Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/19190
DOI URL: http://dx.doi.org/10.21474/IJAR01/19190

RESEARCH ARTICLE

INFLUENCE OF DAMON AND CONVENTIONALBRACKETS ON SOFT TISSUES AND SMILE ESTHETICS ENSUING NON-EXTRACTION TREATMENT

Shubhi Gangwar[1], Preeti Bhattacharya[2], Shivani Singh[3], Anil K. Chandna[4], Ankur Gupta[5], Ravi Bhandari[6] and Resham Irshad[7]

1. MDS, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.
2. MDS, Head of the Department and Professor, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.
3. MDS, Reader, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.
4. MDS, Director PG Studies and Professor, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.
5. MDS, Professor, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.
6. MDS, Professor, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.
7. MDS, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly, India.

Manuscript Info

Manuscript History
Received: 31 May 2024
Final Accepted: 30 June 2024
Published: July 2024

Key words:-
Conventional Bracket, Damon Bracket, Non-Extraction Treatment, Smile Esthetics, Soft Tissue

Abstract

Objectives: Facial and smile esthetics are the principal reasons nowadays for which patients pursue orthodontic treatment and so, the knowledge of the effects of orthodontic treatment on facial esthetics is of paramount importance to orthodontists. Orthodontic literature contains more studies comparing the effects of Damon and Conventional MBT brackets on skeletal and dental structures than on soft tissues and smile esthetics. This study aims to evaluate and compare soft tissues and smile esthetic changes in non-extraction cases treated using Damon and Conventional MBT brackets.

Methods: Thirty participants were divided into 2 groups, Group I comprised of 15 subjects treated using Damon brackets and Group II comprised of 15 subjects treated using Conventional MBT brackets. Smile esthetic parameters were evaluated on frontal smiling photographs in form of ratios while linear and angular measurements were made on lateral cephalograms.

Results: For soft tissue parameters, in Damon group, labrale inferior to E-line and Na-Pog line increased significantly, sulcus inferior to E-Line decreased significantly and nasolabial angle increased significantly. In conventional group, labrale superior to Na-Pog line increased significantly and upper lip length increased significantly. When mean treatment changes in both groups were compared, no significant difference in any linear or angular soft tissue parameters was found

Corresponding Author:-Shubhi Gangwar
Address:-Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, U.P., Bareilly - 243001, India.

except for significant increase in E-Line to labrale inferior in Damon group. For smile esthetic scores, visible dentition width to smile width ratio increased significantly in damon group while smile height to smile width ratio decreased significantly in conventional group. When mean treatment changes in both groups were compared, no significant difference was found.

Conclusions: Both soft tissue and smile esthetics finished in a similar manner after treatment and so, the overall choice of non-extraction treatment modality should not be dependent on the type of bracket system.

……

Introduction:-

Smile esthetics is the foremost reason that patients pursue orthodontic treatment as they evaluate their treatment outcomes not only by proper arrangement of teeth but also by their smile esthetics.[1] In 1955, Wylie proclaimed that the objective of orthodontic treatment should be to bring about the best possible esthetic outcome, both dentally and facially.[2] Orthodontists understand that majority of people seeking orthodontic treatment wish to enhance facial harmony and the use of either of the two orthodontic treatment procedures (extraction or non-extraction) to attain this facial harmony has long been contentious.[3]

In the early 20th century, Edward Angle argued that when teeth are in a balanced occlusion, the soft tissue will adjust according to the occlusion. He also claimed that his appliance aided bone formation, negating the necessity for an extraction.[4] Some researchers have condemned premolar extraction, claiming that this procedure makes the dental arches smaller leading to sunken lip support, narrowing and restricting the smile making the patient look decrepit.[5] Poor smile esthetics has also become a topic of debate when it comes to premolar extraction treatment in the highly aired extraction-non extraction argument asnarrow dental aches results in unesthetic dark intraoral spaces, lateral to buccal segments.[5,6]

Ongoing trends lean towards fuller and more prominent lips for youthful appearancechallenging the premolar extraction treatment modality.[7]Treatment strategy ofa dental arch with mild to moderate crowding by non-extraction treatment protocol demands an increment in the arch perimeter for aligning and leveling of the teeth.This increment in arch perimeter without moving the arches distally results in both transverse expansion as well as proclination of anterior teeth leading to fullness in lips, wider smile and younger appearance.[8]

With the emergence of varied appliances and techniques, non-extraction therapy is taking precedence over the extraction therapy. As an alternative approach to traditional orthodontic brackets, passive self-ligating brackets have gotten a lot of interest lately. Damon and SmartClip are two well-known passive self-ligating system brands. Dwight Damon first proposed the Damon System in 1994, with the notion of using a threshold force sufficient to begin tooth movement. The threshold force must be sufficiently low to prevent blood vessels in the periodontium from becoming obstructed in order to allow the cells and the biochemical messengers to be transferred to the site where bone resorption and deposition will occur, permitting tooth movement.[9]

Broad archwires, self-ligating brackets as well as a twin configuration and a passive slide on the bracket's outer face are included in this system.It was claimed that this system could relieve a significant amount of crowding without extractions.[9] It uses copper-nickel-titanium (Cu-NiTi)archwires for light forces along with the passive ligation to attain arch development and for aligning the teeth in the arches.[10]It is also suggested that with low threshold forces, the lip musculature does not get overpowered, thereby producing a lip bumper effect, restricting the anterior movement of teeth and tongue causing posterior expansion since teeth aligns by taking the path of least resistance.In non-extraction cases, this suggestion means that tooth alignment results in less incisor and labial protrusion than the conventional non-extraction treatment cases.

