Original Article

Evaluation of Mandibular Incisor Extraction Treatment Outcome in Patients with Bolton Discrepancy Using Peer Assessment Rating Index

SM. Safavi[1], **AH. Namazi**[2]

[1]Associate professor of orthodontics, Dental Research Center and Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Researcher, Dentofacial Deformity Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract

Objective: Mandibular incisor extraction in carefully selected cases as an alternative option to four bicuspid extraction or non extraction treatment has been advocated. The purpose of this study was to determine the degree of improvement in occlusion in patients with Bolton discrepancy treated by one lower incisor extraction using Peer Assessment Rating Index (PAR indexes).

Materials and Methods: Pre and post treatment dental casts of 14 patients treated with one lower incisor extraction were included in the study. Pre and post treatment dental casts were scored with PAR index. 70% reduction in PAR index was considered as high standard improvement. To test the hypothesis that the mean improvement in dental occlusion after one mandibular incisor extraction is at least 70%, one-tail one-sample student t-test was used.

Results: The mean improvement in dental occlusion in this group of patients was 78%. Fifty percent of the cases finished with a post treatment PAR score of 2. Spearman correlation coefficient was 0.763 ($p<0.01$), showing that more severe cases had greater post treatment PAR scores.

Conclusion: Mandibular incisor extraction treatment may provide a high standard treatment outcome.

Key Words: Mandibular Incisor Extraction; PAR Index; Treatment Outcome

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Corresponding author:
SM. Safavi, Department of Orthodontics, Faculty of Dentistry, and research Center of Shahid Beheshti University of Medical Sciences, Tehran, Iran
safavimr@yahoo.com

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INTRODUCTION

Mandibular incisor extraction as an alternative option to first/second premolar extractions in carefully selected cases has been advocated by many investigators [1-3]. Canut indicated mandibular incisor extraction in four types of clinical situations; namely, anomalies in the number of anterior teeth, tooth size anomalies, ectopic eruption of incisors and moderate class III malocclusions [4]. Advantages and limitations of lower incisor extraction have been described by expert authors [5-10]. The most important advantage of this option is reducing treatment time and costs, maintenance of harmonious profile and more stable results in the anterior region. Possible disadvantages or side effects of this option include the development of a black triangle at the extraction site, space

Fig 1 (A). Cl I malocclusion , No crowding in upper arch, nice posterior intercuspation 5mm of crowding in lower arch and Bolton discrepancy (narrow upper lateral incisors).

reopening and creation of a midline discrepancy and increased over jet. Traditionally, an ideal occlusion is considered as the gold standard for assessment of orthodontic treatment outcomes. If the ideal occlusion is the ultimate goal, lower incisor extraction treatment provides less than ideal results and may be considered as a compromised treatment option. However, in contemporary orthodontics, patient expectations and preferences as well as cost effectiveness of various options should be included in the treatment planning process. It has been suggested that extraction of one mandibular incisor in carefully selected cases not only effectively treats the problem of crowding but also may significantly reduce the risks and costs of treatment.

To evaluate the effectiveness of an orthodontic treatment outcome, several reliable indices have been introduced in the literature. The PAR index has been used in several studies and has been shown to have good reliability and validity [11-14].

The purpose of this study was to evaluate the effectiveness of mandibular incisor extraction in a group of patients with Bolton discrepancy and mandibular incisor crowding using the Peer Assessment Rating Index.

MATERIAL AND METHODS

Pre and post treatment dental casts of fourteen patients treated with one lower incisor extraction were used in this study. The subjects were selected according to the following criteria: *i)*

Table 1. Descriptive statistics of mandibulatr incisor extraction treatment

	n	Mean	SD	Min	Max
Pre-treatment PAR Score	14	9.43	3.46	5	17
Post-treatment PAR Score	14	2.14	.86	1	4
Improvement	14	78.03	5.10	70	85.5

Figure 1 (B). Extraction of one mandibular incisor solved the problem of crowding.in lower arch. Without any change in normal posterior occlusion Note the role of Bolton discrepancy in prevention of increased over jet or canine or molar Cl III relationship

Presence of all permanent teeth (excluding third molars) in pretreatment casts, *ii)* Completion of a full course of orthodontic treatment with one mandibular incisor extraction and *iii*) Presence of Bolton discrepancy. Patients with missing mandibular incisors and those who had extractions of other teeth were excluded. Peer Assessment Rating Index (PAR index) described by Richmond et al. [14] was used to evaluate pre/post treatment occlusal variables. Treatment effectiveness was considered as 70% reduction in the PAR index [15]. For intra-examiner reliability, one examiner (AHN) assessed 5 randomly selected cases at two separate time intervals (3 weeks). The assessment was calibrated with a specialist (SMS) experienced in the use of the index who recorded the same randomly selected models. To test the hypothesis that the mean improvement in dental occlusion after one mandibular incisor extraction was at least 70%, one-tail one-sample student t-test was used.

RESULTS

The intra-class correlation coefficient between the examiner's duplicate PAR assessments was 0.91 (0.87-0.93) and that between the examiner and the calibrating specialist was 0.90 (95% CI 0.85-0.92).

