



Occlusal Bite Force Analysis in Developing Skeletal Class II Malocclusion and Its Changes Following Treatment with Twin Block Appliance – A T-Scan Study. (Original Research)

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ABSTRACT:AIM: To analyse the occlusal bite forces in developing Class II skeletal malocclusion and its changes following treatment with Twin Block Appliance by using an Occlusal Analysis System – T-Scan (T-Scan III, Tekscan). **METHODOLOGY:** Total of 15 patients of aged between 10-15 years were selected for this study based on the inclusion and exclusion criteria. Subjects were explained about the procedure in detail and an informed consent was obtained from the patients, parents/guardians prior to obtaining the T-Scans pre and post twin block therapy. **RESULT:** The results of this study showed that there was statistically significant difference in the occlusal bite force distribution between the Pre and Post Twin Block appliance therapy and there was a significant equilibrium in the occlusal bite force which can be attributable to the treatment provided to the patients. **CONCLUSION:** It can be concluded that Functional Jaw Orthopedics with Twin Block can bring about favourable skeletal changes which enhances patient's profile by improving the occlusal force distribution. T-Scan analysis was used as an adjunct to Twin Block appliance as it reduced the treatment time and improved the occlusal force distribution post Twin Block therapy.

KEYWORDS:-Occlusal bite force, Twin block appliance, T-Scan analysis.

different removable (Activator, Monoblock, Bionator, Twin Block etc.) or fixed (Herbst, Jasper Jumper, Forsus, Twin Force etc.) functional appliances have been utilised to encourage or redirect mandibular growth to correct skeletal discrepancies.² In Skeletal Class II correction, the Twin Block appliance is one of the most commonly used functional appliances today. It was designed by Dr. William J. Clark in 1977 for full time wear. This appliance achieves rapid functional correction of malocclusion by directing favourable occlusal forces to occlusal inclined planes that cover the posterior teeth.³ The T-Scan III Computerized Occlusal Analysis System (Tekscan Inc., South Boston, MA USA) is a dental device used to analyze relative occlusal force that is recorded intra-orally by a pressure-mapping sensor.⁴ It quantifies and displays relative occlusal force information, so the clinician can minimize repeated errors of incorrect occlusal contact selection that often occur from relying solely on the combination of dental articulating paper and patient feel.²¹ The T-Scan III determines the contact time-sequencing, and the percentage of relative occlusal force between numerous occlusal contacts, and then displays them all for dynamic analysis. This enables the clinician to better identify many interfering contacts that are not readily identified by articulation paper markings.

I. INTRODUCTION:

Class II malocclusion can be caused by a vertical dysplasia of the maxilla, mandible or both and can be impacted by a spatial and sagittal abnormalities of the maxilla, mandible, or both.¹ In the treatment of patients with Skeletal Class II malocclusion with mandibular retrognathia

II. METHODOLOGY:

Ten patients aged between 10-15 years with developing Skeletal Class II malocclusion were taken as the Study group and, five patients aged between 10-15 years with skeletal and dental Class I malocclusion as Control group were selected from the Department. Subjects were



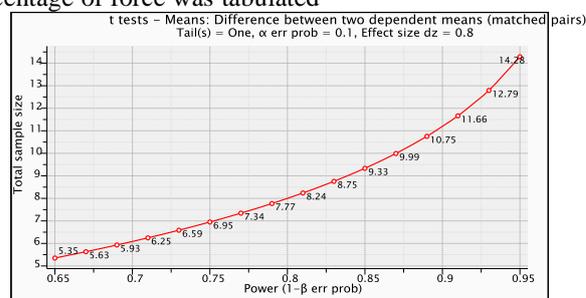
explained about the procedure in detail and an informed consent was obtained from the patients, parents/guardians prior to obtaining the images pre and post twin block therapy. Lateral cephalograms of all 15 subjects were recorded. Angle SNA, SNB and ANB along with Wits analysis was done to assess the antero-posterior relation of the jaw bases. All the subjects had undergone a T-Scan (T-Scan III, Software version 10.0.1, Tekscan, Inc., Boston, MA, USA) occlusal analysis before the commencement of the treatment and after the completion of treatment with Twin Block appliance. An intra-oral examination followed by a multi bite closure T-Scan recording that gathers the occlusal parameters for analysis was done. Prior to recording, each subject had his/her dental arch dimensions and tooth distribution entered into T-scan's tooth chart. All multi bite T-Scan recordings were made with the subject sitting upright in dental chair. Subjects were instructed to occlude into the recording sensor three times in succession using their maximum bite force. Then the single closure that contained the maximum recorded occlusal force were selected for analysis. A T-ScanIII device was used to analyze occlusal bite forces. Data analysis was accomplished by playing and observing the occlusal force changes, timing sequence, and force percentages recorded from each subject. The percentage of force was tabulated

in an Excel sheet which was be correlated with the readings obtained from the analysis. Subjects were instructed to occlude onto the recording sensor three times in succession using their maximum bite force at maximum intercuspation. A single closure that contained the maximum recorded occlusal force was selected for analysis. All measurements were carried out by the same investigator and OBF was recorded at the following time intervals:

- i. Just prior to insertion of Twin Block appliance (T1)
- ii. After removal of Twin Block appliance (T2)

Methods Of Statistical Analysis:

Statistical Package for Social Sciences [SPSS] for Windows, Version 22.0 Released 2013 Armonk, NY: IBM Corp., was used to perform statistical analyses. Descriptive analysis included expression of bite force in terms of mean and standard deviation (SD). Student Paired t Test was used to compare the mean bite force between pre and post treatment periods in Class II Subjects. Independent Student t Test was used to compare the mean bite force between Class I occlusion and Class II malocclusion subjects during post treatment periods. The level of significance was set at $P < 0.05$.