Many studies have been conducted to collate the skeletal and dental changes in cases treated with either Damon self-ligating system or conventional ligating system. However, orthodontic research has traditionally focused on skeletal structures rather than soft tissue structures, on patient profiles rather than frontal views, and on structure in stable functional positions (the centric relationship, the resting posture, and the smallest vertical dimension) instead of

dynamic functional movements (smiling, munching and conversing). Also, surprisingly, only few investigations have been conducted on the smile esthetics post orthodontic treatment. Orthodontic literature does not provide a clear comparison between the two systems in termsof smile esthetics and soft tissue changes after the treatment.

Therefore, the purpose of this study is to evaluate and compare the soft tissue and smile esthetics changes in the non-extraction cases treated with Damon selfligating bracket system and the conventional MBT bracket system.

Materials and Method:-

In this retrospective study, 30 subjectswere included who had undergone fixed orthodontic treatment with non-extraction treatment protocol either by using Damon or Conventional MBT brackets system in the Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly. The inclusion criterias were: subjects having permanent dentition, Class I malocclusion with mild to moderate crowding, acceptable treatment outcome at the end of the treatment and availability of pre- and post-orthodontic treatment records.

The sample comprised of two groups; Group Iincluded 15 subjects (mean age= 15.10 year) treated with Damon Clear brackets (022 slot passive self-ligating appliance system, San Diego, Calif) (Fig. 1) while Group II included 15 subjects (mean age= 14.3 years) treated with the Conventional MBT metal brackets (022 slot 3M Unitek Gemini, Monrovia, USA) (Fig. 2). All these patients had been treated by non-extraction treatment protocol with the aim to provide an ideal occlusion according to Andrew's six keys and Roth's guidelines. No other appliances for expansion had been used. In group I, 0.018 X 0.025-inch CuNiTiarchwires followed by 0.019 X 0.025-inch stainless steel in Damon arch formwithout any customizationhad been used as final archwires in both the arches as opposed to group II, wherein0.019 X 0.025-inch stainless steel broad arch form were used.

Fig. 1:- 0.22" Damon Clear Brackets

Fig. 2:- 0.22" MBT Brackets.

Pre-treatment and post-treatment lateral cephalograms that were taken using the Allengers Smart PAN 2K150330009-D9 were used (Fig. 3). Each cephalogram was hand traced and linear and angular measurements were taken with a 0.5mm and 0.5° precision, respectively. The landmarks, planes and angles that were drawn and used in the study are described in Table 1.

Pre-treatment and post-treatment standardized frontal smilingphotographsin natural head position that were taken in the department were used (Fig. 4). All the photographs were transferred in Adobe Photoshop CC 2019 and measurements were made. Marquee tool was used to obtain data from each photograph with the landmarks defined by Phillips et al.[11] The smile esthetic measurements 1 to 5 were done as described in Table 1. Several ratios were defined using measurements 1 to 5:

Ratio 1: Maxillary intercanine width
Smile width

Ratio 2: Smile height
Smile width

Ratio 3: Visible dentition width
Smile width

Ratio 4: Maxillary intercanine width
Visible dentition width

Ratio 5: Visible incisor height
Smile height

Consistent magnification of photos is essential to allow direct comparison of photographs obtained at various times. To achieve this, photographs were taken in highly standardized manner, together with ambient lighting, background and consistent patient to lens distance each time. However, despite all these measures, there are still chances of magnification error due to manual operation of the procedure.

Therefore, the data collected and comparisons conducted between the pre-treatment and post-treatment images for measurements 1 to 5 are limited to the above-mentioned ratios so that discrepancies in magnification, if any, are not a factor.

The data were entered on a Microsoft Excel spreadsheet and imported intoStatistical Package for Social Sciences (SPSS) version 22 for statistical analysis. The result was presented in the form of mean and standard deviation. For intragroup comparison, paired t-test was used to evaluate the statistical significance of the mean differences between the pre-treatment and post-treatment measurements. For intergroup comparison, unpaired t-test was used to find significant difference in between the groups. A P-value of less than 0.05 was considered statistically significant.

Fig. 3:-Allengers Smart PAN 2K150330009-D9

Fig. 4:- Extra-oral Photograph

CEPHALOMETRIC LANDMARKS (Fig. 5)	
1. Na (Nasion)	Most anterior point of frontonasal suture in median plane.
2. Na' (Soft tissue nasion)	The point of greatest concavity in the midline between the forehead and the nose.
3. Nt (Nose tip)	Most anterior point on sagittal contour of nose.
4. Sn (Subnasale)	Point at junction of columella and upper lip.
5. Ss (Sulcus superior)	Point of greatest concavity between labrale superior and subnasale.
6. Ls (Labrale superior)	Most anterior point on convexity of upper lip.
7. Stomium	The lowermost point on the vermilion of the upper lip.
8. Li (Labrale inferior)	Most anterior point on convexity of lower lip.
9. Si (Sulcus inferior)	Point of greatest concavity between labrale inferior and soft-tissue pogonion.
10. Pog (Pogonion)	Most anterior point on the chin.
11. Pog' (Soft-tissue pogonion)	Most anterior point on soft-tissue chin.
CEPHALOMETRIC LINES &PLANES (Fig. 6)	
1. E-Line (E)	Esthetic line proposed by Ricketts, extending between Nt and Pog'.