The results of the study are presented in Table 1 and indicate that the mean pretreatment PAR index was reduced from 9.43 to 2.14. In other words, the mean improvement in dental occlusion in this group of patients was 78%. The results of statistical analysis (one sample T-test) with test statistic of 5.894 and Df=13 and $p<0.001$ revealed that the null hypothesis (Ho: $\mu \leq 70\%$) was rejected and the study hypothesis was accepted; H1: $\mu > 70\%$ ["lower incisor extraction option can improve the dental occlusion by more than 70%"].

Table 2 shows joint/marginal distribution of pre and post PAR scores of the samples. The sample is sorted according to the pretreatment PAR score; it shows that 50% of the cases finished with a post treatment PAR score of 2, and 21.4% of the cases finished with a post treatment PAR score of 1 and 3. Spearman correlation coefficient was 0.763 with $p<0.01$, which is considered a high positive correlation

Fig 2 (A). Mild upper and severe lower incisor crowding

showing that more severe cases had greater post treatment PAR scores.

DISCUSSION

The results of the present study indicate that in selected cases, lower incisor extraction is an effective treatment option for moderate to severe crowding in the lower anterior region. However, quality assessment of such an option needs a larger sample size, a randomized sampling method and control groups with alternative options. The mean improvement in dental occlusion of this group of patients was 78% which is similar to the findings of Ileri *et al.* [16] and is considered as high standard finishing [15]. Mandibular incisor extraction (MIE) is indicated in certain types of Cl I malocclusions [1, 5].

Class I (Cl I) malocclusions with acceptable soft tissue balance, very mild or no crowding in the upper arch; Bolton discrepancy (narrow upper incisors or wide lower incisors), acceptable posterior occlusion and about 5-6mm of crowding in the lower incisor area are best candidates for MIE. In clinical practice, a patient with all of the above indications has a PAR score of about 5. In well treated cases, the lowest post treatment PAR score of this patient will be 1 (because the midlines are not coincident). This is equivalent to 80% improvement in treatment outcome (80% reduction in PAR score). This was the case for three of the patients in our sample. (Fig 1)

Post treatment PAR scores increase significantly in Cl I malocclusions with a normal Bolton ratio, if a single mandibular incisor is extracted, due to an increase of over jet or movement of lower canines into a Cl III relationship in one/both sides which severely compromise the treatment outcome. Narrow upper lateral incisors do not guaranty perfect finishing (Fig 2). Reduction of the mesiodistal widths of upper incisors improve the finishing specially in cases with very mild or no crowding in the upper arch [10, 16]. Mandibular incisor extraction is also indicated in mild Cl III patients with an open bite tendency who do not require sagittal alterations in the posterior occlusion [7]. The Cl III cases in our sample had higher pretreatment PAR scores. This was due to the presence of an anterior/posterior cross bite, decreased over bite and half cusp Cl III relation in the buccal segments. Mean post treatment PAR scores of Cl III cases were greater than the Cl l cases mainly due to the presence of a Cl III canine relationship.

Fig 2 (B). Extraction of one mandibular incisor solved the problem of crowding. in lower arch. In spite of narrow upper lateral incisors and interproximal reduction, the case finished with post treatment PAR score of 3 because of right and left Cl III canine relation and mid line deviation.

Mandibular incisor extraction is usually recommended in minimum overbite cases [8, 10]. However, in our sample, there were two Cl II subdivision cases with moderate to severe deep bites that were effectively treated.

In the above cases, extraction of a mandibular lateral incisor at the Cl II side contributed to the correction of the canine Cl II relationship and relief of crowding in the incisor/premolar areas (Fig 3).

In contemporary orthodontics, the achievement of ideal occlusion at the expense of soft tissue balance, periodontal health, occlusal stability and prolonged duration of treatment is questioned. A compromised treatment option with less than ideal treatment outcome may be preferred over an ideal plan with considerable treatment duration, costs and risks.

For example, class II malocclusion treatment with 2 maxillary premolar extractions in

Table 2. Joint distribution of pre and post PAR scores.Fifty percent of cases finished with PAR score of 2 and more severe cases finished with greater PAR scores.

Pre-Treatment PAR score	Post- treatment PAR score				Total No. (percent)
	1	2	3	4	
5	3				3 (21.4)
8		2			2 (14.3)
9		2			2 (14.3)
10		1	3		4 (28.6)
11		1			1 (7.1)
15		1			1 (7.1)
17				1	1 (7.1)
Total (percent)	**3 21.4**	**7 50.0**	**3 21.4**	**1 7.1**	**14 100**

Fig. 3 (A). Cl II sub division left, mild upper and sever lower left quadrant crowding and, increased over bite.

Fig 3 (B). Extraction of one mandibular incisor facilitated alleviation of crowding and canine relationship simultaneously. Post treatment PAR score of this patient is 2 because of molar Cl III relation in left side and mid line deviation

selected cases (upper incisor crowding or protrusion) is preferred both by patients and orthodontists. It is considered as an efficient treatment option compared to the 4-premolar-extraction protocol, as it achieves the same functional, stability and esthetic results with less patient costs and risks [17].

