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Original Article

Relationship between Orthodontic Expertise and Perception of Need for Orthodontic Treatment for Mandibular Protrusion in Japan

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The aims of this study were to investigate how the Peer Assessment Rating (PAR index) predicts the perceived need for orthodontic treatment of mandibular protrusion in Japanese subjects, and to elucidate whether the perceived need for treatment was affected by the raters' orthodontic expertise. The subjects were 110 dental students and 32 orthodontists. We showed them casts of 10 untreated mandibular protrusion cases and gave them a questionnaire in which they had to describe their perceptions of the orthodontic treatment needs using a 10-point visual analog scale (VAS). The PAR index was used for cast evaluation. The PAR index scores showed significant correlations with the VAS scores. In casts with a low PAR score, there were no differences in the VAS scores between orthodontists and students. In casts with a PAR score greater than 23, the orthodontists perceived a significantly greater treatment need than did the students; for scores of 22, 28, and 29, students who had received orthodontic treatment themselves were more likely to perceive the treatment need. The PAR index is a good clinical predictor for assessing the perceived treatment needs for mandibular protrusion. Perception of the need for orthodontic treatment for mandibular protrusion depended on the degree of orthodontic expertise in Japanese subjects.

Key words: orthodontic expertise, treatment need, PAR index, mandibular protrusion

Class III malocclusion is one of the most challenging conditions for orthodontists to treat, and is especially common in the Asian population [1]. The prevalence of Class III malocclusion is approximately 3.0% in Caucasian subjects [2], rising to 12.0% in Chinese, 19.0% in Korean and 13.0% in Japanese subjects [3, 4]. Fully one-third of the orthodontic patients who receive orthodontic therapy in Japan exhibit a Class III malocclusion [5]. Most Class III patients visit an orthodontic clinic hoping to improve their aesthetic traits. Orthodontists often find that the patients also have functional problems [6]. These complex problems make treatment more difficult. In modern dentistry and orthodontics, most treatments are elective, and patients actively participate in decision-making process. Some patients visit

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orthodontic clinics independently or are persuaded by their family, whereas others might be recommended by their family dentist. The definition of treatment needs is usually based on the orthodontist's assessment, who then suggests the treatment that they think is appropriate to the patient. Some investigations suggest that the perception of orthodontic treatment needs can differ among dentists (including orthodontists) because of possible differences in dental knowledge and education [7]. In addition, some differences in the recognition of orthodontic treatment needs have been shown between patients and dentists [8, 9]. Therefore, it is important for orthodontists to understand how the perception of orthodontic treatment needs differs among patients. However, few studies have revealed whether patients' recognition of their treatment needs becomes more accurate as they gain experience and knowledge of orthodontic treatment. Consequently, the decision to undergo orthodontic treatment often rests on poorly defined criteria, emphasizing that demand and need might be distinct entities [10].

In the past, various types of occlusal indices have been developed for clinical use, such as the Angle classification, the orthodontic treatment priority index [11], the orthodontic treatment need (IOTN) [12], the index of complexity, outcome and need [13], the American Board of Objective grading system [14] and the Peer Assessment Rating (PAR index) [15]. The PAR index was established to provide a summary score for occlusal anomalies and estimate how far a malocclusion deviates from normal alignment; it is used by orthodontists for objective evaluation of malocclusions. This is a measure of occlusal change that allocates scores to (1) alignment of the dentition (including impactions), (2) buccal segment relationship, (3) overjet, (4) overbite, and (5) midline discrepancy. It is applied to pretreatment and posttreatment dental casts, with changes in PAR scores reflecting the treatment's effect on dental occlusion and alignment. The PAR index is now one of the most popularly used methods to assess the effects of treatment in a variety of circumstances [16–18]. Although the PAR index was not originally designed or validated as an index of treatment needs, several studies have recently indicated that the PAR index is highly correlated with the treatment needs based on orthodontists' subjective assessments [19–21].

We previously demonstrated that there was a significant correlation between the PAR index and the perception of treatment needs not only by orthodontists, but also by non-experts, and that the PAR index could be a clinically useful predictor for evaluating casts with Class II malocclusion in Japanese subjects [22]. However, we also clarified that there are some problems that arise during the application of the PAR index as a predictor of perceived orthodontic treatment needs. The perceived needs for treatment of normal occlusion to mild maxillary protrusion did not depend on the level of professional expertise; however, when the cast of maxillary protrusion showed a high PAR index score, the perception of the need for treatment of the occlusion was significantly increased, and depended on the expertise in dentistry and orthodontics. In Japanese subjects, maxillary protrusion is generally considered to be more favored than mandibular protrusion in terms of facial aesthetics [23, 24]. In addition, the Japanese cephalometric norm has a tendency toward maxillary protrusion compared with Caucasian subjects [25, 26]. These findings suggest that the type of malocclusion might interact with the perception of orthodontic treatment needs according to ethnic background as well as professional expertise.

