025”stainless steel wire. The archwire was inserted into the auxiliary tubes of the first molars and engaged in the six anterior brackets then 3 mm activation of the K-SIR loop was done on both the sides by cinching the wire distal to molar.

Lateral cephalograms were taken for all the patients, before the start of treatment (T1) and at the end of the intrusion and retraction process (T2). All measurements on the lateral cephalogram were done twice by the same examiner to minimize the error of measurements as shown in Table I.

RESULTS:

The results were obtained after statistically analyzing the data using SPSS (Version 21) software. Student’s paired t-test was used to compare pre and post treatment measurements. The comparison of pre and post treatment mean values of the parameters are shown in Table II.

Discussion:

The simultaneous intrusion and retraction of anterior teeth can be achieved by K-SIR arch With K-SIR arch, intrusion and retraction of six anterior teeth occur at same time. But the reactive forces produced from K-SIR arch could result in reciprocal tooth movement which can compromise the treatment outcomes. Hence, the present study was done to evaluate the skeletal, dental and soft tissue changes and amount of anchor loss in the treatment outcomes by using K-SIR arch.

The present study showed statistically insignificant ($p>0.05$) decrease in mean values of SNA, ANB, A-PTV as shown in TableII. There was insignificant decrease because less retraction of incisors was seen due to more tipping movement as the force is not passing through the centre of resistance of anterior teeth, so there was less remodelling at point A. These results were in accordance with the study done by Hariprashad A et al (2020)[3] and Verma P et al (2020)[8].

Further, on comparing the pre-treatment and post-treatment mean values of SNB,L1-NB,IMPA and Facial angle, decrease in the mean values were found to be statistically insignificant ($p>0.05$) as shown in Table II .There was no significant change in the mean values because in the present study we have placed K-SIR arch only in the maxillary arch and retraction in mandibular arch was done using sliding mechanics .So the treatment effects were observed only in the maxillary arch. These results were in accordance to the study done by Lee A et al (2011)[9] and Agnani S et al (2020)[10]**.**

Further, on comparing the pre-treatment and post-treatment mean values of SN-OP, FMA,Y-axis, Ar-Go-Me, GoGn-SN, ANS-Me and U6-PP, statistically significant difference ($p<0.05$) as shown in Table II. This significant change in was due to the fact that the point of force application was along the archwire so the force vector passes away from centre of resistance of anterior segment which leads to extrusion of molars. These results were in accordance to the study done by Hariprashad A et al (2020)[3] and Agnani S et al (2020)[10].

Moreover, on comparing the pre-treatment and post-treatment mean values of U1-PTV, U1-NA(linear and angular),U1-SN,U1-L1 and Overjet statistically significant difference ($p>0.05$) was found as shown in Table II. This decrease in the values were because as anchorage was taken from molars, which resulted in both mesialisation of molars and retraction of incisors.

These results were in accordance with the study done by Hariprashad A et al (2020)[3], Agnani S et al (2020)[10] and Li F et al (2011)[11].

Further, on comparing the pre-treatment and post-treatment mean values of U1-PP, overbite, statistically significant difference ($p>0.05$) was found as shown in Table II.. The significant decrease were found as intrusive force vector was applied by K-SIR arch. These results were in accordance to the study done by Verma P et al (2020)[8] and Kaushik A et al (2016)[12].

Further, on comparing the pre-treatment and post-treatment mean values of U6-SN,U6-PTV statistically significant difference ($p<0.05$) was found in Group I as shown in Table II..The significant change was found because tipping of molar occurs as source of anchorage was dental component. These results were in accordance to the study done by Upadhyay M et al (2008)[13] and Agnani S et al(2020)[10].

Further, on comparing the pre-treatment and post-treatment mean values of Ls-E line and Nasolabial angle, there was statistically significant difference($p>0.05$) found as shown in Table II . There was upper lip was seen because upper lip which follows the incisors. These results were in accordance to the study done by Hariprashad A et al (2020)[6] and Goel P et al(2014)[14].

CONCLUSION

The conclusions drawn from the study were as follows:-

1. The K-SIR arch showed significant changes in dental, skeletal and soft tissues parameters with retraction and intrusion of upper incisors.
2. There was extrusion of molars, change in FMA, change in lower anterior facial height and anchor loss was also seen.