Mandibular incisor extraction is indicated when both the orthodontist and the patient consider it as an efficient approach. One possible alternative to mandibular incisor extraction in these patients is upper arch expansion and creating space to build up narrow upper incisors. Although other alternatives may produce better occlusal results, they lead to significantly higher costs and risks. Patients have the right to contribute to the treatment planning process. If mandibular incisor extraction is preferred to other alternative options, he or she has made an informed decision regarding its possible disadvantages. All the treated cases were satisfied with the results; this was because they contributed to the selection of the option, which well aligned their crowded inci-

sors and was remained unchanged thereafter with fixed retainers. The most important limitation in this study was the restricted number of cases available. Indications of mandibular incisor extraction are limited to situations in which costs and risks of classic treatment options (non-extraction or four bicuspid extractions) surpass its benefits. In this study PAR index was used to evaluate treatment outcomes.

The PAR index only measures the occlusal aspect of treatment outcomes. Recent grading systems focus on other aspects of treatment outcomes including treatment efficiency, facial/arch form, dental esthetics, preservation of the periodontium and root resorption [14]. Another limitation was the retrospective design of this study. A prospective study design with sufficient sample size and an advanced index or grading system will provide more valuable evidence.

CONCLUSION

Mandibular incisor extraction may effectively improve dental occlusion when assessed with PAR index. There is a positive correlation between pre and post PAR scores. More severe cases tend to finish with a greater PAR scores.

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REFERENCES

1- Bahreman AA. Lower incisor extraction in orthodontic treatment. Am J Orthod. 1977 Nov;72(5):560-7.

2- Kokich VG, Shapiro PA. Lower incisor extraction in orthodontic treatment. Four clinical reports. Angle Orthod. 1984 Apr;54(2):139-53.

3- Valinoti JR. Mandibular incisor extraction therapy. Am J Orthod Dentofacial Orthop. 1994 Feb;105(2):107-16.

4- Canut JA. Mandibular incisor extraction: indications and long-term evaluation. Eur J Orthod. 1996 Oct;18(5):485-9.

5- Riedel RA, Little RM, Bui TD. Mandibular incisor extraction--postretention evaluation of stability and relapse. Angle Orthod. 1992 Summer;62(2):103-16.

6- Klein DJ. The mandibular central incisor, an extraction option. Am J Orthod Dentofacial Orthop. 1997 Mar;111(3):253-9.

7- Faerovig E, Zachrisson BU. Effects of mandibular incisor extraction on anterior occlusion in adults with Class III malocclusion and reduced overbite. Am J Orthod Dentofacial Orthop. 1999 Feb;115(2):113-24.

8- Kokich VO, Jr. Treatment of a Class I malocclusion with a carious mandibular incisor and no Bolton discrepancy. Am J Orthod Dentofacial Orthop. 2000 Jul;118(1):107-13.

9- Bayram M Ozer M Mandibular Incisor Extraction Treatment of a Class I Malocclusion with Bolton Discrepancy: A Case Report. Eur J Dent. 2007 January; 1(1):54-9

10- Uribe F, Nanda R. Considerations in mandibular incisor extraction cases. J Clin Orthod. 2009 Jan;43(1):45-51.

11- Birkeland K, Furevik J, Boe OE, Wisth PJ. Evaluation of treatment and post-treatment changes by the PAR Index. Eur J Orthod. 1997 Jun;19(3):279-88.

12- Dyken RA, Sadowsky PL, Hurst D. Orthodontic outcomes assessment using the peer assessment rating index. Angle Orthod. 2001 Jun;71(3):164-9.

13- Holman JK, Hans MG, Nelson S, Powers MP. An assessment of extraction versus nonextraction orthodontic treatment using the peer assessment rating (PAR) index. Angle Orthod. 1998 Dec;68(6):527-34.

14- Richmond S, Shaw WC, O'Brien KD, Buchanan IB, Jones R, Stephens CD, et al. The development of the PAR Index (Peer Assessment Rating): reliability and validity. Eur J Orthod. 1992 Apr;14(2):125-39.

15- Richmond S, Shaw W, Roberts C, Andrews M. The PAR Index (Peer Assessment Rating): methods to determine outcome of orthodontic treatment in terms of improvement and standards. The European Journal of Orthodontics. 1992;14(3):180-7.
16- Ileri Z, Basciftci FA, Malkoc S, Ramoglu SI. Comparison of the outcomes of the lower incisor extraction, premolar extraction and non-extraction treatments. Eur J Orthod. 2011 Jul 10.
17- de Almeida-Pedrin RR, Henriques JF, de Almeida RR, de Almeida MR, McNamara JA, Jr. Effects of the pendulum appliance, cervical headgear, and 2 premolar extractions followed by fixed appliances in patients with Class II malocclusion. Am J Orthod Dentofacial Orthop. 2009 Dec;136(6):833-42.