The aims of this study were to evaluate how the PAR index predicts the perceived need for orthodontic treatment of mandibular protrusion in Japanese subjects, and to elucidate whether the perceived treatment need differed according to the raters' orthodontic expertise.

Subjects and Methods

This study was approved and performed as a part of the undergraduate programs of Okayama University Dental School. Informed consent was obtained from all subjects.

The subjects in this study were 142 people (66 males, 76 females; mean age, 24.5 years; SD, 5.3 years), including 110 undergraduate dental students (47 males, 63 females; mean age, 22.3 years; SD, 2.7 years) from Okayama University Dental School and 32 orthodontists (19 males, 13 females; mean age, 31.6 years; SD, 5.8 years) from Okayama University Hospital. None of the undergraduate students had any clinical practice or education with respect to orthodontic issues.

Dental casts of 10 patients with untreated mandibular protrusion were selected to show a sequential decrease in overjet from 3.0 mm to −5.0 mm, while those with moderate or severe crowding were excluded (Fig. 1). The PAR index was calculated three times for each dental cast by three investigators (Y. K., H. T., R. Y.), who had been assessed to ensure that their findings displayed reasonable conformity. We randomly displayed the casts and gave the subjects a questionnaire in which they had to describe their perceptions of the need for orthodontic treatment using a 10-point visual analog scale (VAS). The VAS was composed of a 10-cm line with anchors at each end ranging from "no need to treat" (0 cm) to "requires extensive treatment" (10 cm). We also asked students whether they had ever received orthodontic treatment.

Statistical analysis. An analysis of variance (ANOVA) and Fisher's protected least-significant difference were used to compare the PAR and VAS scores of the casts and the perception of treatment needs between subject groups. The Spearman rank correlation was used to evaluate the correlations between the PAR index, VAS score and overjet. P values ≤ 0.05 were considered to be significant. All analyses were carried out with a statistical analysis software program (JMP, SAS Institute, Inc., Cary, NC, USA).

Results

The PAR index was strongly correlated with the VAS score for evaluating the casts (Tables 1 and 2). There were also significant correlations between the VAS score and overjet, and between the PAR index and overjet on cast evaluation (Table 2). The greater

Table 1 VAS score for perception of treatment needs

Cast	PAR index	Overjet (mm)	VAS value	
			Mean	SD
A	7	3.0	2.2	1.9
B	11	2.5	3.3	2.4
C	12	1.0	3.7	2.5
D	18	1.0	3.1	2.4
E	22	0.0	2.7	2.3
F	28	−1.0	6.4	2.5
G	29	−1.5	6.4	2.3
H	32	−3.0	7.6	1.9
I	37	−4.5	8.3	1.6
J	43	−5.0	8.5	1.5

Fig. 1 Dental casts of 10 subjects with untreated mandibular protrusion.

the PAR index, the greater the perceived need for treatment (Table 1).

The VAS score was significantly higher when the cast of mandibular protrusion had a PAR index of more than 23 and an overjet below −0.5 mm in the evaluations by both orthodontists and dental students (Fig. 2). In the evaluation of casts with a PAR index below 19 and with positive overjet (Figs. 1A–D), there were no significant difference in the VAS scores between orthodontists and students (Fig. 2, Table 3). In contrast, in casts with severe malocclusion with a PAR index more than 23 and an overjet below −0.5 mm, orthodontists perceived a significantly greater treatment need than did students (Figs. 1E–J, Fig. 2 and Table 3).

Among the 110 undergraduate dental students, there were characteristic differences between the 38 students who had received orthodontic treatment in the past (w/Tx) (13 males, 25 females; mean age, 21.8 years; SD, 2.3 years) and 72 students without past orthodontic treatment (wo/Tx) (34 males, 38 females; mean age, 22.6 years; SD, 2.8 years) with regard to the perceptions about orthodontic treatment needs. Students w/Tx perceived a significantly greater need for treatment than did students wo/Tx when the casts had a PAR index of 22, 28, or 29 (Figs. 1E–G, Fig. 3, Table 4).

