

## Duration Of Levelling And Aligning For Different Malocclusions In Patients Reporting For Orthodontic Treatment

Research Article

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### Abstract

The aim of this study is to assess the duration of levelling and aligning for different malocclusions in patients reporting for orthodontic treatment. The purpose of the study was to determine the duration of levelling and aligning during the orthodontic treatment of class I, class II and class III malocclusion. A hospital based cross-sectional study was conducted. 2100 patients who reported to the orthodontic department of the institution from June 2019 to April 2020 were screened. The inclusion criteria was patients with orthodontic treatment in the levelling aligning stage, young adults, no previous history of orthodontic treatment and only conventional metal brackets with 0.022 MBT prescription. 100 patients with Class I malocclusion, 100 patients with Class II malocclusion and 100 patients with Class III malocclusion were included in the study. The duration of levelling and aligning for each patient was retrieved retrospectively from the stored logs of the digital archives of our institution. Individual tooth abnormalities were also recorded for each patient. One way analysis of variance was performed to compare the difference between the two groups. Results showed that the total sample had a mean duration of  $3.55 \pm 1.668$  months for levelling and aligning which was longer in patients with Class II and class III malocclusion compared to Class I malocclusion. Within the limits of the study, patients with Class I malocclusions usually complete their treatments faster than Class II and Class III patients with Class III and class II div 1 subdivision patients taking the longest time to complete their treatment.

**Keywords:** Duration Of Levelling And Aligning; Malocclusions; Orthodontics.

### Introduction

When conducting an initial consultation, every clinician is called upon to answer questions regarding the duration of treatment proposed. The answer to this question usually depends, among other factors, on the clinician's experience and this, in turn, might depend on his education background, technical skills and management methods. Success in orthodontic practice is influenced by an accurate prediction of treatment duration [1]. In a 2003 study, finishing a case in the predicted time was considered an important practice building method [2]. Patients who are given accurate information also appear to be better consumers of dental services, with more reasonable expectations of treatment outcomes [3] and more greatly satisfied with their overall treatment. Proper diagnosis [4-6] and treatment planning plays an important role in

the duration of treatment and treatment outcome [7-9]. The British Orthodontic Society recommends that patients should receive sufficient information about the proposed treatment, including a realistic estimate of the time scale involved and the retention phase of treatment [10].

In fact, patient undergoing orthodontic treatment especially adult reveal a strong desire for shorter treatment, since the anti-aesthetic look provided by orthodontic brackets in addition to longer correction time are the major factors responsible for demotivating patients to have treatments started [11]. In the existing literature, no consensus has been reached about orthodontic treatment time. A recent systematic review revealed mean treatment time with fixed appliance of 19.9 months. However, there were significant variations among studies and the quality of treatment outcomes

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was not assessed [12]. Whenever cases were assessed under the American Board of Orthodontics (ABO) standards, one-phase orthodontic treatment mean time was 24.6 months [13, 14]. In Brazil, studies assessing orthodontic treatment time suggests variation is within the world average [15, 16].

On the other hand, average orthodontic treatment time seems to be beyond the patient's expectation. When asked about how long they would like treatments to last, 40.8% of adolescent patients answered less than 6 months, while 33.2% of them answered between 6 to 12 months while 26.5% answered between 12 and 18 months [17]. Extremely long treatment time has been associated with susceptibility to iatrogenesis, which in turn are associated with orthodontic appliances. Duration of treatment is also influenced by bonding and bracket failure. Research has been conducted to compare different adhesives [18], their properties [19] and method of recycling [20]. This is the case of root resorption, white spots, carious lesions and gingival inflammation [21]. Furthermore, a patient's quality of life and self-esteem can be harmed as a result of fixed appliance use, as they may lead to discomfort and trouble relative to their daily routine. There are several other factors pertaining to tooth movement which influence duration of levelling and aligning such as type of anchorage [22, 23], the biomechanics involved [24, 25] and medications [26]. Additionally, fixed appliances add extra appointments to patients' agenda. The aforementioned factors are probably associated with the fact that longer than expected treatment time is one of the major causes of patient's discomfort [11, 20].

Cost efficiency is an important concept in modern healthcare and prolonged treatment time may be detrimental in the economical aspect of a practice or a national health care system [27]. Shorter treatments are also desirable in view of the briefer exposure to possible harmful side effects. In contrast to what could have been expected, longer treatments have been associated with worse or unacceptable occlusal outcomes [14]. Such an association might be related to primary factors, such as mistaken diagnosis and planning, as well as lack of patient compliance. A more accurate estimate of treatment costs, in addition to minimising risk of iatrogenesis, as well as increasing success rates and patient's satisfaction which would result in a longer duration of treatment.

