EVALUATING ORTHODONTIC TREATMENT USING PAR & IOTN INDICES

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The objective of this study was to assess the differences between the treatment effectiveness of non extraction cases treated with Begg and Pre Adjusted Edgewise Appliance by PAR and IOTN index. The Pre, Post and 1 year Post treatment records of twenty patients, who were treated in Orthodontic department of the Bapuji Dental College and Hospital, Davangere, were evaluated. The sample was divided into two groups: Group1 comprises of 10 patients treated with PEA Appliance. Group2 comprises of 10 patients treated with Begg Appliance. PEA appliance has performed better than Begg appliance therapy.

KEY WORDS: Peer Assessment Rating; Index of Orthodontic Treatment Needs

Historically, the definition and assessment of malocclusions have been a most vexing task to perform faithfully and satisfactorily. In 1959, VanKirk and Pennell proposed the malalignment index, which involved the grading of tooth displacement and rotation. They defined quantitatively tooth displacement and rotation which was a step forward[1]. An assessment of the need for orthodontic treatment and an evaluation of treatment results followed by a long term post retention assessment of orthodontically treated malocclusions has been of interest for many decades. However, it is only with the recent development of Index of Orthodontic Treatment Need (IOTN) and the Peer Assessment Rating Index (PAR) that there has been increased interest in the use of indices as tools for assessing treatment[2].

The PAR and IOTN indices were developed in late 1980s to address the highly debatable issue of need for orthodontic treatment and quality of outcome. These drew considerable interest during early years as clinical researchers struggled with the difficulties of determining need.

The PAR index was developed at the University of Manchester as a tool for assessing and grading treatment outcome. The index was applied to both pre and post treatment study casts and the change in the total score reflected the success or otherwise, of treatment, in achieving an overall alignment and occlusion. The PAR index measures deviation from ideal occlusion present before and after treatment. It measures occlusal change and allocates scores for alignment of the dentition, buccal segment relationship, overjet, overbite and midline discrepancy. It provided orthodontists with an objective method of assessing treatment outcome[3,4]. Hence, it tells us about the dentoalveolar improvement due to treatment. Esthetic component is not recorded.

IOTN had gained international recognition as a method of objectively assessing treatment needs. It measured the need for orthodontic treatment on the ground of health risk or esthetic impairment[5] .This index ranks malocclusion in terms of the significance of various occlusal traits for individual's dental health and perceived aesthetic impairment with the intention of identifying those individuals who would most likely to benefit from orthodontic treatment. It consists of two components, Dental Health Component (DHC) and an Aesthetic Component (AC) which are not combined into an over-

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all assessment of treatment need. It measures esthetic impairment by applying the index to Pretreatment casts to assess treatment needs.

The objectives were;

1. To assess the treatment effectiveness of non extraction cases treated with Begg and Pre adjusted edge-wise appliances.
2. To compare pre treatment, immediate post treatment, and not less than one year post treatment records and to register the outcome of orthodontic care by using Peer Assessment Rating (PAR) and Index of Orthodontic Treatment Need (IOTN).

Materials and Methods

The records included pre treatment, post treatment and not less than one year post treatment dental casts and frontal dental photographs of the same 20 patients.

The sample was divided into two groups:

Group I: Comprises of 10 patients treated with Pre-adjusted Edgewise Appliance

Group II: Comprises of 10 patients treated with Begg Appliance.

Selection criteria

(a) All patients had skeletal class 1 with Angle's class 1 malocclusion

(b) All cases were treated with non extraction.

(c) There was no sex discrimination.

Two indices were used in this study that is Peer assessment rating (PAR) and Index of orthodontic treatment need (IOTN). The PAR index evaluates dento-occlusal change, was used which provides an initial estimate of how far a case deviates from normal.

The IOTN index has two components which are (i) Dental Health Component (ii) Aesthetic Component. An improvement of the malocclusion will bring about a reduction in the score of both the components.

A special ruler summarizes the information needed for the dental health component and after some calibration of examiners, reliable (i.e., reproducible) data are obtained.

