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A Comparison of Treatment Success between Functional and Camouflage Orthodontic Treatments in cl II Malocclusion

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ABSTRACT

Background: Functional and camouflage orthodontic treatments in cl II malocclusions are different treatment methods that are usually used in orthodontic practice. A comparison of treatment success between those treatment groups shows which treatment method is better to choose.
Objectives: This study aimed to compare functional and camouflage orthodontic treatments outcome in patients with class II malocclusion.
Materials and methods: The sample size was from individuals who completed treatments between February 2017 and July 2020 at the Department of Orthodontics, Faculty of Dentistry in Suleyman Demirel University, Turkey. The subjects were from 2 genders and a total number of 146 cases with an average age of 11-22 years. Peer Assessment Rating (PAR) index was used to evaluate the success of the treatment using plaster models taken from these cases before and after the treatment.
Results: In our study, orthodontic treatment results were evaluated by the PAR index in three groups as very successful, successful, and unsuccessful according to the scores of success rate (PAR%). The majority of treatments were found to be successful (67.81%), approximately a quarter of cases were very successful (26.71%), and low rate of failure (5.48%).
Conclusion: Although there were positive occlusal changes in functional and camouflage orthodontic treatment groups, patients in the functional orthodontic treatment group showed more improvement in the PAR change rate. Therefore, we recommend starting with treatment at an early age to get more benefit from the growth of patients.

Keywords: Orthodontic treatment success; PAR index; Class II malocclusion; Functional and camouflage orthodontic treatment.

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INTRODUCTION

Orthodontics is a field of dentistry that deals with the benefits of dental health, chewing and speaking functions as well as aesthetic appearance and improving patient self-esteem [1, 2]. Therefore, before starting orthodontic treatment, the positive and negative results that may occur during the treatment process should be evaluated and the health service should be provided with high standards to obtain positive results from the treatment. To achieve this, it is necessary to evaluate the result of the performance, which includes improvement after treatment [3].

Over the years, great efforts have been made to develop standard, valid, and reliable measurement tools in orthodontics. Epidemiological and clinical orthodontic indices have been established to standardize orthodontic examination and treatment [4]. With the increasing demand for orthodontic treatment, various indices have been developed to classify various types of malocclusions and determine orthodontic treatment needs and results [3].

Orthodontic indices are evaluated in five groups: diagnostic, epidemiological, determining the need for treatment, evaluating treatment difficulty, and treatment results/success [5, 6]. To professionally evaluate orthodontic treatment re-

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sults, various indices are used to help orthodontists identify problems encountered at the end of the treatment and bring them to perfection in the future [7].

Especially in European countries, indices are widely used to determine the orthodontic diagnosis and treatment priority correctly and measure the success of the treatments performed in public service institutions and plan health services accordingly [8, 9]. One of the most frequently used indices in this regard, the Peer Assessment Rating (PAR) index, which is an index that determines the occlusal changes that occur due to orthodontic treatment, evaluates the success of the treatment, and can express the severity of the anomaly numerically by scoring different features of the occlusion [7, 8].

When we look at the works of literature, in addition to there are a limited number of studies [10–13] in which the results of orthodontic treatment performed by different dentists depend on various treatment practices, treatment methods, and treatment time were evaluated by using the PAR index. There is no study evaluating the results of functional and camouflage orthodontic treatments in class II malocclusion, for these reasons our study has been conducted to compare the two modalities.

MATERIALS AND METHODS

This retrospective study was approved by the Ethics Committee of Suleyman Demirel University Health Sciences Institute (reference number 10, 19.03.2019). The reason, purpose, approach, and methods of this research were examined and found appropriate, and it was decided that there was no ethical or scientific objection to the research in the orthodontic clinic. Informed consent was taken from every subject.

The sample of the study was formed from individuals whose treatments were finished between February 2017 and July 2020 at the Department of Orthodontics in the Faculty of Dentistry, Suleyman Demirel University, Turkey. This study included a total of 146 cases selected between the ages of 11-and 22 years. More than half of the participants were female patients (56.2%). The participants were divided into two main groups and every group was divided into two subgroups according to the treatment method; the first group was made up of 58 patients (39.73%) whose growth potential continued to be treated with a removable (n = 44, 30.1%) or fixed (n = 14, 9.5%) functional appliances and then finished with a fixed appliance (Straight-wire) technique. The second group was composed of 88 patients (60.27%) whose growth potential is reduced or finished to be treated with camouflage orthodontic treatment and was divided into extraction (n = 49, 33.5%) and non-extraction (n = 39, 26.7%) treatments with the help of extra-oral appliances (Headgear) and/or intermaxillary class II elastics and/or skeletal anchorage (miniscrew). The research material constitutes orthodontic plaster models taken from these cases before and after treatment.