Graph 1: Difference between two dependent means using T test

The sample size was estimated using the **GPower software v. 3.1.9.4** [(Franz Faul, Universität Kiel, Germany). Considering the effect size that was measured (dz) at 80% at One-Tailed Hypothesis, power of the study at 85% and the margin of the error at 10%, **the total sample size needed was 10.**

The overall sample size was inflated to 15 with adding 5 samples of Control to compare the Pre-op measurements of study parameters with the Study group. Final Sample Size comprises of 10 samples in Study Group & 5 samples in Control Group.

III. RESULTS:

Total size taken was 15 patients, 10 subjects were in the study group and 5 subjects were in the control group, out of which the mean age group were 12.14 ± 1.07 in the study group and 11.40 ± 0.89 in the control group. In each patient, T-Scan analysis was done before insertion of Twin Block appliance and Post removal of Twin Block appliance.



Table 1: MEAN AGE DISTRIBUTION OF THE SUBJECTS

CATEGORY	N	MEAN	STANDARD DEVIATION
STUDY	10	12.14	1.017
CONTROL	5	11.40	0.89

Table 1 shows the Mean age of the subjects for Study group was 12.14 ± 1.017 and for Control group was 11.40 ± 0.89 .

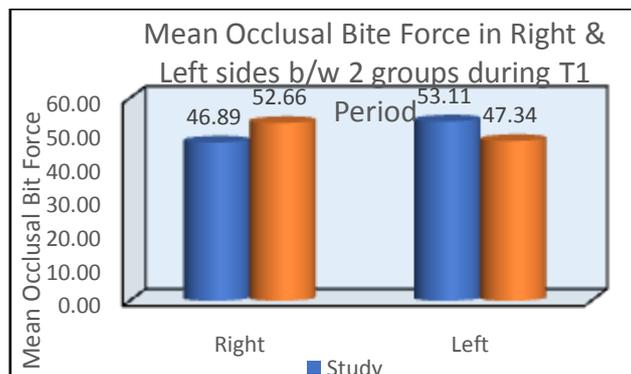
Table 2: GENDER-WISE DISTRIBUTION OF THE SUBJECTS

CATEGORY	N	STUDY		CONTROL	
		N	%	N	%
MALES	10	7	57.1%	3	60.0%
FEMALES	5	3	42.9%	2	40.0%

Table 2 shows the gender distribution of the subjects, out of which the Study group consists of 57.1% are males and 42.9% are females and in the Control group consisting of 60.0% males and 40.0% females.

Table 3: COMPARISON OF MEAN OCCLUSAL BITE FORCE IN RIGHT AND LEFT SIDES B/W 2 GROUPS DURING T1 PERIOD USING INDEPENDENT STUDENT T TEST

SIDE	GROUPS	N	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	P-VALUE
RIGHT	STUDY	10	46.89	8.01	-5.77	0.21
	CONTROL	5	52.66	6.37		
LEFT	STUDY	10	53.11	8.01	5.77	0.21
	CONTROL	5	47.34	6.37		



Graph 2: Mean occlusal bite force in Right and Left sides between 2 groups during T1 period

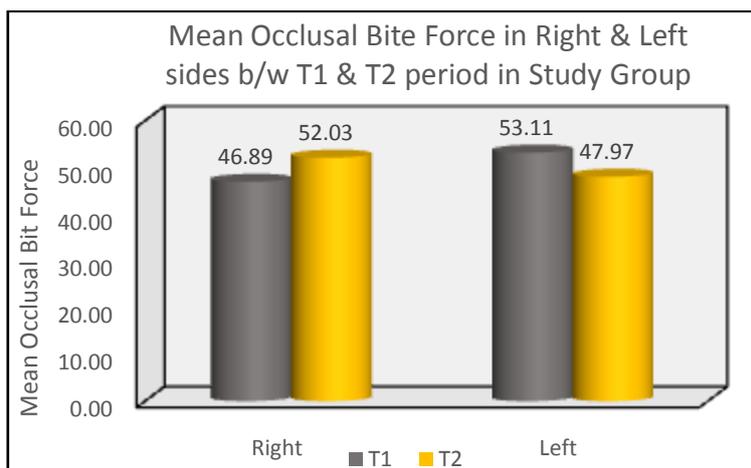
For the **Study** group: The mean occlusal bite force on the right side was 46.89 and on the left side was 53.11. For the **Control** group: The mean occlusal bite force on the right side was 52.66 and on the left side was 47.34. The mean Occlusal bite force on right side during T1 period in study group was 46.89 ± 8.01 and in Control group was 52.66 ± 6.37 and the mean difference was -5.77. However, this mean difference on the right side between 2 groups

was not statistically significant [P=0.21]. Similarly, the mean Occlusal bite force on left side during T1 period in study group was 53.11 ± 8.01 and in Control group was 47.34 ± 6.37 and the mean difference was 5.77. However, this mean difference on the left side between 2 groups was not statistically significant [P=0.21].