Based on the information found in the literature as well as on clinical investigations, the aim of the present study was to assess the duration of leveling and aligning for different malocclusions in patients reporting for orthodontic treatment. The objective was to determine the duration of levelling and aligning during the orthodontic treatment of class I, class II and class III malocclusion.

## Materials And Methods

### Study Setting

This study was carried out by collecting data from record management software at the private dental institute from June 2019 till April 2020 by reviewing and analysing 86000 patient records. A project was evaluated and approved by the committee of the private dental institute. 2100 patients who reported to the orthodontic department of the institution from June 2019 to April 2020 were screened. Informed consent was obtained from the study participants. In order to assess the duration of levelling

and aligning for different malocclusions in patients reporting for orthodontic treatment among patients visiting Saveetha Dental Hospital, Chennai, a hospital based cross-sectional study was conducted. The inclusion criteria was patients with orthodontic treatment in the levelling and aligning stage, young adults, no previous history of orthodontic treatment and only conventional metal brackets with 0.022 MBT prescription. Patients who did not report back for their follow up appointments, cases with insufficient and missing data as well as time constraints were excluded from the study. Clearance was obtained from the scientific review board to conduct the study.

### Ethical Approval

Ethical approval for this study was obtained from the institutional ethical committee (ethical approval number: SDC/SIHEC/2020/DIASDATA/ 0619-0320)

### Sampling

300 patients who met the inclusion criteria were identified. These included 100 patients with Class I malocclusions, 100 patients with Class II malocclusions and 100 patients with Class III malocclusion. Patients with Class II and Class III patients were further categorised into subgroups based on Angle's classification of malocclusion. In the class II malocclusion group there were 60 patients with Class II division 1 malocclusion, 11 patients with Class II division 2 malocclusion, 26 patients with Class II division 1 subdivision malocclusion and 3 patients with Class II division 2 subdivision malocclusion. In the Class III malocclusion group, the patients were further divided with 68 patients having Class III malocclusion and 32 patients having Class III subdivision malocclusion.

### Data Collection

The data obtained were reviewed by two authors who were involved in the study. Cross checking of data is done by random verification. Patients with incomplete follow ups were excluded from the study. Random verification was done for 10% of the patient samples. The internal validity was done by eliminating bias during collection and validation of data. The external validity was done to make the study available and applicable in other clinical settings. Data collection was done by entering the data into Microsoft Excel and then transferred into Statistical Package for Social Sciences (SPSS) software for statistical results.

### Data Analysis

The statistical SPSS software used was one-way ANOVA within the SPSS software was done to compare the duration of levelling and aligning between the different groups. Frequency distribution for the individual tooth abnormalities were also calculated. The statistical SPSS software used for data collection is the chi square test to compare the association of molar relation with gender. Chi square value,  $p = 0.252$  ( $p > 0.05$ ), the results were statistically not significant.

## Results And Discussion

The mean age among all malocclusion classes was  $24.96 \pm 6.275$

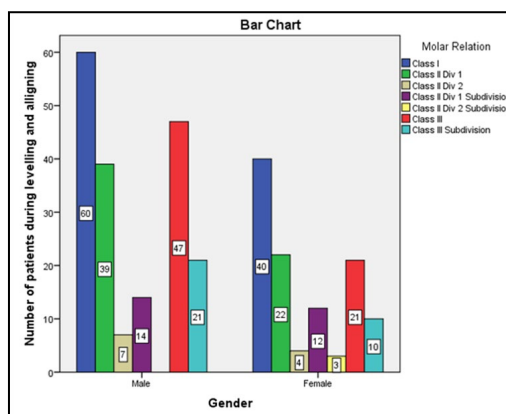
years. [Table 1]. Figure 1 shows the prevalence of males and females in the different types of malocclusion. The total sample had a mean duration of  $3.55 \pm 1.668$  months for levelling and aligning [Table 2]. The duration of levelling and aligning in different types of malocclusions in lieu to the individual tooth differences in both the maxillary and mandibular arches. There was no statistically significant difference between the different types of malocclusion with regard to the duration of levelling and aligning ( $P=0.112$ ) [Table 2]. However, there was a statistically significant difference between the individual tooth abnormalities with regard to the duration of levelling and aligning ( $p = 0.028$ ) [Table 3]. The mean treatment duration for levelling and aligning was greatest for retroclined teeth [Table 3]. While comparing the frequency of individual tooth abnormalities between maxilla and mandible, those with no individual tooth abnormality, had a frequency of 140, percentage of 46.7 in relation to the maxilla while in relation to the mandible those with no abnormalities, had a frequency of 133 and a percentage of 44.3. For spacing, maxilla has a higher