Inclusion criteria include pre-and post-treatment materials that are complete and clear, being in permanent dentition, having no congenital anomaly, have not undergone orthognathic surgery, and those whose treatments were started and finished by the assistants working in the same clinic. While, children in the stage of deciduous or mixed dentition, patients who didn't finish the procedures, those with congenital craniofacial anomalies, and subjects who lost to follow-up were excluded from the study.

In our study, to evaluate the results of functional and camouflage orthodontic treatment in patients with Angle Class II malocclusion we used the PAR index developed by Richmond et al. in 1992 [[8, 9, 14]. Measurements are made by evaluating 5 features of the pre-and post-treatment orthodontic plaster models. The dental arch is divided into 3 regions; left buccal, right buccal, and anterior region. The buccal region is from the mesial anatomical contact point of the 1st or 2nd permanent molar tooth to the distal anatomical point of the canine tooth, the anterior region is between the canine teeth. These features consist of 1. Displacement of the maxillary and mandibular tooth arches, 2. Right and left posterior occlusion, 3. Overjet, 4. Overbite 5. Midline deviation [8].

A specific score is calculated for each region as a result of the measurements made by using a special measuring ruler on the initial and final orthodontic models. The total score of each region is calculated by multiplying the obtained points by the coefficient. Then the total scores of these 5 regions are added together and the final PAR value is calculated as shown in Table 1. The PAR index shows the change during orthodontic treatment in three basic ways [15]. These are a. Absolute decrease in PAR score (PARdif = PARpre - PARpost) b. Evaluation using nomogram c. Decrease in PAR score percentage (PAR%= PARdif / PARpre x100). In our study, the third method (PAR%) was used. Orthodontic treatment results evaluated by PAR index in three groups as very successful (if PAR% > 70%), successful (if PAR% = 30-70%) and unsuccessful (if PAR% < 30%) according to the scores of success rate (PAR%).

Statistical Analyses

The statistical analysis of the study was performed using the SPSS 20.0 (IBM Inc, Chicago, IL, USA) program. Descriptive statistics were presented as mean ± SD and frequency (percentage rate). Compliance of continuous numerical variables to normal distribution was analyzed by the Kolmogorov-Smirnov test. The independent group Student t-test was used for comparisons of two independent groups, and the Mann-Whitney U test was used when parametric conditions were not met. Paired Student's t-test was used to compare PAR scores before and after treatment. One-Way Analysis of Variance (ANOVA) or Kruskal-Wallis tests was preferred for the comparison of multiple groups. Tukey HSD post-hoc test was preferred for results found to be significant, and significant paired comparisons were shown in tables with similar exponential lowercase letters. Results found

Table 1. Evaluation form for orthodontic models in PAR index.

Patient Name													
PAR components	Right						Left						Weighted
Upper anterior segment	3-2		2-1		1-1		1-2		2-3				× 1
Lower anterior segment	3-2		2-1		1-1		1-2		2-3				× 1
Buccal occlusion	Anteroposterior				Right			Left					× 1
	Transverse				Right			Left					× 1
	Vertical				Right			Left					× 1
Overjet	Positive					Negative							× 6
Overbite	Overbite					Openbite							× 2
Centreline													× 4
								Total PAR					

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Table 2. Comparison of the distribution of PAR scores for functional and camouflage orthodontic treatment groups.