2. Subnasale - soft tissue pogonion plane (Sn-Pog')	Line proposed by Burstone to measure labial protrusion, extending between Sn and Pog'.
3. Nasion - Pogonion line (Na-Pog)	Extending between Na and Pog
LINEAR PARAMETERS(Fig. 7)	
1. E – Ss	E-Line - Sulcus superior
2. E – Si	E-Line - Sulcus inferior
3. E – Ls	E-Line - Labrale superior
4. E – Li	E-Line - Labrale inferior
5. Sn-Pog' – Ls	Subnasale-pog' plane -Labrale superior
6. Sn-Pog' – Li	Subnasale-pog' plane - Labrale inferior
7. Na-Pog - Ls	Nasion-Pogonion - Labrale superior
8. Na-Pog - Li	Nasion-Pogonion - Labrale inferior
9. Sn – St	Subnasale - Stomium
ANGULAR PARAMETERS (Fig. 8)	
1. Nasolabial angle (°)	Formed by intersection of line originating in Sn, tangent to lower margin of nose, and line traced between Sn and Ls.
2. H-angle (°)	Formed by intersection of Na'-pog' line and harmony (H) line.
3. Mentolabial angle (°)	Formed by intersection of line traced between Li and Si, and line traced between Si and Pog'.
SMILE ESTHETIC MEASUREMENTS (Fig. 9a-e)	
1. Smile width	The distance between the most medial points on the lips at the angles of the mouth.
2. Smile height	Distance from the most inferior point on the upper lip between the maxillary centralincisors to the most superior point on the lower lip on a perpendicular vertical line from the upper point.
3. Visible dentition width	Distance between the most lateral left andright buccal points of the maxillary dentition.
4. Maxillary intercanine width	Distance between the most distal visible points on the canines.
5. Visible incisor height	Visible height of maxillary central incisor.

Table 1:-Cephalometric landmarks, lines, planes, angles and smile esthetic measurements.

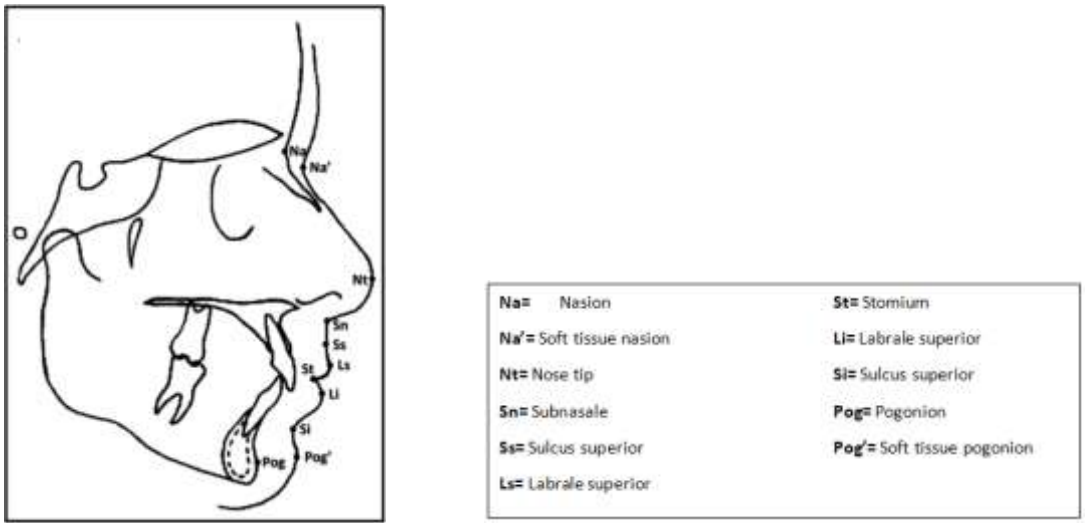

Fig. 6:-Cephalometric landmarks

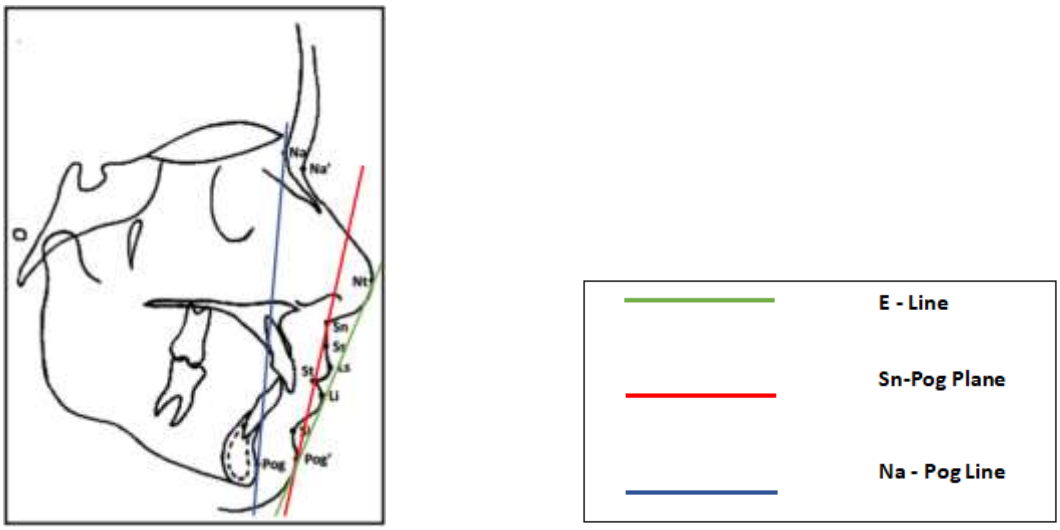

Fig. 7:-Cephalometric lines and planes.