Dental health component (DHC):

Dental Health component (DHC) has five grades, categorizing cases from grade 1 (no need for treatment) to grade 5 (great need). The Dental Health Component was applied both clinically and to study casts. When applied to study casts, Grade 1 and 2 indicate 'no need', grade 3 'borderline need' and grade 4 'definite need', for treatment. Only the worst occlusion feature is recorded.

Aesthetic component (AC):

The aesthetic component consists of a scale of ten photographs showing different levels of dental attractiveness. The dental attractiveness of prospective patients can be rated with reference to the scale. Grade 1 represents the most attractive and Grade 10 the least attractive arrangements of the teeth. Grade 1-4 represents no need to slight need, 5-7 moderate need and 8-10 great need/definite need on esthetic grounds.

STATISTICAL ANALYSIS:

The scores obtained by the PAR and IOTN indices were expressed as mean ± SD. Since the distribution of scores was found to be moderately skewed (non-normal), hence non parametric methods (Wilcoxon's signed Rank Test & Mann-Whitney Test) were used for analysis. Categorical data was analyzed by Fischer's Exact test. A P value of less than 0.05 was considered statistically significant. All the data were analyzed in PC-XT with MINITAB soft ware (series 13.1, USA) and SPSS (version 13, USA).

Armamentarium used in the study were brass wire, metal ruler, dial caliper, vernier calliper, IOTN and PAR ruler.

RESULTS

A comparison of PAR scores for cases treated with PEA and Begg are given in **Table - II.** when the

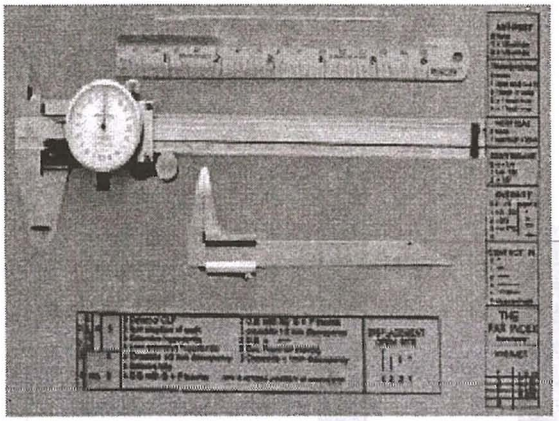


Figure 1 Armamentarium used in the study

Table 1 - Components of the 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. Overjet 9. Overbite
10. Centerline
11. Left buccal occlusion.

Table 2: Assessment of the treatment outcome by PAR index

Comparisons of PAR scores for both appliances at post treatment and not less than 1 year post treatment

Group	DHI Score	Pre treatment		Post treatment		1 year Post treatment	
		PEA	Begg	PEA	Begg	PEA	Begg
Non Extraction	1	—	—	9	1	5	1
	2	—	—	1	9	4	7
	3	2	1	—	—	1	2
	4	4	9	—	—	—	—
	5	4	—	—	—	—	
	PEA Vs Begg	—		P* < 0.001, IIS		P* – 0.09, NS	

Table 3: Assessment of the treatment outcome by Dental Health component of the IOTN index at post and 1 year post treatment

Group	DHI Score	Pre treatment		Post treatment		1 year Post treatment	
		PEA	Begg	PEA	Begg	PEA	Begg
Non Extraction	1	—	—	9	1	5	1
	2	—	—	1	9	4	7
	3	2	1	—	—	1	2
	4	4	9	—	—	—	—
	5	4	—	—	—	—	—
	PEAVs Begg	-		P* < 0.001, HS		P* = 0.09, NS	

