ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2022; 8(1): 214-218

www.oraljournal.com
Received: 22-10-2021
Accepted: 08-12-2021

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A pre and post treatment comparison of class II division 1 malocclusion cases treated with pre-adjusted edgewise appliances using the PAR index

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DOI: https://doi.org/10.22271/oral.2022.v8.i1d.1430

Abstract
PAR index provides a single summary score for all the occlusal anomalies and may be used for all types of malocclusions, treatment modalities and extraction/non extraction cases. The score provides an estimate of how far a case deviates from normal & the difference in score for pre & post – treated cases reflects the perceived degree of improvement & therefore the success of treatment. The aim of the study is to assess the success of treatment in class II Div. 1 cases by PAR index, treated in Department of Orthodontics, RUHS college of Dental Sciences Jaipur. Sample included 100 cases of Class II Div. 1 malocclusion treated with pre adjusted edgewise appliances which were divided into 2 groups, group A (extraction) and group B (non-extraction). The same were evaluated pre and post treatment.
Material: Pre & Post treatment study models of selected cases, PAR index guidelines.
Method-Class II Div. 1 pre treatment study models of patients were assessed by the PAR index and the deviation from the normal occlusion determined by the PAR index.
A comparison of pre and post values in PAR index recorded. It serves as an indicator for correction achieved in malocclusion in post treatment cases.
Results: Results showed significant pre and post treatment difference ($p< 0.05$) between group A and group B using PAR index, in terms of over jet and overbite.
Conclusion: All the cases irrespective of extraction or non extraction mechanics showed significant overall improvement after treatment with pre adjusted edgewise appliance.

Keywords: PAR index, 1 malocclusion, occlusal anomalies

Introduction
PAR index provides a single summary score for all the occlusal anomalies and may be used for all types of malocclusions, treatment modalities and extraction /non extraction cases. Components of PAR index-
1-Upper right segment, 2- Upper anterior segment, 3-Upper left segment, 4- Lower right segment, 5- Lower anterior segment, 6- Lower left segment, 7- Right buccal occlusion, 8- Over jet, 9- Overbite, 10- Centerline, 11- Left buccal occlusion

- The score provides an estimates of how far a case deviates from normal & the difference in score for pre & post – treated cases reflects the perceived degree of improvement & therefore the success of treatment

Aims & Objectives: The aim of the study is to assess the success of treatment in class II Div 1cases by PAR index, treated in our Department.

Objective
A) To evaluate the complexity of the malocclusion prior to treatment. B) To evaluate the percentage reduction of severity of malocclusion after orthodontic treatment using extraction and non extraction mechanics in class II division 1 malocclusion. C) To compare the proportion of reduction in malocclusion in male & female patients in both extraction and non extraction mechanics. D) To compare the success of treatment in extraction & non extraction treatment mechanics.

Materials & Methods

Material

A sample of100 cases (50 male and 50 female) with Class II Division 1malocclusion was selected from the record bank of department of Orthodontics and Dentofacial orthopedics, RUHS Dental College, Jaipur. All the subjects were treated with pre adjusted edgewise appliance and their study models were evaluated at 2 intervals 1) T_1- pre treatment 2) T_2- after completion of active therapy.

Inclusion criteria

1) Models with Class II Division1 malocclusion including subdivision cases.
2) Extraction /non extraction cases treated by pre-adjusted edgewise appliances.
3) The subject age group was 12-30 yrs.

The sample was further divided into 2 groups.

- Group A- extraction mechanics was used.
- Group B- non extraction mechanics was used.

Exclusion criteria-

1) History of previous removable functional appliance therapy.
2) syndromic patients.
3) Patients with history of trauma.
4) Patients requiring Orthognathic surgery as an adjunct to fixed mechanotherapy.

Method

The data was collected by evaluating pre and post treatment study models using PAR index. The models were analysed utilizing the 11 standard components of PAR index.

Description of PAR index

Buccal and anterior segments: the dental arch is divided into three recording segments, left buccal, right buccal, and anterior. Scores are recorded for both upper and lower arches.

Buccal segments: the recording zone is from the mesial anatomical contact point of the first permanent molar to the distal anatomical contact point of the canine.

Anterior segment: the recording zone is from the mesial anatomical contact point of the canine on one side to the mesial anatomical contact point of the canine on the opposite side.

