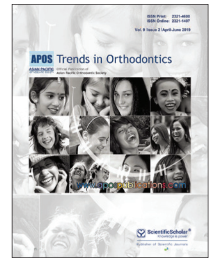
www.apospublications.com

ScientificScholar® Knowledge is power
Publisher of Scientific Journals

APOS Trends in Orthodontics

Article in Press



Clinical Article

Examination of chewing performance with extraction and non-extraction fixed orthodontic treatment – A prospective clinical 1-year study

Serdar Gözler[1], Sanaz Sadry[2]

Departments of [1]Prosthetic and [2]Orthodontics, Faculty of Dentistry, Istanbul Aydin University, Istanbul, Turkey.

***Corresponding author:**
Sanaz Sadry,
Department of Orthodontics,
Faculty of Dentistry, Istanbul
Aydin Universty, Istanbul,
Turkey.

sanazsadry@hotmail.com

Received: 01 February 2022
Accepted: 18 March 2022
EPub Ahead of Print: 09 June 2022
Published:

DOI
10.25259/APOS_19_2022

Quick Response Code:

APOS ASIAN PACIFIC ORTHODONTIC SOCIETY

ABSTRACT

Objectives: It shows that patients receiving orthodontic treatment may have a risk of developing temporomandibular disorder symptoms. The aim of this study is to examine the changes in the chewing system of occlusal contact parameters related to joint vibrations, chewing patterns, and measured excursive movements in fixed and non-extractive orthodontic treatments.

Material and Methods: A total of 43 individuals with premolar extraction (n = 23) and without extraction (n = 20) who applied to the Department of Orthodontics, Dentistry Faculty of Istanbul Aydin University and needed orthodontic treatment were included in the study. In this study, 43 active fixed orthodontic treatment patients were conducted at the beginning (T0) and 6th month (T1) and 12th month (T2) on the parameter recorded during chewing. For occlusion analysis, T-Scan® computerized occlusion analysis recording and examination of the chewing pattern were used for JVA and JT temporomandibular joint parameters. Depending on whether the data showed normal distribution or not, differences between groups were evaluated using the Mann–Whitney or independent t-test, and intragroup differences were evaluated using the Wilcoxon sign test or paired t-test.

Results: At the beginning, 6th month and 12th month of orthodontic treatment, it was observed that the opening, closing, and occlusion times and joint vibration frequencies in the chewing pattern in cases with and without tooth extraction, the integral value differences of total integral, and frequencies below 300 Hz and above 300 Hz were statistically significant (P < 0.001). In digital occlusion analysis values, the right-left differences were not found statistically significant in the measurements made in cases with and without extraction (P > 0.05), while there were statistically significant differences in disclusion values at the beginning, 6th and 12th months (P < 0.05).

Conclusion: At the beginning of the orthodontic treatments with or without extraction, it was observed that the values at the joint level changed significantly in the 6th month. However, the changes in the joints during the treatment, when they return to their ideal values at the end of the 12th month, are more than the change in occlusion.

Keywords: Orthodontic treatment, Occlusion analysis T-scan, Joint vibration analysis, Chewing patterns, TMD, Disclusion time