frequency compared to mandible of 43 (14.3%) to 36 (12%) respectively. For crowding, mandible had a higher frequency of 82, with percentage of 27.3 while for maxilla had a frequency of 41 and percentage of 13.7. For proclination and retroclination, maxilla had a frequency 29 (9.7%) and 3 (1%) respectively. In the mandibular arch, 22 (7.3%) patients had proclination while 3 (1%) patients had retroclination. For spacing and proclination, maxilla had a frequency of 23 and a percentage of 7.7 while from mandible, a frequency of 8 and percentage of 2.7 was obtained. For spacing and retroclination, it was only present in the maxilla with a frequency of 1 and percentage of 0.3. There were 16 (5.3%) patients reporting with crowding and proclination in the maxillary arch while only 4 (1.3%) patients reported crowding with retroclination. In regard to the mandibular arch, crowding and proclination had a frequency of 11 with percentage of 3.7 while those with crowding and retroclination had a frequency of 5 and percentage of 1.7. [Table 4], [Figure 2, Figure 3].

**Table 1.** The table depicts the mean age and SD of different age groups in regards to molar relationships. The average mean age for the patients undergoing orthodontic treatment is 24.96 from a study of 300 patients, with a standard deviation of 6.275. ANOVA test  $p=0.25$ (not significant).

Molar Relation	Mean age	N	Std. Deviation	Asymp.Sig (2-sided)
Class I	25.31	100	5.726	0.25
Class II Div 1	24.61	61	6.2	
Class II Div 2	25.55	11	6.424	
Class II Div 1 Subdivision	23.35	26	5.291	
Class II Div 2 Subdivision	20	3	3.606	
Class III	25.03	68	6.896	
Class III Subdivision	25.97	31	7.525	
Total	24.96	300	6.275	

**Figure 1.** Bar graph represents the association between type of malocclusion and gender. X-axis represents gender and Y-axis represents number of patients during levelling and aligning. Majority of the patients had Class I malocclusions in males compared to females. Chi square analysis done.  $p$  value- 0.252 ( $p>0.05$ ), statistically not significant.



**Table 2.** Shows the duration of levelling and aligning in different types of malocclusions with various molar relationships. The average duration of levelling and aligning for the 300 patients was  $3.55 \pm 1.67$  months. The longest duration of treatment was at 7 months. Anova test shows  $p=0.112$  (not significant).

Molar Relation	N	Mean duration	Std. Deviation	95% Confidence		Asymp. Sig (2-sided)
				Lower Bound	Upper Bound	
Class I	100	3.49	1.541	3.18	3.8	0.112
Class II Div 1	61	3.43	1.648	3	3.85	
Class II Div 2	11	2.45	2.115	1.03	3.88	
Class II Div 1 Subdivision	26	3.88	1.774	3.17	4.6	
Class II Div 2 Subdivision	3	4.67	0.577	3.23	6.1	
Class III	68	3.85	1.73	3.43	4.27	
Class III Subdivision	31	3.35	1.644	2.75	3.96	
Total	300	3.55	1.668	3.36	3.74	

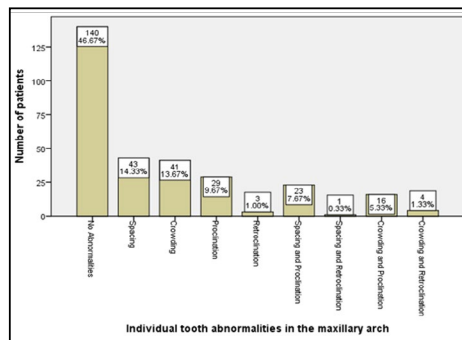
**Table 3.** The table depicts the duration of levelling and aligning in different types of malocclusions in relation to the individual tooth differences in both the maxillary and mandibular arches. The average duration of levelling and aligning in our study was  $3.55 \pm 1.67$  months. ANOVA showed  $p=0.028$   $p \leq 0.05$ , statistically significant.

Individual Tooth Abnormalities	N	Mean duration	Std. Deviation	95% Confidence		Sig
				Lower Bound	Upper Bound	
No abnormalities	140	3.69	1.54	3.44	3.95	0.028
Spacing	43	3.51	1.638	3.01	4.02	
Crowding	41	2.83	1.856	2.24	3.42	
Proclination	29	3.59	1.918	2.86	4.32	
Retroclination	3	5	2	0.03	9.97	
Spacing and Proclination	23	4.09	1.379	3.49	4.68	
Spacing and Retroclination	16	3.63	1.544	2.8	4.45	
Crowding and Retroclination	4	2	2.309	-1.67	5.67	
Total	300	3.55	1.668	3.36	3.74	

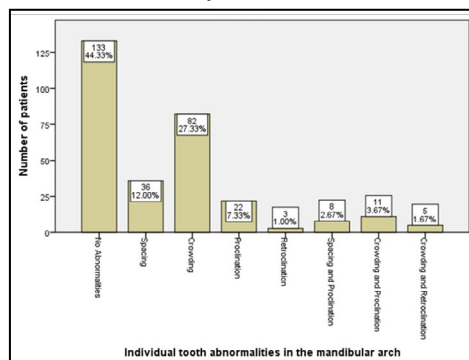
**Table 4.** Table depicts the frequency of individual tooth abnormalities in the maxillary and mandibular arches. In the maxillary arch 53.3% and 55.7% of the patients had individual tooth abnormalities in the maxillary arch and mandibular arch respectively.