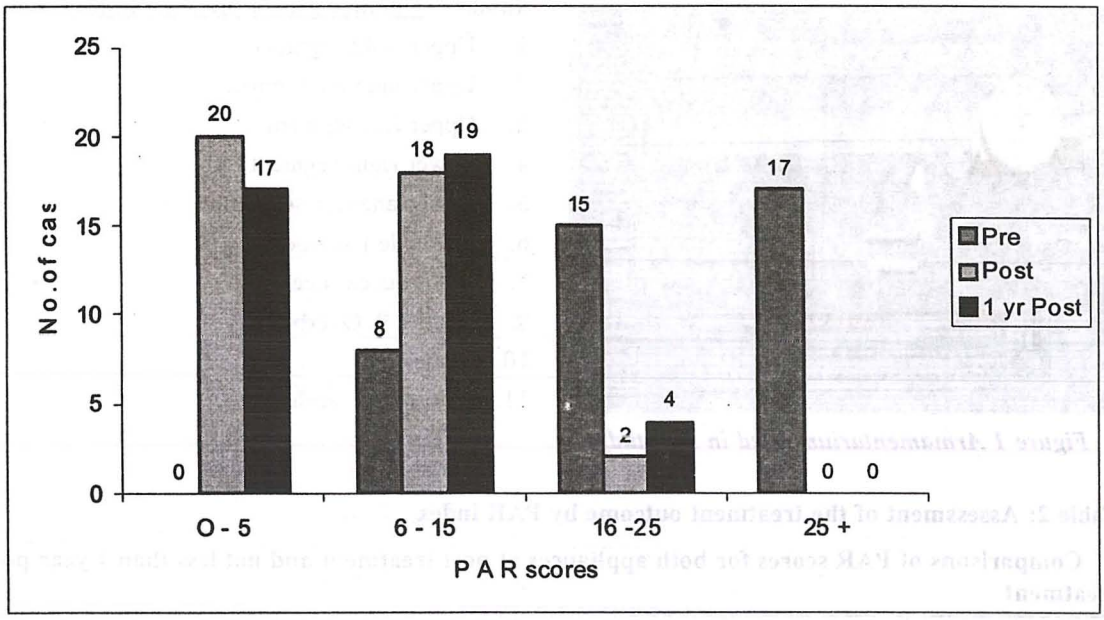


Figure 2: PAR scores for the whole group at Pre, Post & 1 year Post treatment.

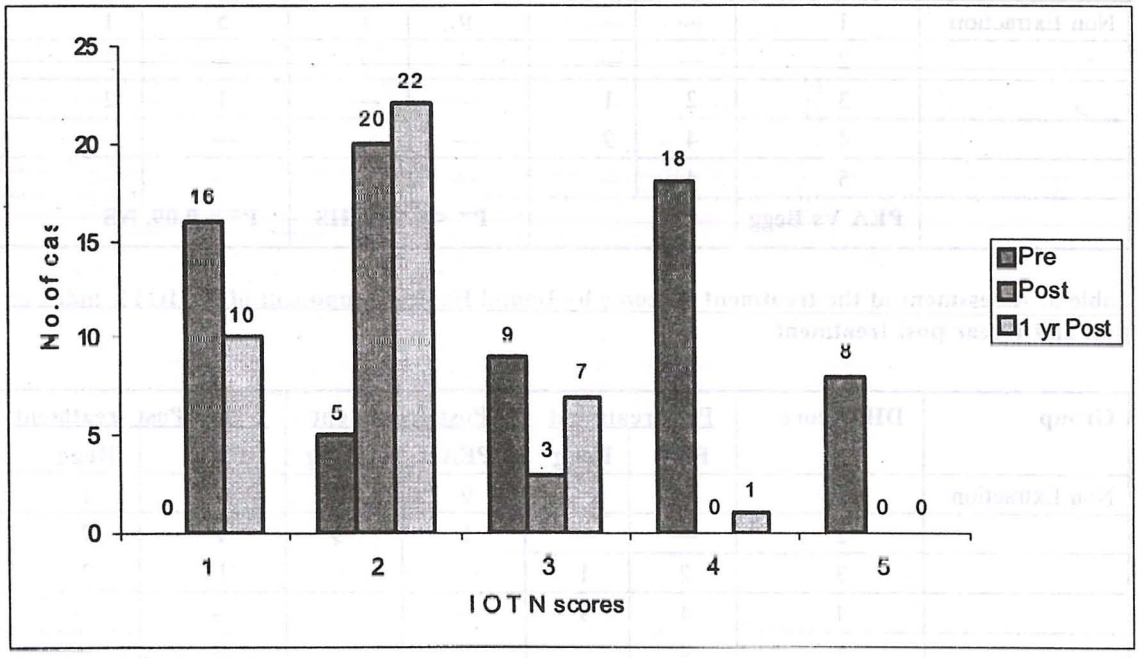


Figure 3: IOTN scores (Dental Health Component) for the whole group at Pre, Post & 1 year Post treatment.