INTRODUCTION

One of the most important goals of orthodontic treatment is to preserve the long-term stability of the occlusion and tooth alignment obtained as a result of the treatment. Dental occlusion is the static relationship of teeth.[1] Prosthetic dental treatment is aimed to provide appropriate esthetics, phonation, function, and occlusion while replacing the lost tissues. All elements of the masticatory system are affected by changes in occlusion. In ideal occlusion, balanced force distribution is provided to all components with bilateral and simultaneous contacts on the teeth.[2,3] If the proper occlusion is not achieved, adverse effects may be seen in teeth, periodontal tissues, masticatory muscles, and temporomandibular joint (TMJ). To avoid these, occlusal analysis and alignment must be done carefully. Many methods have been developed for occlusal analysis. Materials such as articulating paper, metal sheets (shim stock), and silk ribbon have been widely used for many years and studies have been carried out on these methods.[4,5] With the advancement of technology, digital methods have been introduced and interest in these methods has increased rapidly. One of these methods is the T-Scan® occlusal analysis system (Tekscan Inc., USA). CEREC Omnicam™ (Sirona Dental Systems, Germany), a computer-aided design and manufacturing system, is primarily used for the design and manufacture of all-ceramic restorations.[6,7] In addition to the design and production feature, the occlusal contact points on the teeth are also shown by referring to the images obtained. Studies evaluating the accuracy of these contact data are limited in the literature.[8,9] With the T-scan system, it is stated that dynamic contact relations, occlusal force distributions, and disclusion and occlusion times can be evaluated both in maximum intercuspation and during lateral movements of the lower jaw.[10-12] In addition, the estimated error rate, sensitivity, and reliability of the measurements obtained with this system are 1%, 98%, and 97.2%, respectively, and it provides more advanced and reliable information than conventional methods used in the evaluation of occlusion.[13] However, none of the previous studies have adequately evaluated the occlusion using the T-scan III device during the active orthodontic treatment period. On the other hand, no study has been found in the literature in which occlusion was evaluated with T-scan III during the active orthodontic treatment period. It is reported in the literature that the effect of occlusion on TMJ disorders is 10–15%. While some studies investigating the role of TMJ disorders and occlusal factors found a positive relationship between signs and symptoms of TMJ diseases and Angle classification and occlusal guidance factors, no relationship was found in some studies. However, with the thought that malocclusion is the most important factor leading to TMJ disorders, irreversible occlusal adjustments are made by dentists today as in the past.[14,15]

This study aims to determine the distribution of occlusal factors and whether there are changes in the joint due to this in individuals receiving fixed orthodontic treatment.

MATERIAL AND METHODS

Forty-three healthy individuals, aged between 16 and 30 years, who visited the Department of Orthodontics for fixed orthodontic treatment (with and without tooth extraction, 13 and 30 patients, respectively), were included in this study (treatment group).

The study included patients who were systemically and periodontally healthy; treated using fixed orthodontic appliances; underwent symmetrical extraction of premolars, if required, for orthodontic treatment; were not treated with orthognathic surgery; and who achieved optimum occlusion and treatment goals. The analyzes were applied to the patients in 3 different periods: Before starting the treatment (T0), the 6th month of the treatment (T1), and the 12th month (T2), the end of the treatment, and the results obtained were evaluated statistically. All patients in the treatment group received orthodontic treatment using fixed edgewise 0.18-inch Roth brackets.

The occlusal factors determined in our study were recorded as follows:

A) Sagittal tooth relationship Angle classifications were made according to the intermaxillary relationship of the right first molar teeth.

B) Occlusal guides; lateral anterior guidance was recorded by asking the patient to shift the mandible from the maximum intercuspal position to the right and left. During this movement, if only the canines were in contact, the canine was considered as protective occlusion, and if one or more molars were in contact with the canine, group function occlusion was considered. When the patient slides the lower jaw forward, if there is contact with the anterior teeth, it was recorded as "Anterior guidance available," otherwise "No anterior guidance."

C) The presence of balancing party conflict and contact; when the patient shifts his teeth to the right or left if there is a tooth contact on the balancing side, it is considered as "balancing party contact," if the balancer side makes tooth contact to eliminate the contact on the working side, it is considered as "balancing party conflict."

The subjects sat in an upright position. Their maximum unassisted opening and lateral deflections were recorded clinically and entered into the computer with the BioPak software program. The headset device was then placed on the subject's head with the sensors positioned over the TMJs; the subjects were instructed to watch the monitor where they observed an animation illustrating opening and closing mouth movements, synchronized to a metronome. They were then instructed to open their mouth as wide as they could and close, tapping their teeth together following and matching the animation and the metronome, which they observed on the screen. As the subject performed the opening and closing with the joint vibration analysis (JVA), the characteristic vibrations produced by the condyles were detected by the accelerometers and recorded on the computer.