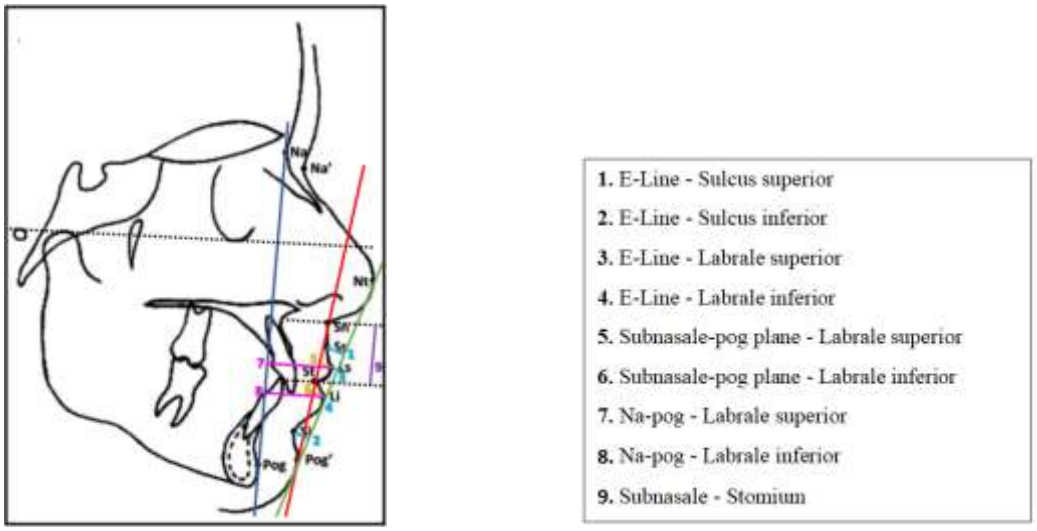

Fig. 8:-Linear Parameters.

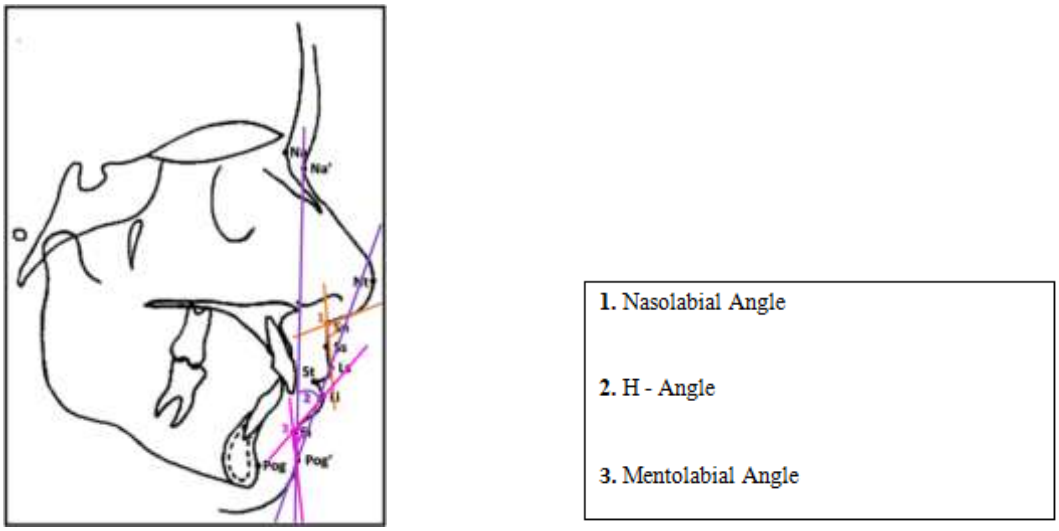

Fig. 8:-Angular Parameters.

Fig 9a:-Smile width**.**

Fig. 9b:-Smile height.

Fig. 9c:-Maxillary intercanine width.

Fig. 9d:-Visible dentition width.

Fig. 9e:- Visible incisor height.

Results:-

Out of 30 patients selected retrospectively15 subjects of Group I had the age range of 11-19 years with a mean ± SD of 15.10 ± 2.38 while the orther 15 subjects of Group II had the age range of 13-20 years with a mean ± SD of 14.30 ± 2.50. Maxillary arch crowding in Group Iwas 4.50 ± 2.08 mm and in Group II was 3.45 ± 2.27 mm while mandibular archcrowding in Group I was 4.25 ± 2.54 mm and in Group II was 3.50 ± 2.42 mm (Table 2).

Table 2:-Basic Characteristics (mean ± SD) of both the groups.

CHARACTERISTICS		**GROUP 1**	**GROUP2**	**t-Value**	**P-Value**
Age in Years (Mean ± SD)		15.10 ± 2.38	14.30 ± 2.50	0.734	0.473#
Crowding	**Maxillary arch(mm)**	4.50 ± 2.08	3.45 ± 2.27	1.079	0.295#
	Mandibular arch(mm)	4.25 ± 2.54	3.50 ± 2.42	0.676	0.507#

#Statistically not significant,*Statistically significant.