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TABLE I: DENTAL, SKELETAL AND SOFT TISSUE MEASUREMENTS USED IN THE STUDY

A. SKELETAL MEASUREMENTS [Figure 1 (A)]

1.	**SNA (°)**	Angle formed between sella- nasion plane and the line joining nasion to point A
2.	**SNB (°)**	Angle formed between sella- nasion plane and the line joining nasion to point B
3.	**ANB (°)**	Angle formed between the line joining nasion to point A and the line joining nasion to point B.
4.	**GoGn-SN (°)**	Angle formed between the line joining gonion to gnathion and the sella-nasion plane.
5.	**SN-OP angle(°)**	Angle formed between sella-nasion plane to occlusal plane
6.	**FMA(°)**	Angle formed between frankfort horizontal plane and tangent to lower border of mandible
7.	**Y axis(°)**	Angle formed by line joining Sella-nasion plane and sella to gnathion.
8.	**Ar-Go-Me(°)**	Angle formed by line joining articulare to gonion and gonion to menton.
9.	**A-PTV (mm)**	Linear distance from point A to pterygoid vertical plane.
10.	**ANS to Me(mm)**	Linear distance from anterior nasal spine to menton.
B. DENTAL LINEAR MEASUREMENTS [Figure 1 (B)]		
1.	**U1-PTV(mm)**	Linear distance from the labial surface of upper incisor to pterygoid vertical plane
2.	**U6-PTV(mm)**	Linear distance from the mid point of the crown of upper molar to pterygoid vertical plane.
3.	**U1- PP(mm)**	Linear distance from the incisal edge of upper incisor to palatal plane

4.	**U6-PP(mm)**	Linear distance from mesial cusp of upper molar to palatal plane
5.	**U1-NA(mm)**	Linear distance between most anterior labial surface of upper central incisor to N-A line.
6.	**LI-NB(mm)**	Linear distance between most anterior labial surface of lower central incisor to N-B line.
7.	**OVERJET**	Linear distance between upper and lower incisors with reference to the upper occlusal plane
8.	**OVERBITE**	Vertical overlap of the upper and lower incisors.
C. DENTAL ANGULAR MEASUREMENTS [Figure 1(B)]		
1.	**U1-SN(°)**	Angle formed between the long axis of upper incisor to sella-nasion plane
2.	**U1- NA(°)**	Angle formed between the long axis of upper incisor to N-A line
3.	**U6-SN(°)**	Angle formed between the mid point of crown of upper molar to sella-nasion plane
4.	**U1-L1(°)**	Angle formed between the long axis of upper incisor to the long axis of lower incisor.
5.	**IMPA(°)**	Angle formed between the long axis of lower incisors to mandibular plane.
D. SOFT TISSUE MEASUREMENTS [Figure 1 (A)]		
1.	**Ls-E line(mm)**	Linear distance from the labrale superius to Esthetic line.
2.	**FACIAL ANGLE(°)**	Angle formed between FH plane and line joining soft tissue nasion to soft tissue pogonion.
3.	**NASOLABIAL ANGLE(°)**	Angle formed between the tangent to the

		base of nose & tangent to the upper lip.