Table 4: COMPARISON OF MEAN OCCLUSAL BITE FORCE IN RIGHT AND LEFT SIDES B/W T1 AND T2 PERIOD IN STUDY GROUP USING STUDENT PAIRED T TEST

SIDE	TIME	N	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	P-VALUE
RIGHT	T1	10	46.89	8.01	-5.14	0.04
	T2	5	52.03	3.48		
LEFT	T1	10	53.11	8.01	5.14	0.04
	T2	5	47.97	3.48		



Graph 3: Mean occlusal bite force in Right and Left sides between T1 and T2 period in Study Group

According to Table 4, there was a significant improvement in occlusal bite force between the right and left sides between T1 and T2 period. The mean occlusal bite force on the **right side** during T1 was 46.89 and during T2 was 52.03. The mean occlusal bite force on the **left side** during T1 was 53.11 and during T2 was 47.97. The mean Occlusal bite force in study group on right side during T2 period was significantly increased 52.03 ± 3.48 as compared to T1 period 46.89 ± 8.01 and the mean difference was statistically significant at $P=0.04$. Contrastingly, the mean Occlusal bite force in study group on left side during T2 period was significantly decreased 47.97 ± 6.37 as compared to T1 period 53.11 ± 8.01 and the mean difference was statistically significant at $P=0.04$. This infers that the T2 period established a significant equilibrium in the occlusal bite force as compared to T1 period which can be attributable to the treatment provided to the patients.

IV. DISCUSSION:

The goal of orthodontic therapy is to improve the patient's quality of life by aligning their teeth enhancing dentofacial aesthetics and good jaw function. Patients with Class II malocclusion frequently have a deficiency in mandibular size, thus an effective method of improving the mandible's forward growth and development is desirable. The goal in developing

the Twin Block approach to treatment was to produce a technique that could maximize the growth response to functional mandibular protrusion by using an appliance system that is simple, comfortable and aesthetically acceptable to the patient.⁵ The main objective of the therapy with Twin-block is to induce supplementary lengthening of the mandible by stimulating increased growth at the condylar cartilage and have maximum therapeutic effects if the mandibular growth spurt is included.³ The T-Scan III analyses contact time-sequencing and percentages of relative occlusal force between multiple occlusal contacts, then displays them all for dynamic study.¹⁵ In this study, we had assessed the occlusal force distribution pattern and the changes in the force distribution pattern in developing Class II malocclusion with Twin Block Appliance by using an Occlusal Analysis System – T-Scan analysis. We had also compared the Pre and Post T-Scan data before Twin Block insertion and Post Twin Block therapy. Based on the findings of the study and the literature reviewed, it was concluded that the state of functional occlusion should be reviewed during the finishing stages of orthodontic treatment to correct any occlusal interferences, as 3-dimensional control of tooth position while the appliance is still in place, it is relatively easy to operate without prolonging treatment time. This study also confirmed that there was a positive correlation



between occlusal bite forces and changes seen post removal of Twin Block appliance. Also, the occlusion's post-debonding settling must be evaluated, and precise occlusal modifications must be made to achieve a stable and healthy functioning occlusion.

V. CONCLUSION:

The T-Scan system offered Orthodontists immediate access to patient's functional occlusion. We could see the static and dynamic quality of inter-arch contacts in real time in a form that was preserved in a record for comparison at any future date. Thus, by gaining information on the earliest occlusal contact, it was adjusted, and simultaneous occlusal contact was established. The consequence of this occlusal therapy was that the patient could feel a more widespread contact sensation at the end, the reason being that the establishment of true and measurable bilateral simultaneous occlusal contact was achievable by using the T-Scan. Besides good esthetics, form and function, achieving a balanced occlusion was an important goal after orthodontic treatment. This study concludes that there was statistically significant difference found in overall bite force readings between the pre insertion of Twin Block Appliance and the post removal of the appliance. In spite of overall bite force varying significantly, bite force imbalance was present on left and right sides in both the groups which indicated a need to balance the same to achieve the aim of good and stable functional occlusion. The bite force imbalance improved significantly post removal of Twin Block Appliance and suggested that the differences in the occlusal bite force distribution between pre and post Twin Block therapy led to a significantly change in the patient's occlusion which showed that the Twin Block appliance helped and improved the patient's occlusion, and the T-scan analysis was a good diagnostic tool because it helped to assess the occlusal force distribution.

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