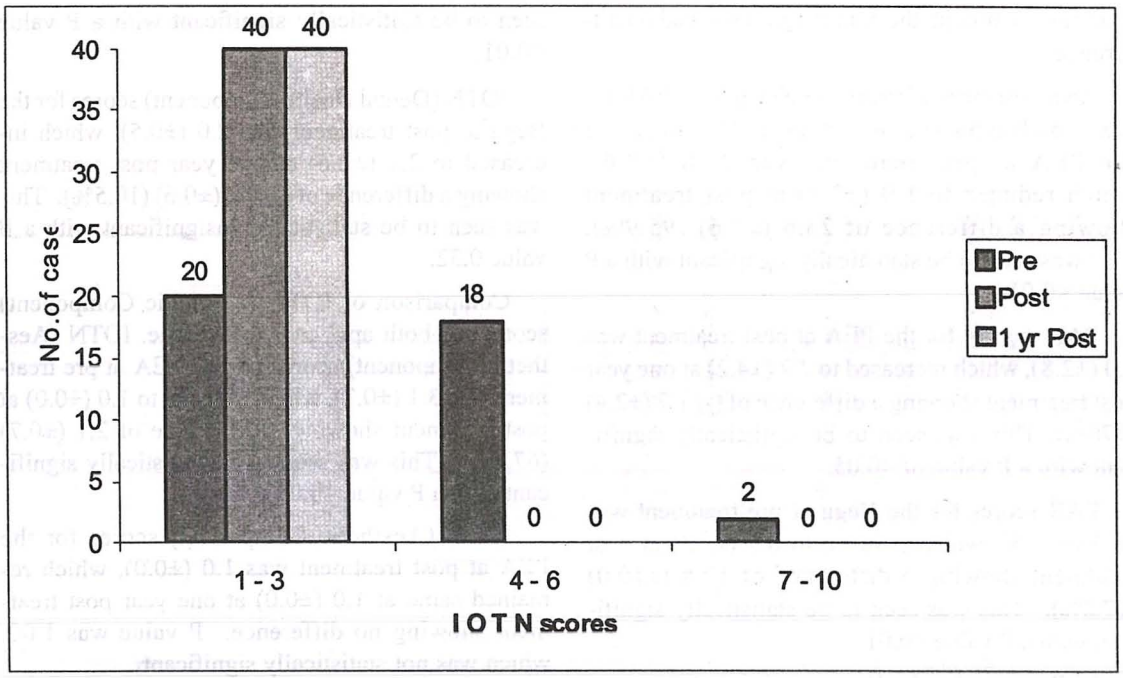


Figure 4: IOTN scores (Esthetic Component) for whole group at Pre, Post & 1 year Post treatment graph.

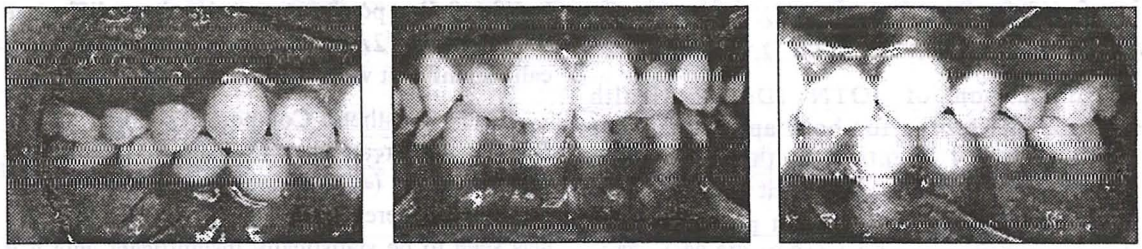


Figure 5. Pre-treatment records of patient L.M. treated with PEA mechanotherapy.

two appliances were compared at pre and post treatment, the results were highly significant with a P value of < 0.001. When the comparison was made at post treatment and one year post treatment, results were significant with a P value of < 0.01.