TABLE II: COMPARISON OF PRETREATMENT AND POST TREATMENT MEAN VALUES OF THE PARAMETERS IN K-SIR ARCH

PARAMETERS	PRETREATMENT	POSTREATMENT	TEST OF SIGNIFICANCE	
	MEAN±SD	MEAN±SD	t value	p value
SKELETAL				
SNA (°)	79.3±1.77	79±1.76	1.96	0.08
SNB (°)	74.9±2.08	74.7±2.36	1.00	0.34
ANB (°)	4.7±0.67	4.4±0.84	1.96	0.08
GoGn-SN (°)	29.7±1.77	31.3±2.21	2.45	**0.04***
SN-OP angle(°)	16.7±1.49	19.4±1.35	10.37	**0.0001*****
FMA(°)	24.3±1.25	27.2±1.32	16.16	**0.0001*****
Y axis(°)	64.7±1.49	67.1±1.20	10.85	**0.0001*****
Ar-Go-Me(°)	128.3±1.57	129.5±1.51	2.03	**0.04***
A-PTV (mm)	55.7±2.45	55.5±2.37	1.50	0.17
ANS to Me(mm)	66.9±2.02	68.9±1.66	7.75	**0.0001*****
DENTAL LINEAR				
U1-PTV(mm)	56.9±1.79	55.8±1.93	2.18	**0.04***
U6-PTV(mm)	19.2±1.93	20.4±1.43	2.69	**0.03***
U1- PP(mm)	26.5±1.35	25.4±1.58	2.91	**0.02***
U6-PP(mm)	19.7±1.49	20.4±1.43	2.50	**0.03***
U1-NA(mm)	7.6±1.26	6.4±1.78	2.03	**0.04***
LI-NB(mm)	5.4±1.07	3.7±0.67	1.91	**0.01***
OVERJET	6.3±1.25	3.9±0.74	10.00	**0.0001*****
OVERBITE	6.5±1.18	3.5±0.74	11.13	**0.001*****
DENTAL ANGULAR				
U1-SN(°)	111.5±1.90	106.2±1.23	12.53	**0.001****
U1- NA(°)	38.1±2.42	28.2±1.55	20.54	**0.0001****
U6-SN(°)	66.3±1.70	68.7±1.42	10.85	**0.0001*****
U1-L1(°)	111.6±3.37	122.4±2.63	11.21	**0.0001*****
IMPA(°)	98.4±2.01	90.9±4.29	2.17	**0.04***
SOFT TISSUE				
Ls-E line(mm)	3.0±0.82	1.1±0.57	8.14	**0.0001*****

FACIAL ANGLE(°)	88.4±2.27	88.5±2.55	0.56	0.59
NASOLABIAL ANGLE(°)	96±5.66	100±3.68	3.05	**0.03***

p<0.05 * statistically significant; p<0.001** statistically highly significant ;p<0.0001*** statistically very highly significant