Occlusal features recorded are crowding, spacing, and impacted teeth. Displacements are recorded as the shortest distance between contact points of adjacent teeth parallel to the occlusal plane. The greater the displacement the greater the PAR score. The displacements between first, second, third molars are not recorded as these contacts are so broad and are extremely variable within the normal range. An impacted tooth is recorded when the space for this tooth is less than or equal to 4mm. Impacted canines are recorded in the anterior segment.

Scores for the displacements and impactions are added to give an overall score for each recording zone. The scores for discrepancies are-

Table 1: Displacement Scores

	Score Discrepancy
0	0 mm- 1 mm
1	1.1 mm-2 mm
2	2.1 mm- 4mm
3	4.1 mm- 8mm
4	Greater than 8mm
5	Impacted teeth

Buccal occlusion: the buccal occlusion is recorded for both left and right sides. The fit of the teeth is scored with respect to the three planes of space. The recording zone is from canine to the last molar, either first, second, third. All discrepancies are recorded when the teeth are in occlusion. The antero-posterior, vertical and transverse irregularities are summed for each buccal occlusion.

Table 2: Buccal occlusion assessment (temporary developmental stages and submerging deciduous teeth are excluded)

Scores	Discrepancy
Antero-posterior	
0	good interdigitation class I, II, III
1	less than half unit discrepancy
2	half a unit discrepancy (cusp to cusp)
Vertical	
0	no discrepancy in intercuspation
1	lateral open bite on at least two teeth greater than 2mm
Transverse	
0	no cross- bite
1	cross- bite tendency
2	single tooth in cross- bite
3	more than one tooth in cross- bite
4	more than one tooth in scissor bite

Over jet: positive over jet as well as crossbite are recorded. The recording zone is from the left to right lateral incisors. The most prominent aspect of any one incisor is recorded. When recording the over jet the ruler is held parallel to the occlusal plane and radial to the line of the arch. It is not uncommon to see two upper laterals in cross bite as well as an increased over jet on the central incisors.

Table 3: Over Jet Measurements

Scores	Discrepancy
Over jet	
0	0-3 mm
1	3.1-5mm
2	5.1- 7 mm
3	7.1- 9 mm
4	Greater than 9mm
Anterior crossbite	
0	no discrepancy
1	one or more teeth edge to edge
2	one single tooth in crossbite
3	two teeth in crossbite
4	more than two teeth in crossbite

Table 4: Overbite measurements Cross-bites including the canines are recorded in the anterior segment.

Scores	Discrepancy
Open bite	
0	no open bite
1	open bite less than and equal to 1mm
2	open bite 1.1- 2mm

3	open bite 2.1- 3mm
4	open bite greater than or equal to 4mm
Overbite	
0	less than or equal to one third coverage of the lower incisor
1	Greater than one third, but less than two-thirds coverage of the lower incisor
2	Greater than two- thirds coverage of the lower incisor
3	Greater than or equal to full tooth coverage

Table 5: Centerline Assessments

Scores	Discrepancy
0	Coincident and up to one-quarter lower incisor width
1	one-quarter to one-half lower incisor width
2	Greater than one- half lower incisor width

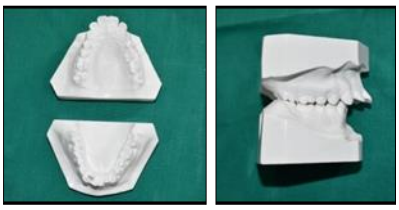


Fig. 1: Pre treatment study models

Result: The present study was conducted in Department of Orthodontics and Dentofacial Orthopedics, RUHS College of Dental Sciences, Jaipur (Rajasthan). 100 subjects study models were selected who required fixed mechanotherapy. In our study, the PAR index values were measured by Vernier caliper. To analyze the measurements statistically the data was grouped as follows:

Group A- extraction
Group B- non extraction

- Data so obtained was subjected to statistical analysis for obtaining mean, range, standard deviation and significance value for variables. Independent t- tests were performed for the comparisons of the mean values of the variables among the 2 groups- extraction and non extraction. P values < 0.05 show statistically significant results.