After the first set of JVA tracings was recorded, the Research Diagnostic Criteria examination was performed, then the second set of JVA tracings was recorded [Figure 1a and b]. In our study, the T-scan III (Tekscan, Inc., South Boston, USA) system was used to analyze the number of contact points and occlusal force parameters associated with centric occlusion and eccentric movements. The T-scan III system consists of a foil/sensor, bite-fork (with small and large options), holding part, and software [Figures 2 and 3]. Each foil/sensor is 0.06–1-mm thick; there are approximately 1300–1500 sensors on the system that can detect even the smallest force. On connecting the device to the computer, the data received by the sensor can be evaluated during the recording and saved for subsequent analysis. This diagnostic device is compatible with Microsoft Windows (Microsoft Corp. USA) and requires a standard Intel processor computer and a minimum of 1 GB RAM. The G * Power (G * Power Ver.3.0.10, Kiel, Germany) package program was used to determine the number of individuals to be included in the study. In our study, for a power >80%, at least 15 patients were required in each group to achieve a significance level of $\alpha = 0.05$. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) 22.00 (SPSS Inc., Chicago, IL, USA) for Windows. For each parameter, a normal value was determined using the arithmetic mean of all the values obtained. The Wilcoxon test was used to compare the qualitative data. The results were evaluated using a 95% confidence interval and a significance level of $P < 0.05$. The distribution of the data was evaluated using the Shapiro–Wilk test. Since the quantitative data did not show a normal distribution in the comparison between the periods, they were evaluated using the Friedman test.

RESULTS

Descriptive statistics regarding the mean age and total duration of the treatment of the individuals included in the study are shown in [Table 1]. As shown in the table, the mean treatment period of 43 individuals included in the study was 13.08 ± 0.50 years (months), and their mean age was 16.22 ± 3.45 years [Table 1]. As a result of the comparison of the number of occlusal contact points at maximum intercuspidation between the beginning of treatment and the 6th and 12th months in individuals treated with and without extraction treatment: The increase in the number of posterior regions occlusal contact points is $P < 0.001$, the increase in the number of anterior regions occlusal contact points is $P < 0.05$, and the increase in the total number of occlusal contact points was statistically significant at the $P < 0.001$ level. As a result of the comparison between the 6th and 12th months, it was determined that there was no statistically significant difference in terms of the number of anterior occlusal contact points, the number of posterior occlusal contact points, and the total number of occlusal contact points [Table 2]. As a result of the comparison of the occlusal force distributions of the right anterior, right posterior, left anterior, and left posterior quadrant at maximum intercuspidation between the beginning of the treatment and the 6th and 12th months in fixed orthodontic treatment, it was observed that there was no statistically significant difference [Table 3]. As a result of the comparison of the occlusal force distributions of the right half-jaw and the left half jaw at maximum intercuspidation between the beginning of the treatment and the 6th and 12th months, it was observed that there was no statistically significant difference in the individuals who received treatment with and without extraction [Table 4]. As a result of the comparison of the force distributions of the right working