FIGURE 1(A): LATERAL CEPHALOGRAM SHOWING SKELETAL AND SOFT TISSUE PARAMETERS

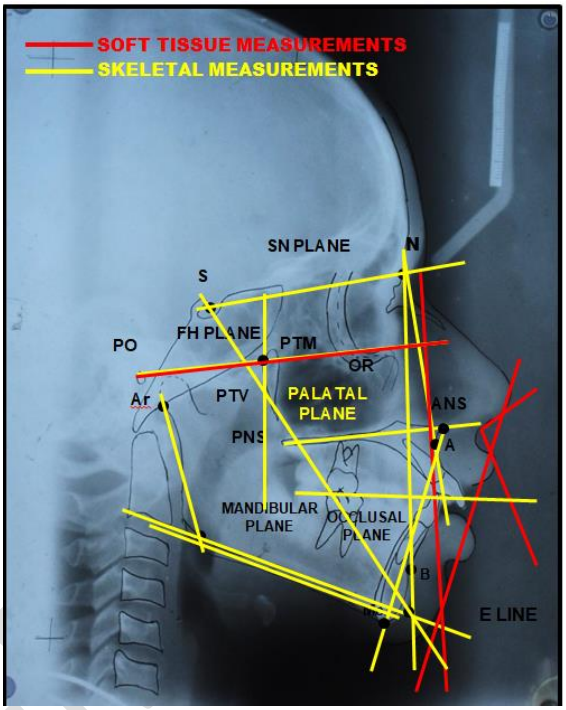


FIGURE 1(B): LATERAL CEPHALOGRAM SHOWING DENTAL ANGULAR AND DENTAL LINEAR PARAMETERS

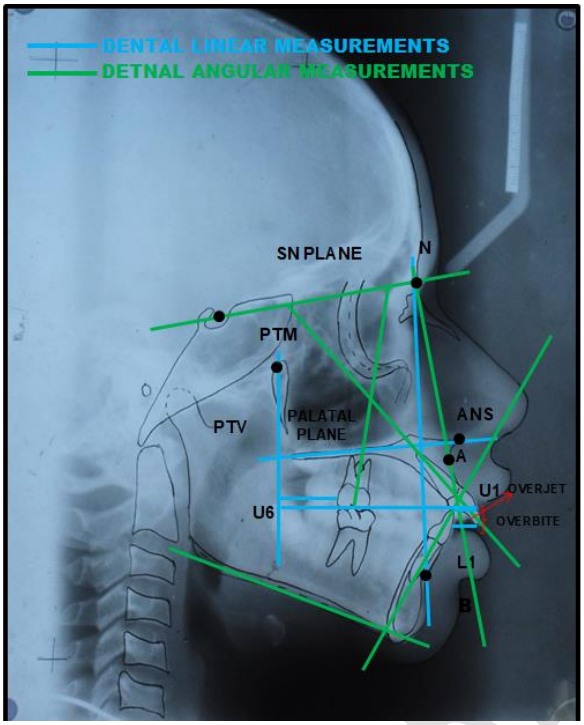


FIGURE 2 : PRE-TREATMENT EXTRA ORAL PHOTOGRAPHS OF PATIENT TREATED WITH K-SIR ARCH MECHANICS

(A): FRONTAL VIEW

(B): OBLIQUE VIEW

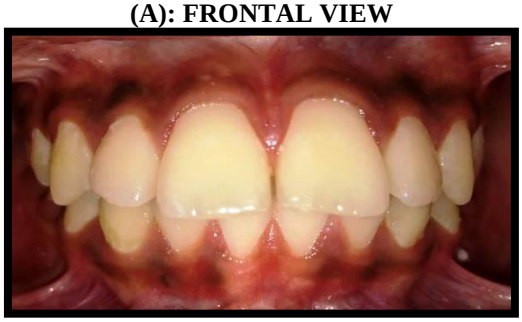
(C): LEFT LATERAL VIEW

(D): RIGHT LATERAL VIEW

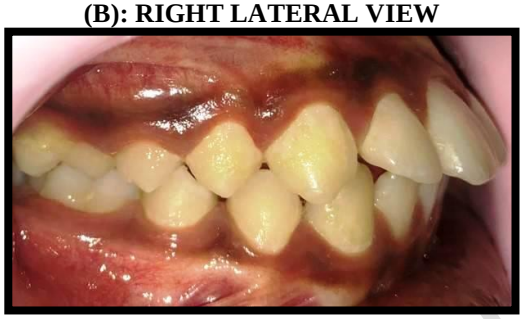
(E): SMILE VIEW

FIGURE 3 : PRE-TREATMENT INTRA ORAL PHOTOGRAPHS OF PATIENT TREATED WITH K-SIR ARCH MECHANICS

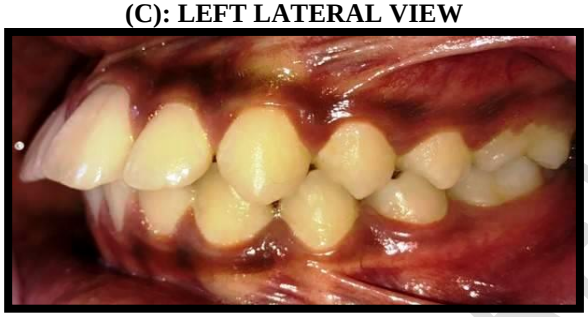
(A): FRONTAL VIEW



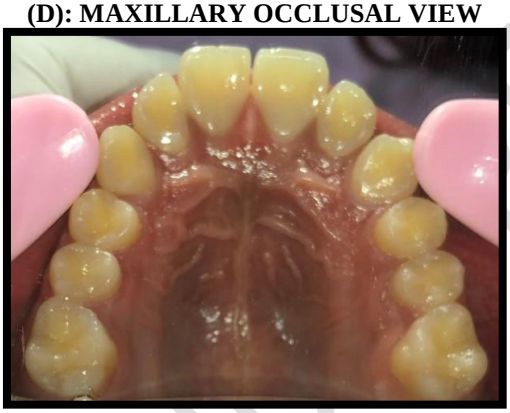
(B): RIGHT LATERAL VIEW



(C): LEFT LATERAL VIEW



(D): MAXILLARY OCCLUSAL VIEW



(E): MANDIBULAR OCCLUSAL VIEW