For the soft tissue analysis, the measurement of the lips relative to Ricketts' E-line, Burstone's subnasale–soft tissue pogonion (Sn-Pog') line and Nasionpogonion (Na-Pog) line were done. In the Damon group(Table 3), the lower lip was found to be protruded significantly after treatment in relation to the E-line (P= 0.012) and Na-Pog line(P= 0.007). Statistically significant increase in the nasolabial angle (P= 0.040) was also found in the Damon group.Inthe conventional group (Table 4), there was statistically significant increase in the procumbency of upper lip in relation to Na-Pog line (P= 0.035). Statistically significant increase in the upper lip length (P= 0.042) was also found in the conventional group. When the mean treatment changes in both the groups were compared (Table 5), no statistically

significant difference in the linear as well as angular soft tissue parameters between Damon and conventional group was found (P>0.05) except for the significantly increased lower lipprocumbency in the Damon group (P= 0.019).

In the present study, three buccal corridor ratios were calculated i.e. ratio 1, ratio 3 and ratio 4. Ratio 1 increased from pre-treatment to post-treatment in both the groups but the treatment change was statistically insignificant (P>0.05). Ratio 3 also increasedin both the groups but the increase was statistically significant in the Damon group only (P= 0.012). Ratio 4 decreased in both the groupbut the change was statistically insignificant (P>0.05). Ratio 2 was found to be increased in both the groups but the increment was statistically significant in the conventional group only (P= 0.021)(Table 6 & 7). When the mean treatment change of the smile esthetic scores was compared between the two groups, there was no statistically significant difference (P>0.05) (Table 8).

Table 3:-Intra-group comparison of pre-treatment and post-treatment scores of different soft tissue parameters in Group I (Damon Group).

Variables	Pre-Treatment			Post-Treatment			Treatment Change	P - Value
	Mean	S.D.	S.E.	Mean	S.D.	S.E.		
E-Line Sulcus superior	-8.65	2.9	0.92	-7.3	1.09	0.34	-1.35	0.158#
E-Line - Sulcus inferior	-5	1.78	0.56	-4.25	1.64	0.52	-0.75	0.005*
E-Line - Labrale superior	-3.05	2.5	0.79	-2.25	1.62	0.51	-0.8	0.137#
E-Line - Labrale inferior	-0.7	2.76	0.87	0.45	2.4	0.76	-1.15	0.012*
Subnasale-pog' plane - Labrale superior	3.75	2.07	0.66	3.7	1.23	0.39	0.05	0.919#
Subnasale-pog' plane - Labrale inferior	3.35	2.33	0.74	4.05	2.09	0.66	-0.7	0.066#
Na-pog - Labrale superior	17.45	3.63	1.15	18.6	1.85	0.59	-1.15	0.172#
Na-pog - Labrale inferior	15.35	2.98	0.94	17.25	2.15	0.68	-1.9	0.007*
Subnasale - Stomium	18	2.33	0.74	18.6	2.4	0.76	-0.6	0.126#
Nasolabial angle	102.1	11.58	3.66	107.9	6.76	2.14	-5.8	0.040*
Mentolabial angle	132.2	14.45	4.57	134.6	7.75	2.45	-2.4	0.534#
H-angle	15.2	4.23	1.34	16.55	1.74	0.55	-1.35	0.229#

#Statistically not significant,*Statistically significant.

Table 4:-Intra-group comparison of pre-treatment and post-treatment scores of different soft tissue parameters in Group II (Conventional Group).

Variables	Pre-Treatment			Post-Treatment			Treatment Change	P - Value
	Mean	S.D.	S.E.	Mean	S.D.	S.E.		
E-Line Sulcus superior	-7.75	3.22	1.02	-8	2.88	0.91	0.25	0.485#
E-Line - Sulcus inferior	-5.3	2.37	0.75	-5.15	2.42	0.76	-0.15	0.703#
E-Line - Labrale superior	-3	3.86	1.22	-2.85	3.4	1.08	-0.15	0.616#
E-Line - Labrale inferior	-0.15	3.22	1.02	-0.55	3.39	1.07	0.4	0.423#
Subnasale-pog' plane - Labrale superior	4.1	2.55	0.81	4.05	2.43	0.77	0.05	0.859#

Subnasale-pog' plane - Labrale inferior	3.8	2.2	0.7	3.6	2.72	0.86	0.2	0.682#
Na-pog - Labrale superior	18.55	4.52	1.43	19.6	5.02	1.59	-1.05	0.035*
Na-pog - Labrale inferior	16.2	3.51	1.11	17.3	4.49	1.42	-1.1	0.172#
Subnasale - Stomium	17.8	2.67	0.84	18.65	2.33	0.74	-0.85	0.042*
Nasolabial angle	96.7	8.44	2.67	99.85	12.08	3.82	-3.15	0.386#
Mentolabial angle	126.2	16.28	5.15	130.6	14.61	4.62	-4.4	0.255#
H-angle	15.8	5.81	1.84	17.1	6.06	1.92	-1.3	0.148#

#Statistically not significant,*Statistically significant.

Table 5:-Inter-group comparison of treatment changes in soft tissue parameters.