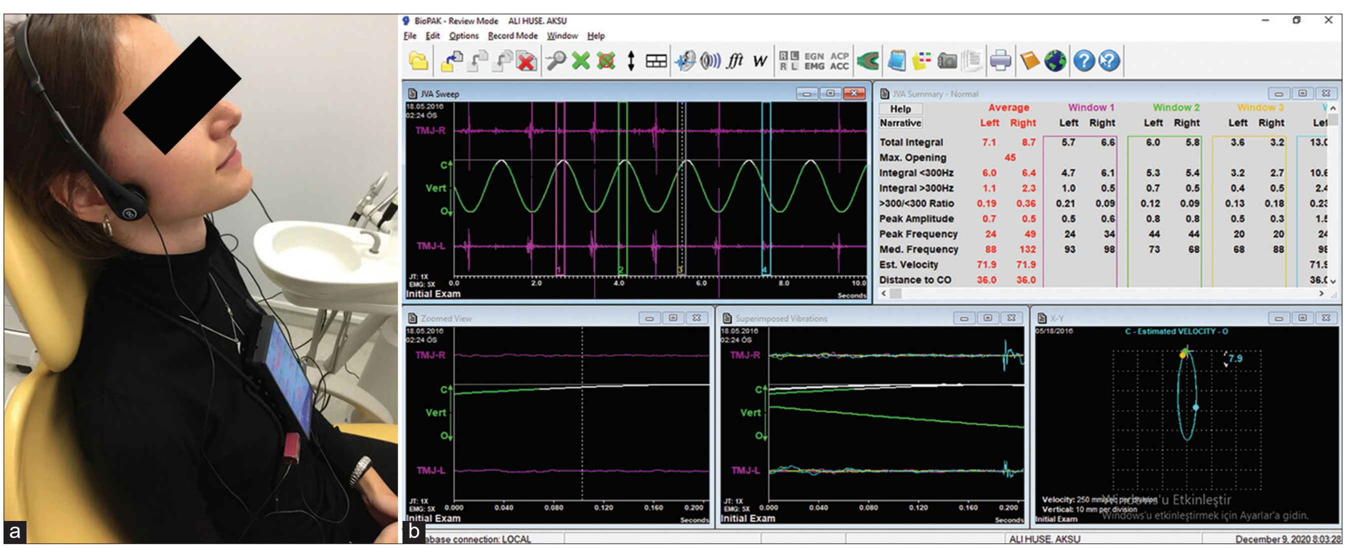


Figure 1: (a and b) Joint vibration analysis record.

Figure 2: Tscan analysis record.

Table 1: Descriptive statistics for average age and duration of treatment.

	Number of patients (*n*)	Treatment Time	Treatment Age		
			Mean±SD	**Min.**	**Max.**
Total	63	6.1±0.50	Female: 16.6±3.11 Male: 16.8±3.23	13.35	30.1

and non-working side observed during lateral movements in individuals receiving treatment with and without extraction, there was no statistically significant difference between the beginning of the treatment and the 6th and 12th months. Likewise, when the force distributions of the left working and non-working sides were compared between the beginning of the treatment and the 6th and 12th months, it was seen that there was no statistically significant difference [Table 5]. As a result of the comparison of the occlusion time between the beginning of the treatment and the 6th and 12th months in individuals treated with and without extraction, it was seen that there was no statistically significant difference. In addition, as a result of the comparison of the disclusion time determined for the right and left sides between the beginning of the treatment and the 6th and 12th months, it was seen that there was no statistically significant difference [Table 6]. There was no significant difference between the left and right sides (total integral, integral 300 Hz, and Ratio) $P > 0.05$ [Figure 4].

DISCUSSION

In orthodontic treatments, tooth extraction is a method frequently implemented by orthodontists to make space in

Table 2: The total number of anterior region, posterior occlusal contact points observed at the beginning of treatment (T0), 6. months (T1) and 12. months (T2) in individuals receiving extracton-non extraction treatments, and the results of repeated Measured Variance Analysis performed to evaluate the change of this parameter between times.

Number of Occlusal Contact Points at Maximum Intercuspation	Extraction Group							Non-extraction Group						
	T0		T1		T2		P	T0		T1		T2		P
	Mean	Sd	Mean	Sd	Mea n	Sd		Mean	Sd	Mean	Sd	Mean	Sd	
Anterior Region	10.2	3.15	13.0 8	3.25	11.0 9	3.60	0.41 3	10.1 3	4.25	12.1	4.2	11.87	3.11	0.228 ns
Posterior Region	25.2 2	4.67	27.1	4.57	26.4	5.48	0.36 3 ns	25.1 7	4.48	26.43	4.21	25.05	5.2	0.861 ns
Total	31	6.32	35.0 5	6.80	33.1 2	7.97	0.40 6 ns	32.0 8	4.77	35.18	5.5	33.4	6.25	0.081 ns

Mean: Average, Sd: Standard deviation, ns: nonsignificant, p <0.05: *, p <0.005: **, p <0.001: ***

Table 3: Measured Variance Analysis results for evaluating distribution of occlusal force of the right anterior, right posterior, left anterior and left posterior quadrant at the beginning of treatment (T0), 6. months (T1) and 12. months (T2) in individuals receiving extracton-non extraction treatments, and the results of repeated Measured Variance Analysis performed to evaluate the change of this parameter between times.