The results of the study show that the differences in the changes of the parameters between the two groups are statistically significant

Table 6: Comparison of parameters between two groups

		Pre treatment	Post Treatment	Change of Scores	Percentage Change in Scores	P value	Significance
Over jet	Group A	2.90±0.99	0.00±0.00	2.90±0.99	100.00±0.00	0.001	Significant
	Group B	2.98±1.11	0.18±0.38	2.80±1.06	94.83±11.65		
Over Bite	Group A	2.00±0.83	0.58±0.60	1.42±1.05	64.00±47.89	0.018	Significant
	Group B	2.04±0.85	0.32±0.47	1.72±0.85	83.16±29.57		
PAR Index	Group A	21.42±8.87	1.52±1.07	19.90±8.66	92.21±6.14	0.032	Significant
	Group B	16.92±7.52	1.64±1.19	15.28±7.54	88.67±9.70		

Table 6 shows that
The mean change in the Over jet is higher in Group A than in Group B (2.90±0.99 in Group A and 2.80±1.06 in Group B) and the difference is statistically significant (P=0.001).

- The mean change in the Overbite is lower in Group A than in Group B (1.42±1.05 in Group A and 1.72±0.85 in Group B) and the difference is statistically significant (P=0.018). The mean change in the PAR Index is higher in Group A than in Group B (19.90±8.66 in Group A and 15.28±7.54 in Group B) and the difference is statistically significant (P=0.032).

Graph 1 shows: The percentage Changes in over jet (100 in Group A and 94.83 in Group B).

- Overbite (64 in Group A and 83.16 in Group B) and PAR Index (92.21 in Group A and 88.67 in Group B).

Table 7: Comparison of parameters between two groups among males

		Pre treatment	Post Treatment	Change of Scores	Percentage Change in Scores	P value	Significance
Over jet	Group A	2.76±1.01	0.00±0.00	2.76±1.01	100.00±0.00	0.026	Significant
	Group B	3.04±1.09	0.20±0.40	2.84±1.06	94.00±13.07		
Over Bite	Group A	1.92±0.95	0.56±0.60	1.36±1.03	66.00±39.52	0.032	Significant
	Group B	2.20±0.91	0.36±0.47	1.84±0.85	84.33±25.03		
PAR Index	Group A	22.88±7.77	1.32±0.90	21.56±7.48	94.14±4.53	0.021	Significant
	Group B	16.96±6.54	1.60±1.19	15.36±6.77	88.94±9.94		

The differences in changes of the parameters between the two groups among the males are also statistically significant.
Table 7 shows that, the mean change in the Over jet is lower in Group A than in Group B (2.76±1.01 in Group A and 2.84±1.06 in Group B) and the difference is statistically significant (P=0.026). The mean change in the Overbite is lower in Group A than in Group B (1.36±1.03 in Group A and 1.84±0.85 in Group B) and the difference is statistically significant (P=0.032).

- The mean change in the PAR Index is higher in Group A than in Group B (21.56±7.48 in Group A and 15.36±6.77 in Group B) and the difference is statistically significant (P=0.021).

Graph 2 shows: The Percentage Changes in over jet (100 in Group A and 94 in Group B), Overbite (66 in Group A and 84.33 in Group B) and PAR Index (94.14 in Group A and 88.94 in Group B).

Table 8: Comparison of parameters between two groups among females

		Pre treatment	Post Treatment	Change if Scores	Percentage Change in Scores	P value	Significance
Over jet	Group A	3.04±0.97	0.00±0.00	3.04±0.97	100.00±0.00	0.043	Significant
	Group B	2.92±1.15	0.16±0.37	2.76±1.09	95.66±10.24		
Over Bite	Group A	2.08±0.70	0.60±0.64	1.48±1.08	62.00±55.80	0.021	Significant
	Group B	1.88±0.78	0.28±0.45	1.60±0.86	82.00±33.93		
PAR Index	Group A	19.96±9.78	1.72±1.20	18.24±9.55	90.28±6.98	0.132	Non-Significant
	Group B	16.88±8.52	1.68±1.21	15.20±8.35	88.39±9.65		

Most of the differences in changes of the parameters between the two groups among the Females are statistically significant

Table 8 shows that

- The mean change in the Over jet is higher in Group A than in Group B (3.04±0.97 in Group A and 2.76±1.09 in Group B) and the difference is statistically significant (P=0.043). The mean change in the Overbite is lower in Group A than in Group B (1.48±1.08 in Group A and 1.60±0.86 in Group B) and the difference is statistically significant (P=0.021). The mean change in the PAR Index is higher in Group A than in Group B (18.24±9.55 in Group A and 15.20±8.35 in Group B) but the difference is not statistically significant (P=0.132).