Comparison of IOTN (Dental Health Component) scores for both appliances at post treatment and one year post treatment is given in **Table III.** When the comparison between the two appliances was made at pre and post treatment, the results were highly significant with P value of < 0.001

When the comparison was made between the two appliances at post treatment and one year post treatment, the results were not significant with P value of 0.09.

Comparison of IOTN (Aesthetic Component) scores for both appliances at post treatment and one year post treatment has been given in **Table - IV.** When the comparison was made between the two treatment modalities at pre and post treatment, the results showed no difference. When the two appliances were compared at post treatment and one

year post treatment, the results again showed no difference.

An assessment of treatment changes by PAR index in both appliances was studied. PAR scores for the PEA at pre treatment was 24.6 (±8.6), which reduced to 1.0 (±2.8) at post treatment showing a difference of 23.6 (±7.6) (95.9%). This was seen to be statistically significant with a P value <0.01.

PAR scores for the PEA at post treatment was 1.0 (±2.8), which increased to 2.7 (±4.2) at one year post treatment showing a difference of (-) 1.7 (±2.4) (170%). This was seen to be statistically significant with a P value of <0.05.

PAR scores for the Begg at pre treatment was 26.5 (±11.3), which reduced to 8.7 (±2.3) at post treatment showing a difference of 17.8 (±10.0) (67.2%). This was seen to be statistically significant with a P value <0.01.

PAR scores for the Begg at post treatment was 8.7 (±2.3), which increased to 10.1 (±4.5) at one year post treatment showing a difference of (-) 1.4 (±2.6) (16.1%). This was seen to be statistically insignificant with a P value of 0.12.

Comparison of IOTN (Dental Health Component) scores for both appliances was studied. IOTN (Dental Health Component) scores for the PEA at pre treatment was 4.2 (±0.8), which reduced to 1.1 (±0.3) at post treatment showing a difference of 3.1 (±0.9) (73.8%). This was seen to be statistically significant with a P value <0.01.

IOTN (Dental Health Component) scores for the PEA at post treatment was 1.1 (±0.3), which increased to 1.6 (±0.7) at one year post treatment showing a difference of (-) 0.5 (±0.5) (45.5%). This was seen to be statistically significant with a P value <0.05.

IOTN (Dental Health Component) scores for the Begg at pre treatment was 3.9 (±0.3), which reduced to 1.9 (±0.3) at post treatment showing a difference of 2.0 (±0.5) (51.3%). This was seen to be statistically significant with a P value <0.01.

IOTN (Dental Health Component) scores for the Begg at post treatment was 2.0 (±0.5), which increased to 2.1 (±0.6) at one year post treatment showing a difference of (-) 0.2 (±0.6) (10.5%). This was seen to be statistically insignificant with a P value 0.32.

Comparison of IOTN (Aesthetic Component) scores for both appliances was done. IOTN (Aesthetic Component) scores for the PEA at pre treatment was 3.1 (±0.7), which reduced to 1.0 (±0.0) at post treatment showing a difference of 2.1 (±0.7) (67.7%). This was seen to be statistically significant with a P value <0.01.

IOTN (Aesthetic Component) scores for the PEA at post treatment was 1.0 (±0.0), which remained same at 1.0 (±0.0) at one year post treatment showing no difference. P value was 1.00, which was not statistically significant.

IOTN (Aesthetic Component) scores for the Begg at pre treatment was 4.3 (±1.8), which reduced to 1.2 (±0.4) at post treatment showing a difference of 3.1 (±1.6) (72.1%). This was seen to be statistically significant with a P value <0.01.

IOTN (Aesthetic Component) scores for the Begg at post treatment was 1.2 (±0.4), which increased to 1.3 (±1.5) at one year post treatment showing a difference of (-) 0.1 (±0.6) (8.3%). This was seen to be statistically insignificant with a P value 0.56.