PAR Values / Treatment types	PARpre Mean ± SS	PARpost Mean ± SS	PARdif Mean ± SS	PAR% Mean ± SS	P-value main groups
A) Functional treatment (n:58)	25,31 ± 6,63	9,79 ± 5,54	15,5 ± 4,01	63,13 ± 14,52	Bef.≤0,001* , Aft. =0,107
1) Removable functional treatment (n:44)	25,63 ± 6,66	9,88 ± 5,37	15,7 ± 4,10	63,18 ± 14,76	Diff.=0,001* , Mean=0,562
2)Fixed functional treatment (n:14)	24,28 ± 6,68	9,50 ± 6,28	14,7 ± 3,74	63,00 ± 14,29	
P-value subgroups	0,853	0,995	0,905	0,999	
B) Camouflage treatment (n:88)	29,23 ± 4,54	11,19 ± 4,79	18,04 ± 4,94	61,72 ± 14,20	Bef.≤0,001* , Aft. =0,434
1)Extraction treatment (n:49)	28,93 ± 5,43	11,04 ± 4,66	17,89 ± 5,04	61,85 ± 13,00	Diff.=0,014* , Mean =0,951
2) Non extraction treatment (n:39)	29,61 ± 3,11	11,38 ± 5,00	18,23 ± 4,87	61,56 ± 15,75	
P-value subgroups	0,940	0,989	0,987	0,999	

Table 3. Comparison of the distribution of PAR scores in the gender of functional and camouflage orthodontic treatment groups.

Gender / PAR values	Functional treatment (n = 58)			Camouflage treatment (n = 88)		
	Female (N= 37) Mean ± SS	Male (N= 21) Mean ± SS	P-value	Female (N= 45) Mean ± SS	Male (N= 43) Mean ± SS	P-value
PARpre	25,75 ± 10,21	24,52 ± 6,90	0,502	29,75 ± 4,28	28,69 ± 11,023	0,277
PARpost	10,21 ± 5,79	9,04 ± 5,13	0,446	11,35 ± 4,28	11,02 ± 5,32	0,747
PARdif	15,54 ± 3,73	15,47 ± 4,56	0,954	18,40 ± 5,04	17,67 ± 4,87	0,495
PAR%	62,21 ± 14,29	64,76 ± 15,14	0,526	61,40 ± 13,48	62,06 ± 15,07	0,826

significant were visualized with relevant graphics. Measurement results were calculated using the inter-class correlation coefficient (ICC) to evaluate method error and to calculate intra-observer agreement values. Spearman's Rho correlation coefficients were calculated to determine the relationships between the various characteristics of the patients. In the whole study, the type-I error value was accepted as 5%, and P-value < 0.05 was considered statistically significant.

RESULTS

The PAR values at pre-and post-treatment were taken and from these values differences in PAR values were obtained then PAR change rates were calculated as shown in Table 2. PAR values at the beginning of the treatment were found to be significantly higher in the camouflage orthodontic group (29.23 ± 4.54) (P-value < 0.001). Although PAR values after treatment were higher in patients in the camouflage orthodontic treatment group (11.19 ± 4.79), the difference was not significant (P-value = 0.107). Differences in PAR values were found to be significantly different between treatment types (P-value = 0.001). PAR difference was found to be higher in patients who received camouflage orthodontic treatment (18.04 ± 4.94). The PAR change rates calculated according to the PAR differences were not significantly different between treatment types (P-value = 0.562). There was no significant difference between the subgroups for pre-and post-treatment PAR values, PAR difference values, and PAR change rates values (P-value > 0.05).

The differences between the genders in the treatment success according to the PAR index were not found to be significant in patients who received functional and camouflage orthodontic treatment. PAR pre, PAR post, and PAR dif. values were slightly higher in females, while PAR% was slightly higher in males (Table 3).

The success rates were compared in the main and subgroups (Table 4) and found there was no statistically significant difference between the patients in these groups

DISCUSSION

PAR index is a simple, valid, objective, and reliable index for objective evaluation of the result and success of orthodontic treatment. Although it contributes to the quality of the treatment, it does not take into account and does not measure in any way important factors for total treatment quality such as facial profile and aesthetics, cephalometric measurements, periodontal health, root resorption, dental angulations, patient compliance, treatment time, and iatrogenic injuries. PAR index also cannot evaluate the motivation of treatment, functional occlusion, temporomandibular joint, and patient satisfaction [11, 16]. The mean success rate PAR% in the functional and camouflage treatment groups was 63% and 61% respectively. Our success rate has been compared with other reported studies like O'Brien et al. [17] and Al Yami et al. [18] and was found slightly lower than their rates (68-69%). The difference may be due to the difference in the experience of the orthodontist. It is thought that treatment efficiency might be higher if it were in the hands of more experienced clinicians.

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Table 4. Comparison of the distribution of PAR scores for functional and camouflage orthodontic treatment groups.