Variables	**Group I (Damon)**			**Group II (Conventional)**			**Mean Difference**	**P - Value**
	Mean	**S.D.**	**S.E.**	**Mean**	**S.D.**	**S.E.**		
E-Line Sulcus superior	-1.35	2.76938	0.87575	0.25	1.08653	0.34359	-1.6	0.115#
E-Line - Sulcus inferior	-0.75	0.63465	0.20069	-0.15	1.20301	0.38042	-0.6	0.185#
E-Line - Labrale superior	-0.8	1.54919	0.4899	-0.15	0.91439	0.28916	-0.65	0.272#
E-Line - Labrale inferior	-1.15	1.1559	0.36553	0.4	1.50555	0.4761	-1.55	0.019*
Subnasale-pog' plane - Labrale superior	0.05	1.51749	0.47987	0.05	0.86442	0.27335	0	1#
Subnasale-pog' plane - Labrale inferior	-0.7	1.05935	0.335	0.2	1.49443	0.47258	-0.9	0.14#
Na-pog - Labrale superior	-1.15	2.45006	0.77478	-1.05	1.34268	0.42459	-0.1	0.911#
Na-pog - Labrale inferior	-1.9	1.72884	0.54671	-1.1	2.34284	0.74087	-0.8	0.397#
Subnasale - Stomium	-0.6	1.12546	0.3559	-0.85	1.13162	0.35785	0.25	0.626#
Nasolabial angle	-5.8	7.62744	2.41201	-3.15	10.92156	3.4537	-2.65	0.538#
Mentolabial angle	-2.4	11.74214	3.71319	-4.4	11.44261	3.61847	2	0.704#
H-angle	-1.35	3.30866	1.04629	-1.3	2.59487	0.82057	-0.05	0.97#

#Statistically not significant,*Statistically significant.

Table 6:-Intra-group comparison of pre-treatment and post-treatment scores of smile estheticin Group I (Damon).

Variables	**Pre-Treatment**			**Post-Treatment**			**Treatment Change**	**P - Value**
	Mean	**S.D.**	**S.E.**	**Mean**	**S.D.**	**S.E.**		
Ratio 1	0.621	0.055	0.017	0.631	0.04	0.013	-0.01	0.437#
Ratio 2	0.144	0.049	0.015	0.165	0.027	0.009	-0.021	0.274#
Ratio 3	0.745	0.048	0.015	0.787	0.037	0.012	-0.042	0.012*
Ratio 4	0.832	0.051	0.016	0.799	0.04	0.013	0.033	0.084#
Ratio 5	0.839	0.154	0.049	0.816	0.14	0.044	0.023	0.660#

#Statistically not significant,*Statistically significant.

Table 7:-Intra-group comparison of pre-treatment and post-treatment scores of smile estheticin Group II (Conventional).

Variables	Pre-Treatment			Post-Treatment			Treatment Change	P - Value
	Mean	S.D.	S.E.	Mean	S.D.	S.E.		
Ratio 1	0.642	0.069	0.022	0.647	0.045	0.014	-0.005	0.838#
Ratio 2	0.149	0.045	0.014	0.183	0.055	0.017	-0.034	0.021*
Ratio 3	0.763	0.041	0.013	0.805	0.065	0.021	-0.042	0.064#
Ratio 4	0.842	0.08	0.025	0.798	0.056	0.018	0.044	0.129#
Ratio 5	0.877	0.176	0.056	0.807	0.14	0.044	0.07	0.106#

#Statistically not significant,*Statistically significant.

Table 8:-Inter-group comparison of treatment changes in smile esthetic scores.

Variables	Group I (Damon)			Group II (Conventional)			Mean difference	P - Value
	Mean	S.D.	S.E.	Mean	S.D.	S.E.		
Ratio 1	-0.01	0.03887	0.01229	-0.005	0.07517	0.02377	-0.005	0.855#
Ratio 2	-0.021	0.05705	0.01804	-0.034	0.03864	0.01222	0.013	0.559#
Ratio 3	-0.042	0.04211	0.01332	-0.042	0.06303	0.01993	0	1#
Ratio 4	0.033	0.05376	0.017	0.044	0.08316	0.0263	-0.011	0.73#
Ratio 5	0.023	0.16014	0.05064	0.07	0.12338	0.03902	-0.047	0.472#

#Statistically not significant

Discussion:-

To achieve facial harmony, orthodontic therapy includes two treatment approaches: extraction and non-extraction, and it has long been known that extraction of premolars is frequently followed by alterations in the soft-tissue profile. Sometimes these changes lead to considerable improvements in the profile which usually justifies extraction of teeth in the patients. However, at other times, the premolar extraction can result in appearance which is sometimes referred to as the "orthodontic look" or "dished-in" profile.[12]

Poor smile esthetics have deprecated the employment of premolar extraction as a treatment of choice in mild to moderate crowding cases.[13] This view stems from the idea that transverse arch dimensions, buccal corridors, and smile esthetics are all linked, and that removing teeth will change the dynamics between them.[14,15] Nonetheless, there is also some opposition to this belief system. In their investigation, Johnson and Smith,[16]discoveredthat a subject's esthetics following tooth extraction have no relationship with parameters related to the buccal corridor or other measurements of relationships between dentition and mouth widths while smiling.