DISCUSSION

PAR scores for both PEA and Begg appliances showed that there is more decline in the scores of PEA when we compare pre and post treatment results. This outcome was well supported by study done by Nigel (1993)[7]. He assessed PAR index on 100 cases and results showed that PAR score for pretreatment ranges from 21 to 30, which was suggestive of "treatment need". Post treatment score ranges from 1 to 10 suggested to be of good treatment outcome.

Table 4: Assessment of the treatment outcome of esthetic component index at post and 1 year post treatment.

Mann Whitney Test*

Group	Esthetic Score	Pre treatment		Post treatment		1 year Post treatment	
		PEA	Begg	PEA	Begg	PEA	Begg
Non Extraction	1 – 3	7	2	10	10	10	10
	4 – 6	3	7	—	—	—	—
	7– 10	—	1	—	—	—	—
	PEA Vs Begg	—		**No difference**		**No difference**	

When post and one year post treatment PAR scores were compared, both appliances showed increase in the scores which indicates slight deterioration in the occlusion and alignment. This outcome was well supported by study done by Otuyemi, Jones (1995)[8]. They concluded that maintenance of post treatment results was only achieved in 38 to 60 per cent of the cases. The major factor involved in this deterioration appeared to be lower anterior crowding.

Comparison of IOTN (Dental Health Component) scores for both appliances at pre and post treatment was done; the results were highly significant ($P < 0.001$) showing that the PEA appliance has outweighed the Begg appliance in performance.

When the same comparison was done at post treatment and 1 year post treatment, relapse did occur in both appliances but PEA still performs better.

This outcome was well supported by study done by Kahl, Fishbach, Schwarze (1995)[8]. They did a long term follow up of the orthodontically treated cases.They observed that the lower incisor crowding may increase in the follow up post treatment phase.

When comparison of IOTN (aesthetic component) scores for the non extraction group was done, the results showed that whether at post treatment or 1 year post treatment there was no difference seen in the performance of Begg and PEA appliance.

This outcome was well supported by study done by Buchanan et al (1994)[9] in which they said that Aesthetic Component of IOTN index may not be that precise in evaluating minute malocclusion details as it is evaluated from frontal dental photographs. Hence a three dimensional problem is effectively converted into a two dimensional one.

When a comparison is made between post and one year post treatment changes assessed by PAR index, the PEA appliance showed a percentage reduction of 95.9% which was significant statistically ($P<0.01$), whereas Begg appliance showed a percentage reduction of 67.2% which was also significant statistically ($P<0.01$). These values showed that PEA appliance is quite superior as compared to Begg appliance. This outcome was well supported by study done by Buchanan, Russell, Clark (1996)[10]. In this study they calculated the PAR scores for Pre Adjusted Edgewise and Begg appliance pre and post treatment. They found that the Pre Adjusted Edgewise group achieved a significantly greater reduction in PAR scores than Begg group.

When the same comparison was done at one year post treatment, both appliances showed increase in scores, PEA slightly more than Begg, which indicates deterioration in the occlusion after 1 year. This outcome was well supported by study done by Kahl, Fishbach, Schwarze (1995)[8]. According to this

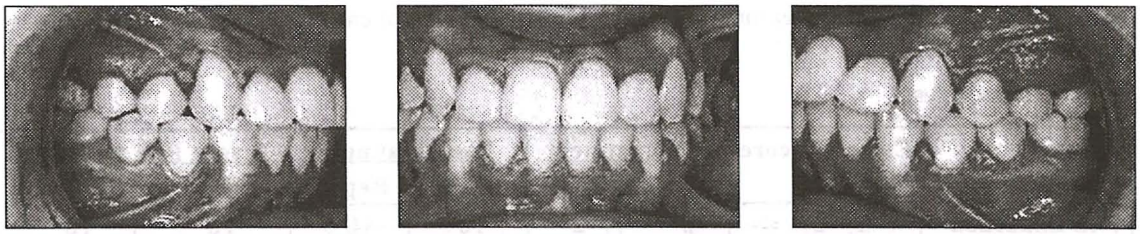


Figure 6. Post treatment records of patient L.M. treated with PEA mechanotherapy.