Individual tooth abnormalities	Maxilla		Mandible	
	Frequency	Percent	Frequency	Percent
Valid No abnormalities	140	46.7	133	44.3
Spacing	43	14.3	36	12
Crowding	41	13.7	82	27.3
Proclination	29	9.7	22	7.3
Retroclination	3	1	3	1
Spacing and Proclination	23	7.7	8	2.7
Spacing and Retroclination	1	0.3	0	0
Crowding and Proclination	16	5.3	11	3.7
Crowding and Retroclination	4	1.3	5	1.7
Total	300	100	300	100

**Figure 2.** Bar graph depicts the frequency of individual tooth abnormalities in patients in relation to the maxillary arch. X-axis denotes individual tooth abnormalities in the maxillary arch. Y-axis denotes the number of patients. The most common individual tooth abnormality in the maxillary arch was spacing (14.33%) followed by crowding (13.67%).



**Figure 3.** Bar graph depicts the frequency of individual tooth abnormalities in patients in relation to the mandibular arch. X-axis denotes individual tooth abnormalities in the mandibular arch. Y-axis denotes the number of patients. The most common individual tooth abnormality in the mandibular arch was crowding (27.33%).



According to Dimitros Maveas et al, Class II division 1 malocclusions are considered to have longer its duration as there is evidence that the earlier the orthodontic treatment begins [28].

While comparing, the duration of levelling and aligning in different types of malocclusions in lieu to the individual tooth differences in both the maxillary and mandibular arches, we found that those with spacing abnormality alone had a mean duration of levelling aligning of  $3.51 \pm 1.64$  months while those with crowding had a mean duration of  $2.83 \pm 1.86$  months. Proclination alone had a mean duration of  $3.59 \pm 1.92$  months while those with retroclination alone had a mean duration of  $5 \pm 2.0$  months. In patients with spacing and proclination the mean duration was  $4.09 \pm 1.38$  months. Since there were only three patients with spacing and retroclination they were not evaluated in the study. However, crowding and proclination compared to crowding with retroclination had a slightly higher sample size of 16 patients and 4 patients respectively. For crowding with proclination, the mean duration was  $3.63 \pm 1.544$  months. For crowding with retroclination, the mean duration was  $2 \pm 2.309$  months. The overall mean duration of levelling and aligning for all the samples was  $3.55 \pm 1.668$  months.

Based on our study, after completing a one way analysis of variance test, our analysis showed that in regards to dental malocclusions, Class I malocclusion had a mean duration of  $3.49 \pm 1.54$  months. Class II Division 1 malocclusion had a mean duration of  $3.43 \pm 1.648$  months while Class II Division 2 malocclusion had a mean duration of  $2.45 \pm 2.115$  months. Class II Division 1 Subdivision had a mean duration of  $3.88 \pm 1.774$  months. Class II Division 2 Subdivision malocclusion had the highest mean duration of  $4.67 \pm 0.577$  months. Class III malocclusion, had a mean duration of  $3.85 \pm 1.73$  months, while Class III Subdivision malocclusion had mean duration of  $3.35 \pm 1.644$  months.

As Dimitros Mavreas et al showed in his study, he stated various factors, such as the technique employed, the skill and number of operators involved, the compliance of the patients and the severity of the initial malocclusion, all seem to play a role in the duration of treatment [28]. In a study conducted by Bedwith FR et al, the quality of finished cases and appropriateness of the original diagnosis and treatment plan were not evaluated [29].

The maxilla and mandible relationship is divided into spacing, crowding, retroclination as well as combinations such as spacing with proclination, spacing with retroclination, crowding with proclination and crowding with retroclination. It was also seen from our study that more than 50% of Class I patients reported with no abnormalities regarding maxilla and mandible relationships.

The limitations of this study were the fewer samples in some of the groups. There is a big scope of exploration in regards to duration of orthodontic treatment as there are multiple areas to be covered such as in cases of extractions, orthognathic surgeries as well as headgears done by Fink and Smith [30]. These can be evaluated in detail in future studies.

## Conclusion

Within the limits of the study, patients with Class I malocclusions usually complete their treatments faster than Class II and Class

III patients with Class III and Class II div 1 subdivision patients taking the longest time to complete their treatment. This could be due to the various individual tooth abnormalities in the maxillary and mandibular arches that leads to a longer duration of treatment in patients with Class III and Class II div 1 malocclusions.

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