

AN OVERVIEW OF THE ALTERATION OF ORTHODONTIC TREATMENT RESULTS WITH A REMOVABLE ORTHODONTIC APPLIANCE USING LITTLE'S IRREGULARITY INDEX: PRELIMINARY STUDY OF THE DENTAL HOSPITAL FACULTY OF DENTISTRY, UNIVERSITAS INDONESIA, INTEGRATION CLINIC PATIENTS

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ABSTRACT

INTRODUCTION: The complexity of malocclusions, such as anterior dental irregularity, is important in determining the outcome of treatment with a removable orthodontic appliance. Little's Irregularity Index is used to assess alterations of anterior teeth.

MATERIAL AND METHODS: This was a descriptive study done on 47 patients' dental casts before and after treatment using a removable orthodontic appliance, between 2013 and 2017. Measurements were made using Little's Irregularity Index.

RESULTS: Patients who presented most often for removable orthodontic appliance treatment had minimal and moderate anterior dental irregularity. After treatment completion, the condition of the patients' anterior teeth was altered to having either no or minimal irregularities, and no further patients had severe irregularities.

CONCLUSIONS: The condition of patients' maxillary and mandibular anterior teeth improved after undergoing removable orthodontic appliance treatment provided by dental students at our dental hospital between 2013 and 2017. Thus, the treatment given can be considered appropriate and in accordance with removable orthodontic appliance indications and functioning.

KEY WORDS: removable orthodontic appliance, Little's Irregularity Index, treatment result.

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INTRODUCTION

Anterior dental irregularity is the most common malocclusion characteristic [1]. Based on Indonesian National Health Research in 2013, the prevalence of dental irregularities in Indonesia's overall

population was 14.3% [2]. Dental irregularity refers to an overlapped condition of teeth that are therefore beyond the proper dental arch [3]. The irregularity of teeth, especially the anterior teeth, becomes aesthetically unpleasing, for example when a person is smiling [4]. This creates discomfort and disrupts

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the overall appearance, which leads to patients seeking orthodontic treatment.

Two types of orthodontic appliances are used for treatment (removable and fixed types) [1], including active (mechanical appliances and functional appliances) and passive (retainers and space maintainers) removable orthodontic appliances [1]. An active removable orthodontic appliance is indicated for simple malocclusions without any skeletal abnormalities such as: mild crowding and multiple diastema, non-extraction and mixed dentition cases, limited tooth movement like tipping, and arch expansions [1, 3]. The design of this appliance consists of a clasp, a spring, and an acrylic plate that can be removed by the patient [5]. Patient compliance for routine use of the appliance and periodic control becomes an important part of achieving the desired orthodontic treatment outcome [3].

In their study, Skidmore *et al.* [6] suggested that several factors affect treatment outcomes, including the duration of use, complexity of malocclusion, treatment methods, patient cooperativeness, and sociodemographic characteristics. The complexity of malocclusions is a main factor in successful orthodontic treatment [6]. Success is evaluated from treatment outcomes and becomes important as the demand for orthodontic treatment rises, and as a form of improved quality of treatment.

A variety of simple indexes are used to assess the complexity of malocclusions. In 1975 Little introduced the irregularity index to assess the complexity of malocclusions [7]. This index was used to assess alteration of the anterior arrangement of the teeth of each jaw by using digital callipers to measure the distance from the contact point of each incisor to the adjacent tooth contact point [7-10]. Measurement with Little's Irregularity Index results in five categories of irregularities: category 1 – no irregularity/perfect alignment; category 2 – minimum; category 3 – moderate; category 4 – severe; and category 5 – very severe irregularity [7-10].

Orthodontic treatment using a removable appliance was performed by dental students at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia integration clinic. Each case was indicative for the removable orthodontic appliance and was approved by the clinical supervisor. No previous studies were conducted to examine the results of treatment with a removable orthodontic appliance using Little's Irregularity Index at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia integration clinic.