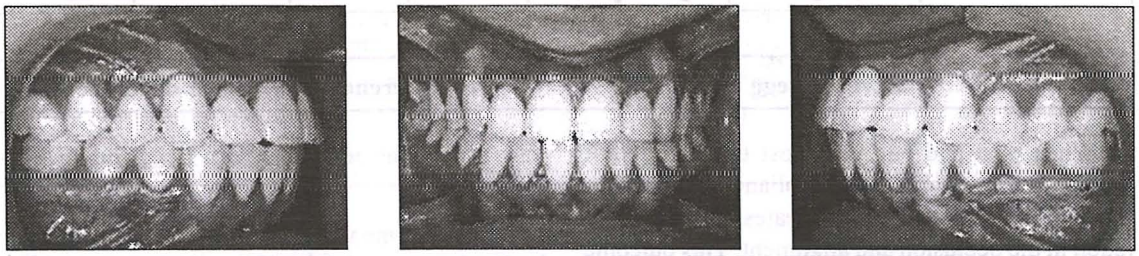


Figure 7. 1 year post treatment records of patient L.M. treated with PEA mechanotherapy.

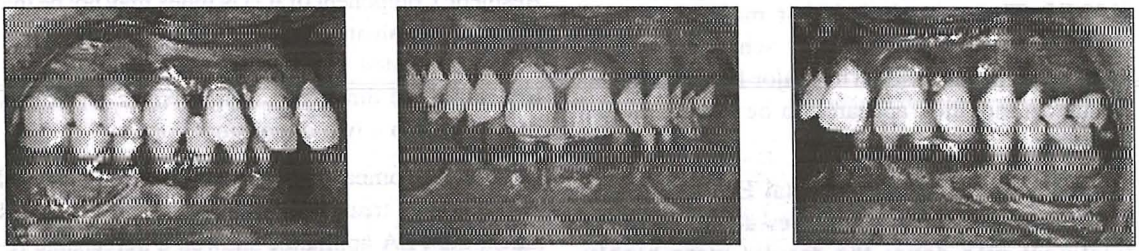


Figure 8. Pre-treatment records of patient G.C. treated with Begg mechanotherapy.

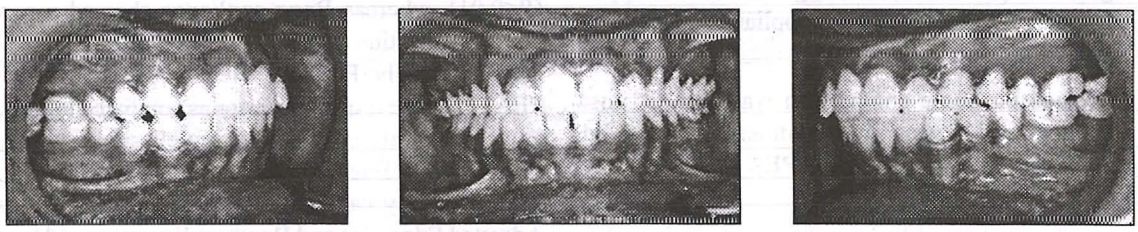


Figure 9. Post-treatment records of patient G.C. treated with Begg mechanotherapy.

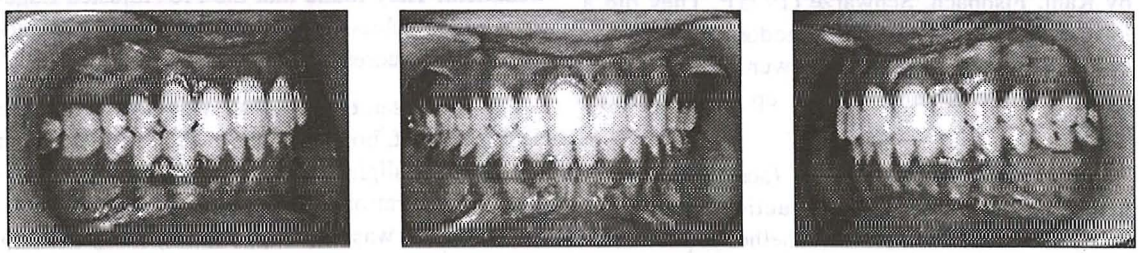


Figure 10. 1 year post treatment records of patient G.C. treated with Begg mechanotherapy.

study they found out that there are more chances of late mandibular crowding in the non extraction group.