Table 2 Pearson correlation coefficients for perception of treatment need

	Correlation	*P value*
PAR index and VAS score	0.9065	<0.001
PAR index and overjet	0.9762	<0.001
Overjet and VAS score	0.8814	<0.001

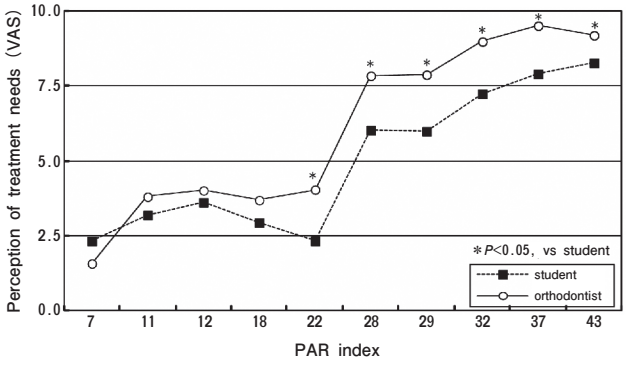

Fig. 2 Comparison of the perception of treatment needs between students and orthodontists.

Discussion

Quantitative measurements of the perception of orthodontic treatment needs are considered to be clinically valuable. In this study, we compared the perceptions of orthodontic treatment needs of orthodontists and dental students using the PAR index. The present study suggests that the PAR index is a good predictor of the need for orthodontic treatment of mandibular protrusion in Japanese subjects. The PAR index was closely correlated with both the orthodontists' and dental students' perception of the treatment

Table 3 VAS score for perception of treatment needs of students and orthodontists

		VAS score			
		Students		Orthodontists	
Cast	PAR index	Mean	SD	Mean	SD
A	7	2.3	1.9	1.6	1.5
B	11	3.2	2.3	3.8	2.4
C	12	3.6	2.4	4.0	2.6
D	18	2.9	2.4	3.7	2.6
E	22	2.3	2.2	4.0	2.3
F	28	6.0	2.5	7.8	1.9
G	29	6.0	2.3	7.9	1.8
H	32	7.2	1.9	9.0	1.3
I	37	7.9	1.6	9.5	0.6
J	43	8.3	1.6	9.2	1.2

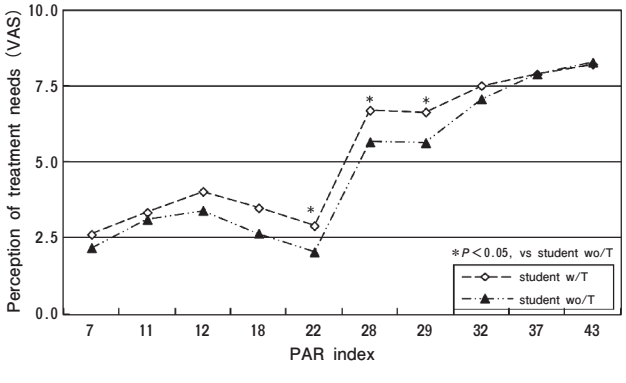

Fig. 3 A comparison of the perceptions of treatment needs between students with and without a history of orthodontic treatment.

Table 4 VAS score for perception of treatment needs of students with or without past orthodontic treatment

		VAS score			
		w/Treatment		wo/Treatment	
Cast	PAR index	Mean	SD	Mean	SD
A	7	2.6	2.2	2.2	1.8
B	11	3.3	2.1	3.1	2.5
C	12	4.0	2.6	3.4	2.3
D	18	3.5	2.4	2.7	2.4
E	22	2.9	2.2	2.0	2.2
F	28	6.7	1.9	5.7	2.7
G	29	6.7	1.7	5.6	2.5
H	32	7.5	1.6	7.1	2.0
I	37	7.9	1.7	7.9	1.6
J	43	8.2	1.7	8.3	1.5

needs. The greater the PAR index of the cast, the greater the perceived treatment needs in the cast evaluation.

The perceived orthodontic treatment needs showed a rapid increase when the cast of mandibular protrusion had a PAR index greater than 23 in both the orthodontist and student groups. In the evaluation of casts with low PAR scores, there were no significant differences in the perception of treatment needs between the 2 groups. In the casts with PAR scores greater than 19, orthodontists recognized the treatment needs more effectively than students. This indicates that the perceived need for treatment of normal occlusion to mild mandibular protrusion was not affected by professional expertise; in contrast, the perceived needs for treatment of moderate to severe mandibular protrusion depended on the level of professional expertise. This trend was similar to the assessment of the perceived treatment needs for maxillary protrusion in our previous study [22].