Graph 3 shows

- The Percentage Changes in over jet (100 in Group A and 95.66 in Group B), Overbite (62 in Group A and 82 in Group B) and PAR Index (90.28 in Group A and 88.39 in Group B).

Table 9: Comparison of buccal occlusion between the groups

	Class I	Class II	Chi Square Value	P value
Extraction	39 (78.0%)	11 (22.0%)	9.500	0.001
Non-Extraction	49 (98.0%)	1 (2.0%)		

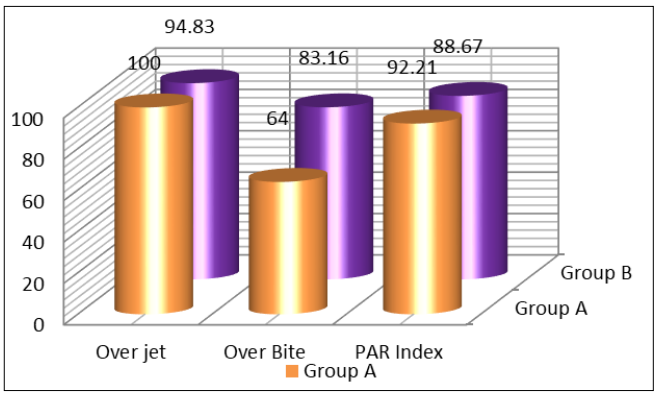
The comparison of the buccal occlusions between the groups is also statistically significant

Table 9 shows that

- Chi Square test value for the comparison of Class I and Class II between the groups is 9.5 which is statistically significant (P=0.001).

Graph 4 shows

The proportions of Class I and Class II occlusions which are 78% Class I and 22% Class II in Extraction group and 98% Class I and 2% Class II in Non-extraction group.



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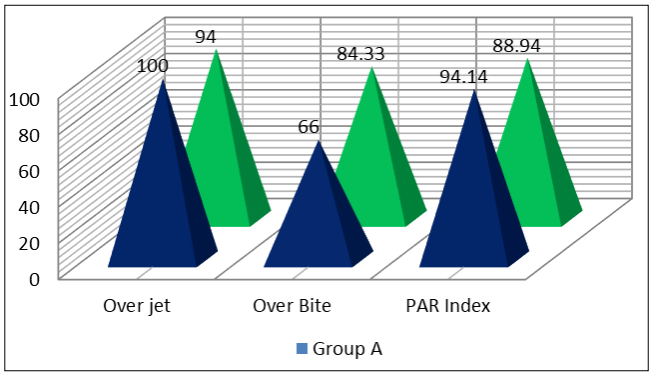

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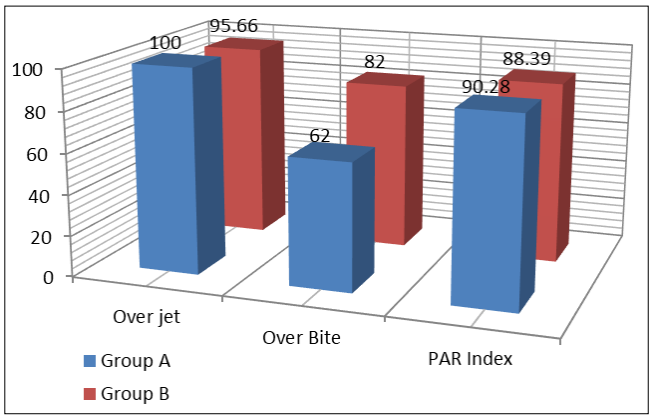

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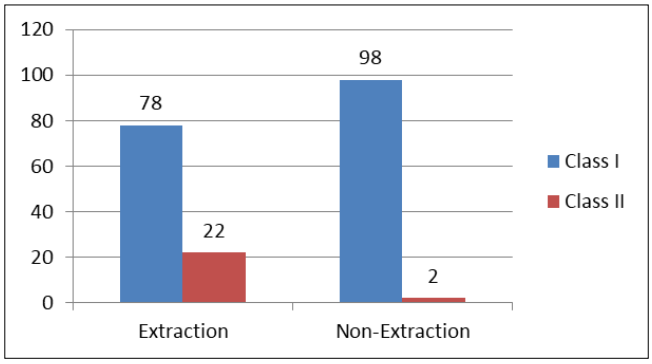

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Discussion

The mean pre-treatment PAR index score of the extraction group was 21.42±8.87 which was higher than the non-extraction group that was 16.92±7.52. On the other hand, the mean post-treatment PAR index score of the extraction group was 1.52±1.07 which was lower than the non-extraction group that was 1.64±1.19. The difference between the pre and post-treatment PAR index score was 19.90±8.66 in the extraction group which was higher than the difference between the pre

and post-treatment PAR index score in the non-extraction group which was 15.28±7.54.