In the present study, in the Damon group (Table 3), the increase in lower lipprocumbency can be due to advancement and proclination of mandibular incisor with the intention of gaining space for alignment of crowded anteriors. This in-turn refutes the lip bumper effect claimed by the Damon system as the anterior movement of the teeth is not restricted. Bascifti et al[8] also found protrusion of lower lip with the Damon system after treatment. Contrary to this, Sayed et al,[10] found insignificant amount of retraction of lower lip in relation to E-line. Statistically significant increase in the nasolabial angle in the Damon group can be due to upper lip coursing along the decrowded maxillary incisors after their alignment which earlier might be resting on an unduly proclined incisor/s in a crowded dental arch.Sayedet al[10] found an increase in the nasolabial angle (P= 0.809) in the non-extraction orthodontic cases treated with Damon system but the change was insignificant.

In the conventional group (Table 4), significant procumbency of upper lip was found which can be due to increased labial crown torque in upper MBT brackets.Contradictoryto this, Kocadereli[17] and Konstantinos[3] found that upper lip exhibited retraction in the non-extraction group.

In the intergroupcomparision (Table 5), significant increase in lower lip procumbency in the Damon group can be attributed to different torque values of the mandibular incisor brackets which includes less lingual crown torque in the Damon group compared to the conventional MBT group.

In the last decade, arch form and buccal corridors have gained a lot of attention in the field of smile esthetics. Several studies have established that broader smiles with narrow buccal corridors appear more esthetic.[18-20] Conversely, from an esthetic point of view, several other authors[16,21-23] observed that smile is not affected by the buccal corridor width. Furthermore, according to Isiksal et al,[24] transverse traits appear to have minimal impact on smile attractiveness. In addition to this, some researchers proclaim that the negative spaces present laterally, impact smile esthetics only when it becomes excessively wide.[22]

In the present study, three buccal corridor ratios were calculated i.e. ratio 1, ratio 3 and ratio 4. Ratio 1 buccal corridor space in relation to canine. It signifies the percentage of smile width filled by intercanine distance. In this study, ratio 1 increased insidgnificantlyin both the groups indicating insignificant arch exapansion in canine region. Ratio 3 indicates the percentage of smile width filled by visible dentition and it reflects the dental arch fullness in the buccal segments better than Ratio 1. The subjects with higher ratio 3 showed lesser buccal corridor space in relation to last visible tooth. This ratio increased from pre-treatment to post-treatment in both the groups but the increase was statistically significant in the Damon group signifying greater arch expansion in Damon group as compared to conventional group attributing to broader archwires in Damon group (Table 6 & 7). Analogous findings have been reported by Isiksal et al.[24] However, the use of Damon appliance cannot redeem an extraction case relying on arch expansion to prevent premolar extraction. In fact, the presence of straight soft tissue profile and upright incisors is necessary as a precondition for non-extraction treatment planning. Besides, a cordial relationship between chin and lip position is the key requirement for successful non-extraction treatment with Damon appliance.

Ratio 4 signifies the percentage of visible dentition occupied by the intercanine distance and it decreased from pre-treatment to post-treatment in both the groups (Table 6 & 7) indicating that the visibility of teeth increased more with respect to the increase in the intercanine distance but the change was statistically insignificant.

Ratio 2 is represented as the ratio of smile height to smile width. It was found to be increased in both the groups but the increment was statistically significant in the conventional group only (Table 6 & 7). Increased ratio signifies increased smile height in relation to smile width which is indicated by increased incisal exposure. This finding represented an improvement in the patients' smile and is congruent with the studies which found that the most pleasing smiles have consonance of the gingival smile line at the gingival margin of upper central incisors exposing the incisors during smile.[25-27]

When the mean treatment change of the smile esthetic scores was compared between the two groups, there was no statistically significant difference ($P>0.05$) (Table 8). This can be partially due to the individual variance as the sample in this study comprised of live subjects and not computer-simulated images. A recent systematic review[28] suggested that the studies which used digitally altered images instead of actual patient photographs for the evaluation of smile characteristics led to more definitive results.

There were some limitations to the present study. The present study was a retrospective study which might result in selection and detection bias though only patients who satisfied the inclusion criteria were comprehended in the present study. Another limitation of this retrospective study would be the utilization of restricted information from patients' electronic health records. The study only looked at specific aspects of a smile on full-face frontal smiling images, but lateral cephalograms and direct biometric measurements, which show the amount of lip contraction and vertical lip drape over dentition at rest and while smiling, can provide more information. Two-dimensional photographs of actual patients were used as objective measures to evaluate the esthetics of a dynamic facial trait—the smile—was also one of the limitations of the present study. Future research should be planned to evaluate smile characteristics utilizing 3-D images and digital videography in order to corroborate existing findings, improve our knowledge in this subject, and to dynamically visualize and quantify a smile.

Conclusion:-

The marketing of one bracket system as producing improved smile esthetics with increased smile width and decreased buccal corridors to create fuller and broader smiles than conventional brackets has been debatable for many years. This concept has not been substantiated because no difference between the Damon self-ligating bracket

system and the traditional brackets when the two systems were compared for the effect on buccal corridors after the treatment. At the end of the treatment both modalities finished the soft tissues in a similar fashion while smile width increased and the buccal corridor area decreased in both the groups. The concept that only a particular type of bracket system results in broader or narrower arches is not advocated by the results of the present study as the results were similar in both the groups.

Predicting the response of soft tissue and smile esthetic parameters to orthodontic tooth movement is complex, and would require the application of further tests and advanced research for greater understanding and even better treatment results. Because the art of esthetics lies in the clinicians' hands, it is not surprising to find no difference in soft tissue as well as smile esthetics parameters among both the groups. As a result, it is possible to conclude that treatment modality has no foreseeable effect on overall esthetics. A harmonious relationship between nose, chin and lip position is the main key leading to the successful non-extraction treatment with either of the two treatment modalities.