MATERIAL AND METHODS

This observational descriptive cross-sectional study was conducted on patients recruited from the Orthodontic Integration Clinic of the Dental Hospital Faculty of Dentistry, Universitas Indonesia Salemba, Central Jakarta, Indonesia between 2013 and 2017. Inclusion cri-

teria were: age 12-24 years, patients currently in the permanent dental period, class I skeletal case, and a dental cast obtained before and after treatment, including those who did not finish treatment with a removable orthodontic appliance, and the date of jaw impression and sex were listed on the dental cast. The dental cast used consisted of a pair of maxilla and mandibles intact or with no damage, no loss of anterior teeth, and no diastema or multiple diastema cases. From calculation of the minimum number of samples, 47 samples were collected from medical records and the study model storage room of the Department of Orthodontics Faculty of Dentistry, Universitas Indonesia.

The study was approved by the Ethics Commission. Research samples that met the inclusion/exclusion criteria were fixated. An interrater reliability test then was performed by the researchers and was remeasured by the experts. An intra-rater reliability test was conducted by the same researchers remeasuring at different times. Both tests were done on five samples (10% of the total sample) selected at random. The first and second measurements were then tested using the κ test with expected inter- and intra-rater reliability values > 0.6 . Serial numbering of all samples and assessment of the malocclusion complexity with Little's Irregularity Index on the dental cast were performed before and after removable orthodontic appliance treatment. Little's Irregularity Index scores were then recorded in Microsoft Excel (Microsoft Corp., Redmond, WA, USA). The data obtained were processed and analysed using the SPSS program (SPSS, Inc., Chicago, IL, USA).

RESULTS

A total of 47 pairs of pre- and post-treatment dental casts were obtained from 40 female and seven male patients, regardless of completed or uncompleted treatment with the removable orthodontic appliance. Measurements were made over two weeks at the Dental Material Laboratory of FKG UI Salemba using Mitutoyo digital callipers with a precision of 0.01 mm. Most patients (14, 29.8%) were 22 years old (average age 21 years), and most (8, 17%) had a treatment duration of 14 months (average duration, 17.19 months; Table 1 and 2).

An inter- and intra-reliability test was done twice to determine conformity of the measurement result using κ calculation. The inter-reliability test was conducted between researchers and the expert, while the intra-reliability test was done between the researchers themselves with an interval of two days in 10% of patients (five samples). The lowest interrater reliability test value of 0.615 showed substantial agreement between the researcher and expert; hence, the measurement conducted by the researcher and the method used were considered reliable. The lowest intra-rater test result of 0.706 showed an almost perfect level of agreement; hence, the mea-

surements made by the researcher were considered consistent.

Afterwards, the average alteration in average Little's Irregularity Index score on each jaw based on the grouping according to the measurement criteria was compared. Scores of 0, 1-3, 4-6, 7-9, and 10 indicated perfect alignment or no irregularities, minimum, moderate, severe, and very severe irregularities, respectively.

DISCUSSION

In this study, there were more female (40, 85%) than male (7, 15%) patients. Similar results also were found in the study by Bernas *et al.* [11] in Canada and in the study by Edman Tynelius *et al.* [9] in Sweden, in which women were more likely than men to receive orthodontic treatment with fixed and removable appliances. The tendency of women to pay more attention to facial aesthetic factors as compared to men was the possible cause of the higher number of female patients [11]. This is also a potential reason why women are more likely to seek removable orthodontic appliance treatment at our clinic.

The patients age in this study ranged from 12 to 24 years (average age, 21 years), with most (14, 29.8%) being 22 years old. Similar results were found in the study by Klages *et al.* [12] in Europe in patients who were undergoing fixed and removable orthodontic treatment, where the average age of the patients was 25 years or patients belonged to the group of late adolescents (age range, 21-30 years). Health and beauty are of great concern in this phase of life; hence, in late adolescence, a person tends to seek care that may improve their health and beauty, such as orthodontic treatment [12]. In contrast with the research conducted by Paula *et al.* [13] in patients who were undergoing fixed and removable orthodontic treatment, the average age of patients who received orthodontic treatment was 16 years (range, 13-20 years), i.e. they were young adolescents. The young adolescent phase is a transition from physical and mental development to a new environment and a psychological structure of more mature nature, during which some aspects of facial appearance and dental aesthetics play in important role in self-confidence [13]. The different results in these studies may be due to the limited num-