When changes were assessed at pre and post treatment by Dental Health Component of IOTN index in both appliances, the results were significant with 73.8% reduction for PEA (P<0.01) and 51.3 % reduction for Begg appliance (P<0.01) and are weighed in favour of PEA mechanotherapy. This outcome was well supported by study done by Cooper, Mandall, Diabase (2000)[11] which suggested that IOTN was a good tool for measuring treatment need.

When the same comparison was done at one year post treatment in both appliances, Dental Health Component scores were increased for both appliances with 45.5% for PEA (P<0.05) and 10.5% for Begg (P=0.32). This indicates that more relapse has taken place in PEA than the Begg. This outcome was well supported by study done by Paquette, Beattie, Johnston (1992)[12] who found out that there are more chances of relapse in lower incisor crowding in non extraction cases.

When pre and post treatment changes were assessed by Aesthetic component of IOTN index in both appliances, the results are significant with 67.7% reduction for PEA (P<0.01) and 72.1% reduction for Begg appliance (P<0.01). This showed that Begg appliance performed better in non extraction cases than extraction cases. This outcome was well supported by study done by Cooper, Mandall, Diabase (2000)[12] which suggested that IOTN was a good tool for measuring treatment need.

When the same comparison was done at one year post treatment the results were not significant with 0.0% for PEA (P=1.00) and 8.3% for Begg appliance (P=0.56).That shows that results in PEA appliance are more stable as compared to Begg appliance. This outcome was well supported by study done by Buchman, Downing, Stirrups (1994)[9] in which they said that Aesthetic Component may not be that precise in evaluating minute malocclusion details as it is evaluated from frontal dental photographs.

Although IOTN and PAR are both reliable and valid, both have some limitations. The limitations are as under:

1. The two indices were developed to assess pretreatment and post treatment as separate entities. However, additional training is required and therefore duplicates efforts of measuring similar occlusal traits.
2. Treatment categorization can be contradictory using the dental health component and the Aesthetic component.
3. A separate protocol of the hierarchical structure of the dental health component is required only when study models are available.
4. The indices have been validated using UK dental opinion, and therefore may not represent professional opinion of other countries.
5. The PAR index has been found to be unduly harsh on treatments with limitations and has been criticized for leniency on residual extraction space, unfavorable incisor inclination and rotation.
6. There is immense difficulty in assessing the parameters of periodontal destruction, decalcification, root resorption, dynamic occlusion and facial aesthetics. The PAR index takes no notice of these factors.

CONCLUSION

Although many occlusal indices have been put forth to classify or digitize the malocclusion, they all have some drawbacks. The PAR and IOTN indices are no different. Hence the need for constant updating and modification as and when the incongruencies arise.

As far as appliances are concerned the PEA appliance has definitely performed better as compared to Begg appliance. When the results are followed for one year it was noticed that there is a tendency for relapse in both appliances more so in the extraction cases.

SUMMARY

The PAR index seems to be sensitive enough to determine differences in outcome between the

Pre-Adjusted Edgewise and Begg treatment techniques. So, a measure has been developed to assess improvement objectively. Using the PAR index it was revealed that at least 30 per cent reduction was needed for a case to be judged 'improved' and change in score usually of 22 (70%) to bring about a change judged to be greatly improved.

For a practitioner to demonstrate high standards, the proportion of an individual's case load lying in the 'worse or no different category should be negligible and the mean percentage reduction should be as high as possible (e.g. greater than 70 per cent). The greater the mean percentage reduction in PAR scores, the higher the standard of orthodontics achieved. If the mean percentage reduction is high and the proportion of cases that have been greatly improved is also high this indicates that the practitioner is treating a greater proportion of cases with a clear need for treatment, to a high standard. Both, IOTN and PAR index can be used as epidemiological tools.

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