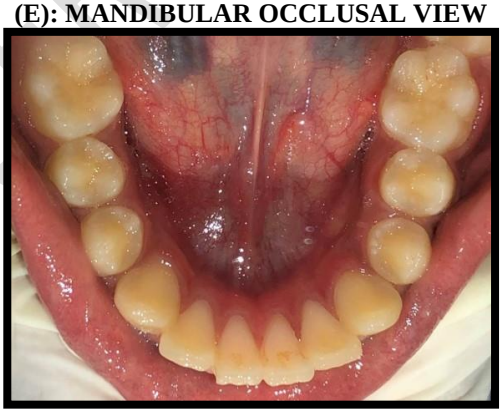


FIGURE 4: MID TREATMENT INTRA ORAL PHOTOGRAPHS OF PATIENT TREATED WITH K-SIR ARCH MECHANICS

(A): FRONTAL VIEW

(B): RIGHT LATERAL VIEW

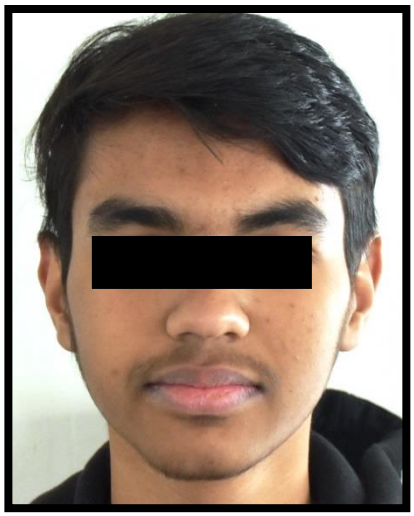
(C): LEFT LATERAL VIEW

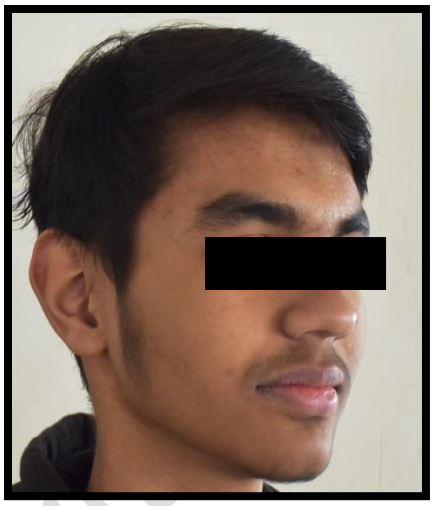
(D): MAXILLARY OCCLUSAL VIEW

(E): MANDIBULAR OCCLUSAL VIEW

FIGURE 5 : POST-TREATMENT EXTRA ORAL PHOTOGRAPHS OF PATIENT TREATED WITH K-SIR MECHANICS

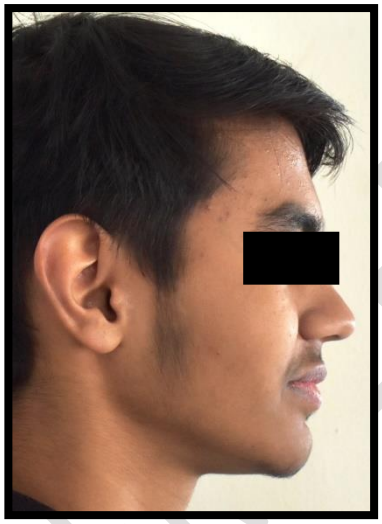
(A): FRONTAL VIEW **(B): OBLIQUE VIEW**

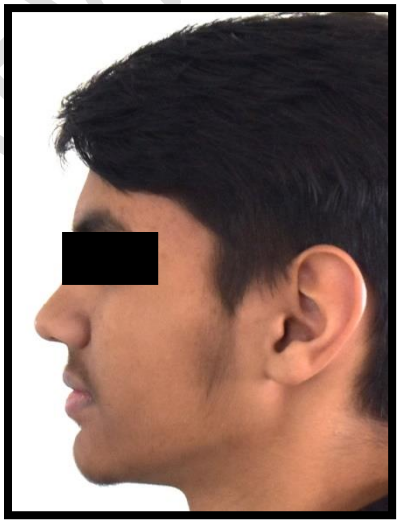




(C): RIGHT LATERAL VIEW

(D): LEFT LATERAL VIEW





(E): SMILE VIEW

FIGURE 6: POST-TREATMENT INTRA ORAL PHOTOGRAPHS OF PATIENT TREATED WITH K-SIR ARCH MECHANICS

(A): FRONTAL VIEW

(B): RIGHT LATERAL VIEW

(C): LEFT LATERAL VIEW

(D): MAXILLARY OCCLUSAL VIEW

(E): MANDIBULAR OCCLUSAL VIEW