TABLE 1. Distribution and frequency of the number of patients by age and sex in the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

Age (years)	Number of patients		Total
	Women	Men	
12	1	0	1
13	1	0	1
15	2	0	2
16	1	0	1
17	2	0	2
18	1	0	1
19	2	0	2
20	3	1	4
21	3	1	4
22	12	2	14
23	8	0	8
24	4	3	7
Total	40	7	47

TABLE 2. Overview of the treatment duration on the patients at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

	Minimum value	Maximum value	Average value	Mode	SD
Treatment duration	21 months	26 months	17.19 months	14 months	3.99

ber of study subjects and existing differences in the population, whereas in our study the age groupings used were according to the method of Newman *et al.* [14], i.e. young (12-18 years) and late (18-24 years) adolescence.

The duration in our study of treatment using a removable orthodontic appliance ranged from 12 to 26 months (average, 17.19 months), and most patients were treated for 14 months (17%). This result differed from those of the study conducted by Al-Moghrabi *et al.* [15] on patients at some UK clinics, where the average duration of orthodontic treatment was 11.2 months. This

TABLE 3. Distribution of Little's Irregularity Index score on the patients at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

	Minimum value (mm)	Maximum value (mm)	Mean value (mm)	Mode (mm)	Standard deviation
Maxilla before treatment	0.63	8.31	3.48	4.13	1.98
Mandible before treatment	0.97	7.38	3.29	2.92	1.49
Maxilla after treatment	0	6.98	2.31	2.23	1.72
Mandible after treatment	0	6.59	1.85	1.44	1.43

TABLE 4. Comparison of the average score of Little's Irregularity Index on patient's maxillas after removable orthodontic appliance treatment at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

Information	Before treatment (mm)		After treatment (mm)	
	Average	No irregularity	Minimum irregularity	Moderate irregularity
Minimum irregularity	2.25	0	1.92	–
Moderate irregularity	5.24	–	2.80	4.92
Severe irregularity	7.64	–	2.87	5.36

TABLE 5. Comparison of the average score of Little's Irregularity Index on patient's mandibles after removable orthodontic appliance treatment at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

Information	Before treatment (mm)		After treatment (mm)	
	Average	No irregularity	Minimum irregularity	Moderate irregularity
Minimum irregularity	2.6	0	1.46	4.35
Moderate irregularity	4.97	–	2.19	4.59
Severe irregularity	7.38	–	–	4.12

TABLE 6. Changes in the number of patients based on Little's Irregularity Index score on patient's maxillas after removable orthodontic appliance treatment at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

Information	Before treatment		After treatment	
	Total	No irregularity	Minimum irregularity	Moderate irregularity
Minimum irregularity	30	8	22	0
Moderate irregularity	14	0	9	5
Severe irregularity	3	0	1	2
Total	47	8	32	7

TABLE 7. Changes in the number of patients based on Little's Irregularity Index score on patient's mandibles after removable orthodontic appliance treatment at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

Information	Before treatment		After treatment	
	Total	No irregularity	Minimum irregularity	Moderate irregularity
Minimum irregularity	32	4	27	1
Moderate irregularity	14	0	12	2
Severe irregularity	1	0	0	1
Total	47	4	39	4

may be due to many other factors that influence treatment duration, such as severity of malocclusion, patient cooperation, operator skills, and sociodemography [6]. Our research was conducted at the Dental Hospital Faculty of Dentistry, Universitas Indonesia integration clinic between 2013 and 2017, where the operator was a dental student supervised by an orthodontist.