The results of the study are in accordance with those of Nazir *et al*. (2010) who also did pre and post treatment evaluation of class I and class II. The mean weighted PAR score reduction was22.56, whereas the mean percentage reduction was almost 92% indicating a significant improvement in malocclusion as a result of orthodontic treatment.

The mean pre-treatment over jet of the extraction group was 2.90±0.99 which was lower than the non-extraction group that was 2.98±1.11. On the other hand, the mean post-treatment over jet of the extraction group was 0.00±0.00 which was lower than the non-extraction group that was 0.18±0.38. The mean pre-treatment overbite of the extraction group was 2.00±0.83 which was lower than the non-extraction group that was 2.04±0.85. On the other hand, the mean post-treatment overbite of the extraction group was 0.58±0.60 which was higher than the mean post-treatment overbite of the non-extraction group that was 0.32±0.47.

In case of the males, the mean pre-treatment PAR index score of the extraction group was 22.88±7.77 which was higher than the non-extraction group that was 16.96±6.54. On the other hand, the mean post-treatment PAR index score of the extraction group was 1.32±0.90 which was lower than the non-extraction group that was 1.60±1.19. In both scenarios change in the PAR index score from pre-treatment to post-treatment was found to be greater in patients who underwent extraction than the patients who did not. The mean pre-treatment over jet of the extraction group was 2.76±1.01 which was lower than the mean pre-treatment over jet of the non-extraction group that was 3.04±1.09. On the other hand, the mean post-treatment over jet of the extraction group was 0.00±0.00 which was lower than the mean post-treatment over jet of the non-extraction group that was 0.20±0.40. The difference between the pre and post-treatment over jet was 2.76±1.01 in the extraction group which was lower than the difference between the pre and post-treatment over jet in the non-extraction group which was 2.84±1.06. The mean pre-treatment overbite of the extraction group was 1.92±0.95 which was lower than the mean pre-treatment overbite of the non-extraction group that was 2.20±0.91. On the other hand, the mean post-treatment overbite of the extraction group was 0.56±0.60 which was higher than the mean post-treatment overbite of the non-extraction group that was 0.36±0.47. The difference between the pre and post-treatment overbite was 1.36±1.03 in the extraction group which was lower than the difference between the pre and post-treatment overbite in the non-extraction group which was 1.84±0.85.

In case of the females, the mean pre-treatment PAR index score of the extraction group was 19.96±9.78 which was higher than the mean pre-treatment PAR index score of the non-extraction group that was 16.88±8.52. On the other hand, the mean post-treatment PAR index score of the extraction group was 1.72±1.20 which was higher than the mean post-treatment PAR index score of the non-extraction group that was 1.68±1.21. The mean pre-treatment over jet of the extraction group was 3.04±0.97 which was higher than the mean pre-treatment over jet of the non-extraction group that was 2.92±1.15. On the other hand, the mean post-treatment over jet of the extraction group was 0.00±0.00 which was lower than the mean post-treatment over jet of the non-extraction group that was 0.16±0.37. The mean pre-treatment overbite of the extraction group was 2.08±0.70 which was higher than the mean pre-treatment overbite of the non-extraction group that was 1.88±0.78. On the other hand, the mean post-treatment overbite of the extraction group was 0.60±0.64 which was higher than the mean post-treatment overbite of the non-extraction group that was 0.28±0.45. The difference between the pre and post-treatment overbite was 1.48±1.08 in the extraction group which was lower than the difference between the pre and post-treatment overbite in the non-extraction group which was 1.60±0.86.

Conclusion

1. The PAR index appeared to be sensitive enough to determine difference in outcome between the techniques used in this study.
2. All the cases irrespective of extraction or non extraction mechanics showed significant overall improvement after treatment with pre adjusted edgewise appliance.
3. Significant reduction in PAR index were found in the post-treatment cases.
4. Improvement in the over jet was statistically significant.
5. Improvement in the overbite was statistically significant.
6. Males and females individually showed noteworthy improvement in the parameters measured for PAR index.

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