There was a characteristic perception gap between students who had undergone orthodontic treatment and students who had not. The students with a history of orthodontic treatment recognized the treatment needs more effectively than the students without past orthodontic treatment, but only in casts with a PAR score of 22, 28, or 29. In this study, the cases with PAR scores of 22, 28, and 29 had an overjet of 0.0 mm, −1.0 mm and −1.5 mm. A previous study indicated that overjet was a major occlusal trait that greatly influences dental esthetics [27]. Generally, an obvious reverse overjet which shows an anterior cross bite can be easily recognized and noted as a therapeutic objective. In contrast, it might be difficult to evaluate the necessity for treatment in casts with an overjet around 0 mm. The Dental Health Component of the IOTN evaluates "Grade 2; reverse overjet greater than 0 mm but less than or equal to 1 mm" as "Little treatment need" [12]. The casts with an overjet from 0.0 mm to −1.5 mm, which had a PAR scores of 22, 28, and 29 in this study, might be considered borderline for orthodontic treatment by non-experts. Although none of the students had received any clinical practice or education with respect to orthodontic issues, it would be appear that students with past orthodontic treatment had more knowledge regarding orthodontics as a result of their treatment than the students without past orthodontic treatment. Consequently, the level of orthodontic expertise might influence the perception of orthodontic treatment needs for mandibular protrusion based on occlusion.

Our data also indicated that the optimal PAR index cutoff score varies with the type of malocclusion. In Asian subjects, a PAR index of 17, which is a well-recognized optimal cutoff score based on the decisions of orthodontic experts in Caucasian subjects, was found to be the optimum cutoff for presumed compromised dental health, but a PAR index of 20 was considered to be the optimal cutoff score for esthetic impairment [27, 28]. We previously reported that a PAR index of 17 was adequate for orthodontists but might be low for dental students' perceptions regarding maxillary protrusion in Japanese subjects [22]. Compared with the maxillary protrusion, the cutoff value of the PAR index in cases of mandibular protrusion had a tendency to be higher. The PAR index cutoff score of 17 was low for both the orthodontists' and dental students' perceived treatment needs for mandibular protrusion in Japanese subjects.

The relationship between physician and patient has become more and more delicate and requires an appropriate amount of attention and balance. This holds true in all medical disciplines and, in particular, in cases of plastic surgery, which deals with the correction of perceived and actual body deformities, and patients often misunderstand treatment outcomes or have inappropriate expectations [29]. Although there are few equivalent studies in other areas of medicine, some researchers have found differences in treatment

choices depending on whether the subject has expertise in the field of plastic surgery. Foo *et al.* reported that there exist differences in facial aesthetics ratings and perceived need for further surgery of a repaired cleft among plastic surgeons, dentists, orthodontists, psychologists and laypeople with or without a cleft [30]. Additionally, Mani *et al.* concluded that there were different perceived treatment needs among professionals and laypeople and patients in secondary surgical treatment for nasolabial appearance in adults with repaired unilateral cleft lip and palate [31]. These studies suggest that plastic surgeons should consider the differences in the perceptions of treatment need when managing cleft treatment expectations.

It is also clinically important for orthodontists to understand the perception of treatment needs by patients and to be able to assess patients by quantitative measurements to develop the best approach with regard to treatment preference and in order to set individual treatment goals. The present study found that there are differences in the perceptions of orthodontic treatment need between professionals and nonprofessionals. Although the student group was not composed of patients or the general public, none of the students had any clinical experience, nor had any of them completed a preclinical course in orthodontics. Hence, their perceptions of treatment needs were considered to be comparatively similar to those of the general public. Our findings suggest that the recognition of orthodontic treatment needs differs between patients and orthodontists. Moreover, such perceptions might be affected by the type of malocclusions being examined. Orthodontists should consider the differences in perceived treatment needs between professionals and the general public in diagnoses and treatment planning because patients' perceptions of their orthodontic treatment needs change as they gain orthodontic experience and may depend on the type of malocclusions.

In conclusion, the PAR index is clinically useful for evaluating malocclusions in the identification of Class III cases among Japanese population. The perception of treatment needs is significantly increased in Japanese subjects when the cast of the mandibular protrusion has a PAR index of more than 23 and an overjet under −0.5 mm. The perception of treatment needs for normal occlusion to mild mandibular protrusion was not affected by the orthodontic knowledge and experience of the subjects, but the perceived treatment needs for moderate to severe mandibular protrusion depended on the level of orthodontic expertise. The perception of orthodontic treatment needs based on occlusion changed with orthodontic expertise as well as the type of malocclusion.

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