The initial anterior dental irregularity on the patient's dental cast before treatment with the removable orthodontic appliance was assessed using Little's Irregularity Index. There was a difference in measurements of the maxilla with the mandible cast, where the average maxillary anterior dental irregularity scores before and after treatment (3.48 and 2.31 mm, respectively) with a removable or-

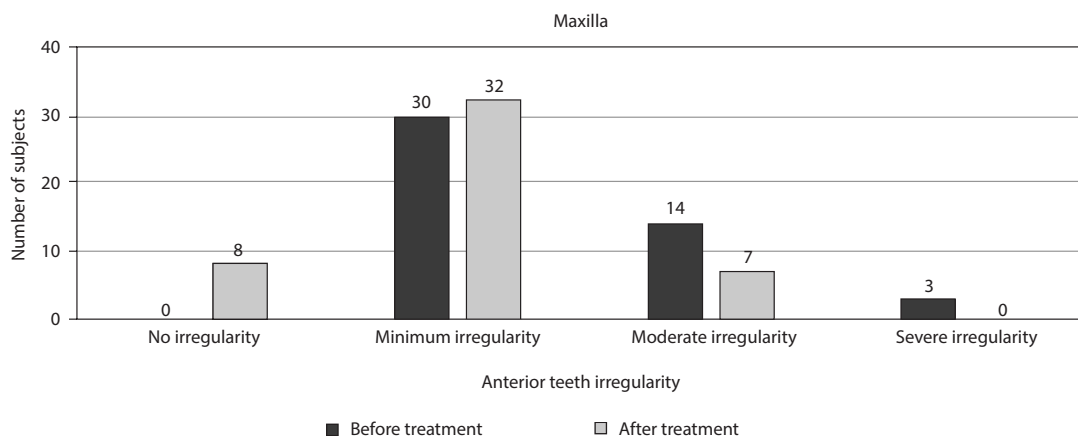


FIGURE 1. A comparison of number of patients based on the Little’s Irregularity Index score on the maxilla before and after treatment with a removable orthodontic appliance at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

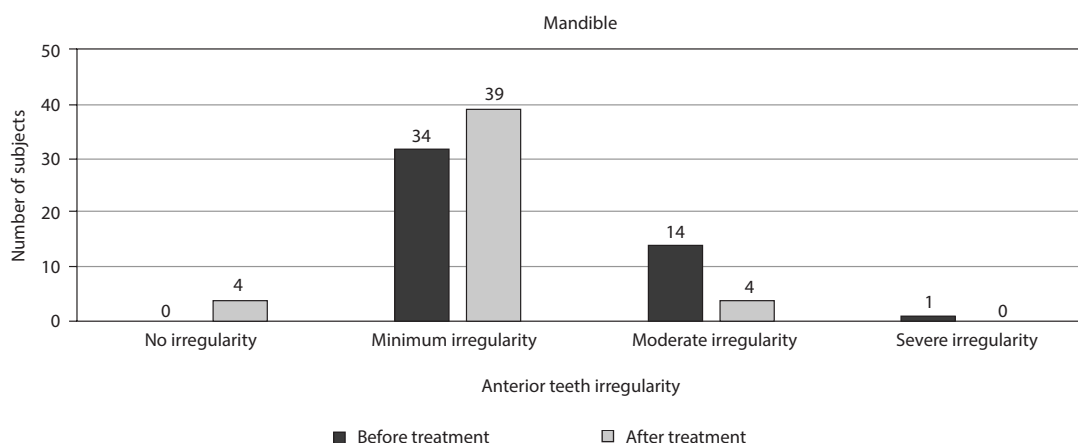


FIGURE 2. A comparison of the number of patients based on Little’s Irregularity Index score on the mandible before and after treatment with a removable orthodontic appliance at the Dental Hospital of the Faculty of Dentistry, Universitas Indonesia Integration Clinic in the years 2013-2017

thodontic appliance were greater than those of the mandible (3.29 and 1.85 mm, respectively). This result differed from that of the study result of Edman Tynelius *et al.* [9] in Sweden, who found a greater average Little’s Irregularity Index score in the mandible as compared with that obtained from the maxilla (2.2 vs. 2.7 mm, respectively). This may occur due to differences in the conditions in which the studies by Edman Tynelius *et al.* [9] were performed in patients with a relapsed tooth condition after removable orthodontic appliance treatment, where the maxilla had better relapse resistance than the mandible. In addition, it may also be due to the limited number of subjects and the methodology used in this study as compared with the study by Edman Tynelius *et al.* [9].