Development / Treatment types	Unsuccessful N(%)	Successful N(%)	Very successful N(%)	p-value
A) Functional treatment (n = 58)	4 (50,00) %6,9	39 (39,40) %67,2	15 (38,50) %25,9	0,826
1) Removable functional treatment (n = 44) 2) Fixed functional treatment (n = 14)	3 (75,00) 1 (25,00)	30 (76,90) 9 (23,10)	11 (73,30) 4 (26,70)	0,846
B) Camouflage treatment (n = 88)	4 (50,00) %4,5	60 (60,60) %68,2	24 (61,50) %27,3	
1)Extraction treatment (n = 49) 2) Non-extraction treatment (n = 39)	1 (25,00) 3 (75,00)	35 (58,30) 25 (41,70)	13 (54,20) 11 (45,80)	0,721

In our study, the functional treatment group had a lower PAR score at the end of treatment (9.79) than that of the camouflage treatment group (11.19), this indicates a greater improvement of malocclusion through the PAR change rate. Thus, it shows that functional orthodontic treatment gives more positive occlusal results. This may be attributed to the improvement in the malocclusion is better by taking the advantage of the growth potential since the functional group starts treatment at an earlier age [19]. Another reason is that as the age of the patient increases, the patient's cooperation may decrease [7, 20].

Our findings are compatible with the study of Cansunar and Uysal [21], who compared the clinical results of 2 maxillary premolar extractions, 4 premolar extractions, and non-extraction functional orthodontic treatment protocols. The authors showed that the 4 premolar extractions group was the least satisfactory. However, the functional orthodontic treatment group showed a better sagittal relationship, more teeth in occlusion, and better root angulations.

In addition, Janson et al. [22], who evaluated the treatment results using (a treatment priority index) that was very similar to the PAR index, the 1st group contains a mix of camouflage and functional treatment as a non-extraction treatment group, and 2nd group: extraction treatment group (4 premolar extraction). In the 1st group, they reported that although it was not statistically significant compared to the 2nd group which shows slightly better occlusal results. However, Holman et al. [23] and Xu et al. [24], stated that there is no significant difference between functional and camouflage orthodontic treatment results. On the other hand, Janson et al. [25] in another study, compared the results of full Class II malocclusion (without extraction and 2 maxillary premolar extraction) treatment and noted that the extraction group ended with more positive results. While our opposite results with this study may be because the samples consisted of only 2 premolar extraction, in our example, 2 and 4 premolar extractions were evaluated.

In our study, pre-treatment PAR values were slightly higher in females in patients who received functional and camouflage therapy, while PAR% was slightly higher in males. However, the differences between the sexes were not significant. There are very few studies investigating the effect of gender on the quality of occlusal results. This is because treatment success is claimed to be independent of gender. It has been reported that the quality of treatment outcomes is the same for both sexes [26]. Willems et al. [27] reported that pre-treatment PAR scores of males were significantly higher than females, but there was no significant difference between PAR scores at the end of treatment.

CONCLUSION

Although there were positive occlusal changes in functional and camouflage orthodontic treatment groups, patients in the functional orthodontic treatment group showed more improvement in the PAR change rate. Therefore, we recommend starting with treatment at an early age to benefit from the patients' growth. The difference between the genders in the treatment success in patients who received functional and camouflage orthodontic treatment was not found to be significant. It was found that the camouflage orthodontic treatment group had less treatment success because the patient in this group was older at the beginning of the treatment and it may be due to less cooperation with treatment. PAR index, is one of the indices evaluating treatment outcomes in recent years but it is not included in its evaluation of important criteria such as periodontal health, functional occlusion, root resorption, and patient satisfaction. For the validity and reliability of this index, we think that it can invent an ideal index to evaluate the treatment results ideally by completing its deficiencies.

ETHICAL DECLARATIONS

Acknoweldgements

None.

Ethics Approval and Consent to Participate

Written approval had been gained from the Ethics Committee of Suleyman Demirel University Health Sciences Institute (reference number 10, 19.03.2019). Study data/information was used for the research purpose only. Informed consents from every participant was taken.

Consent for Publication

Not applicable (no individual personal data included).

Availability of Data and Material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Competing Interests

The authors declare that there is no conflict of interest.

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Authors' Contributions

Both authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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