References:-

1. Cheng HC, Wang YC. Effect of non-extraction and extraction orthodontic treatments on smile esthetics for different malocclusions. American Journal of Orthodontics and Dentofacial Orthopedics 2018;153(1):81-6.
2. Wylie WL. The mandibular incisor - Its role in facial esthetics. The Angle Orthodontist 1955;25(1):32-41.
3. Konstantonis D. The impact of extraction vs non-extraction treatment on soft tissue changes in Class I borderline malocclusion. The Angle Orthodontist 2012;82(1):209-17.
4. Angle EH. Treatment of malocclusion of the teeth (ed 7). Philadelphia: SS White Dental Manufacturing Co., 1907.
5. Spahl TJ, Witzig JW. The clinical management of basic maxillofacial orthopedic appliances, in Mechanics, Vol 1. Littleton, MA, PSG Publishing Co, 1987.
6. Dierkes JM. The beauty of the face: an orthodontic perspective. Journal ofAmerican Dental Association 1987;(1):89E-95E.
7. Erbay EF, Caniklioglu CM. Soft tissue profile in Anatolian Turkish adults: Part II. Comparison of different soft tissue analysis in the evaluation of beauty. American Journal of Orthodontics and Dentofacial Orthopedics 2002;121(1):65-72.
8. Basciftci FA, Akin M, Ileri Z, Bayram S. Long-term stability of dentoalveolar, skeletal, and soft tissue changes after non-extraction treatment with a self-ligating system. Korean Journal of Orthodontics 2014;44(1):119-27.
9. Birnie D. The Damon Passive Self-Ligating Appliance System. Seminars inOrthodontics 2008;14(1):19-35.
10. Sayed YM, Gaballah SM, Shourbagy EME. Effectiveness of the Damon system in the treatment of non-extraction orthodontic cases. Tanta Dental Journal 2016;13(1):18–27.
11. Phillips C, Greer J, Vig P, Matteson S. Photocephalometry: errors of projection and landmark location. American Journal of Orthodontics and Dentofacial Orthopedics 1984;86(1):233-43.
12. Drobocky OB, Smith RJ. Changes in facial profile during orthodontictreatment with extraction of four first premolars. American Journal of Orthodontics and Dentofacial Orthopedics 1989;95(3):220-30.
13. Prasad V, Tandon P, Sharma VP, Singh GK, Maurya RP, Chugh V.Photographical evaluation of smile esthetics after extraction orthodontictreatment. Journal of Orthodontic Research 2015;3(1):49-56.
14. Ghafari JG. Emerging paradigms in orthodonticsan essay. American Journal of Orthodontics and Dentofacial Orthopedics 1997;111(1):573-80.
15. Spahl TJ. Premolar extractions and smile esthetics. American Journal of Orthodontics and Dentofacial Orthopedics 2003;124(1):16A-17A.
16. Johnson DK, Smith RJ. Smile esthetics after orthodontic treatment with and without extraction of four first premolars. American Journal of Orthodontics and Dentofacial Orthopedics 1995;108(1):162-7.
17. Kocadereli I. Changes in soft tissue profile after orthodontic treatment with and without extractions. American Journal of Orthodontics and DentofacialOrthopedics 2002;122(1):67-72.
18. Kokich VO, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. Journal of Esthetic Dentistry 1999;11(6):311-24.
19. Moore T, Southard KA, Casko JS, Qian F, Southard TE. Buccal corridors and smile esthetics. American Journal of Orthodontics and Dentofacial Orthopedics 2005;127(2):208-13.
20. Abu Alhaija ES, Al-Shamsi NO, Al-Khateeb S. Perceptions of Jordanian laypersons and dental professionals to altered smile esthetics. European Journal of Orthodontics 2011;33(4):450-6.
21. Roden-Johnson D, Gallerano R, English J. The effects of buccal corridor spaces and arch form on smile esthetics. American Journal of Orthodontics and Dentofacial Orthopedics 2005;127(3):343-50.

22. Ritter DE, Gardini LG, Pinto A, Locks A. Esthetic influence of negative space in the buccal corridor during smiling. The Angle Orthodontist 2006;76(2):198-203.
23. Gianelly AA. Arch width after extraction and non-extraction treatment. American Journal of Orthodontics and Dentofacial Orthopedics 2003;123(1):25-8.
24. Işıksal E, Hazar S, Akyalçın S. Smile esthetics: perception and comparison of treated and untreated smiles. American Journal of Orthodontics and Dentofacial Orthopedics 2006;129(1):8-16.
25. Hulsey CM. An esthetic evaluation of lip-teeth relationshipspresentin the smile. American Journal of Orthodontics and Dentofacial Orthopedics 1970;57(1):132–144.
26. Bhuvaneswaram M. Principles of smile design. Journal of Conservative Dentistry 2010;13(4):225–32.
27. Davis N. Smile design. Dental Clinics North America 2007;51(1):299–318.
28. Janson G, Branco NC, Fernandes TM, Sathler R, Garib D, Lauris JR. Influence of orthodontic treatment, midline position, buccal corridor and smile arc on smile attractiveness: A systematic review. The Angle Orthodontist 2011;81(1):153-61.