The score results were then grouped according to the measurement criteria (0, 1-3, 4-6, 7-9, 10 mm indicating perfect alignment or no irregularities, and minimum, moderate, severe, and very severe irregularity). In

this study, the results indicated that most patients with anterior dental irregularity who sought treatment at our clinic from 2013 to 2017 had minimal and moderate dental irregularities. These results are in accordance with the removable orthodontic appliance indication, which deals with cases that are not complex or that just involve a shift of the tooth location that requires only simple movements and does not involve skeletal abnormalities [1, 11]. Similar results also were found by Bernas *et al.* [11] who in their study treated patients with a class I skeletal case with minimal and moderate irregularities. However, there were differences in the results of previous studies conducted by Hidayah in 2015, in which most patients had no or minimal irregularities [16]. The difference may be due to the limited number of research subjects and research methodology used in this study.

In our study, measurements were also made on the dental casts of the patients after treatment with a remov-

able orthodontic appliance, to determine the anterior dental irregularity at the end of treatment, using Little's Irregularity Index. After treatment, the anterior maxillary and mandible teeth showed no, minimum, and moderate irregularities. These results indicated that patients had no or minimum anterior dental irregularities after treatment and suggested that the treatment provided at our integration clinic between 2013 and 2017 was in accordance with the function of the removable orthodontic appliance, which is to improve the condition of mild malocclusion without skeletal abnormalities [1, 5]. The low number of patients who successfully achieved no irregularities or perfect alignment was probably due to lack of patient cooperation, such as with routine control and duration of appliance use [1, 5].

A detailed breakdown of the mean values and number of patients who had a condition alteration in the maxillary teeth after treatment with a removable orthodontic appliance was conducted to determine how much these values changed, and the number of patients undergoing group changes. In general, there were changes after treatment, which can be seen from the group changes that occurred. These results indicated that, in general, conditions improved after treatment, but only a few patients in the group with minimum irregularities before treatment experienced group changes. This might have been caused by the clinical difficulties in achieving no irregularities or perfect alignment conditions because the difficulties rely heavily on treatment plans and operator skills, as well as on patient cooperation [1, 6]. Treatment with a removable orthodontic appliance at our integration clinic was conducted by dental students who had never performed any orthodontic treatment in patients previously; therefore, the results may indicate that the treatment provided is good, since there was improvement in the mean value, although this was not followed by improvement of group alteration.

In the mandibles these results indicated that, in general, there was a change in the form of improved conditions after treatment, but some patients in the minimum irregularities group before treatment experienced changes in the moderate irregularities group. In line with a study conducted by Bernas *et al.* [11] in patients undergoing removable orthodontic appliance treatment, there were also subjects with worsening malocclusion due to poor patient cooperation, inefficiency, and appliance impairment. This was found more commonly in patients undergoing treatment with a removable compared to a fixed orthodontic appliance [11]. In addition, other factors existed, such as operator skill as well as sociodemographic characteristics. In this study, not all patients completed the treatment.

CONCLUSIONS

Our results suggest that most patients who sought removable orthodontic appliance treatment had minimum

and moderate anterior dental irregularities in the upper and lower jaws. After treatment was complete, there was generally a decrease in the average Little's Irregularity Index or, in other words, improvement of the anterior maxillary and mandibular dental condition to there being no and minimal irregularities, and no patient had severe irregularities. Therefore, removable orthodontic appliance treatment provided by dental students at the Dental Hospital Faculty of Dentistry, Universitas Indonesia integration clinic between 2013 and 2017 can be considered appropriate treatment and in accordance with the indications and functioning of a removable orthodontic appliance.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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