Occlusal Force Distribution at Maximum Intercuspation	Extraction Group							Non-extraction Group						
	T0		T1		T2		P	T0		T1		T2		P
	Mean	Sd	Mean	Sd	Mean	Sd		Mean	Sd	Mean	Sd	Mean	Sd	
Right Anterior Quadrant	16.2 3	6.3 5	15.9	6.7 5	16.1 8	6.50	0.35 4	16.0 5	6.42	15.2	6.55	16.48	6.22	0.100 ns
Left Anterior Quadrant	16.8 6	5.2 1	16.03	5.3 5	15.1 9	7.81	0.76 3 ns	16.3 3	5.81	15.55	6.02	16.07	6.19	0.562 ns
Right Posterior Quadrant	35.4 2	7.4 5	36.5	7.4 4	34.1 5	8.39	0.31 1 ns	35.2 6	7.39	35.78	7.12	35.18	7.02	0.422 ns
Left Posterior Quadrant	34.1 5	8.4 8	35.24	8.4 6	34.6 7	7.77	0.24 9 ns	35.1 7	8.17	35.32	8.33	35.02	7.1	0.688 ns

Mean: Average, Sd: Standard deviation, ns: nonsignificant, p <0.05:*, p <0.005: **, p <0.001: ***

cases with excessive space restriction in the jaw. Providing three-dimensional control during the retraction of canines in extraction treatments is of great importance for the stability of orthodontic treatment.[16] Therefore, success in orthodontic treatments depends on the treatment mechanics as well as a good treatment plan. In our study, there was a significant increase in the number of posterior, anterior, and total contact points in the individuals who underwent fixed orthodontic treatment (with and without extraction) between T0, T1, and T2. There is a lack of studies in the literature regarding the changes in occlusion analysis values of the number of contact points before and after individuals' orthognathic surgery, with

Table 4: Measured Variance Analysis results for evaluating distribution of occlusal force of the right hemi-jaw and the left hemi-jaw at the beginning of treatment (T0), 6. months (T1) and 12. months (T2) in individuals receiving extracton-non extraction treatments and the results of Repeated Measured Variance Analysis performed to evaluate the change of this parameter between times.

Occlusal Force Distribution at Maximum Intercuspation														
	Extraction Group							Non-extraction Group						
	T0		T1		T2		P	T0		T1		T2		P
	mean	Sd	mean	Sd	Mean	Sd		mean	Sd	mean	Sd	Mean	Sd	
Right Hemi-Jaw	50.2	10.33	51.42	7.86	50.46	6.26	0.433 ns	50.21	6.67	50,44	6.5	51.44	6.48	0.921 ns
Left Half Chin	51.65	10.42	50.38	7.82	51.33	6.45	0.558 ns	49.42	6.86	49.67	6.75	50.27	6.38	0.623 ns

Mean: Average, Sd: Standard deviation, ns: nonsignificant, p <0.05: *, p <0.005: **, p <0.001: ***

Table 5: Measured Variance Analysis results for evaluating distribution of occlusal force of the right working and non-working side, left working and non- working side at the beginning of treatment (T0), 6. months (T1) and 12. months (T2) in individuals receiving extracton-non extraction treatments. and the results of Repeated Measured Variance Analysis performed to evaluate the change of this parameter between times.

Force Distribution in Lateral Movements														
	Extraction Group							Non-extraction Group						
	T0		T1		T2		P	T0		T1		T2		P
	mean	Sd	mean	Sd	mean	Sd		mean	Sd	Mean	Sd	Mean	Sd	
Right working side	85.5	16.5 4	87.8 2	12.1 7	87.9 3	13.6 4	0.083 ns	86.77	15.2 1	87.93	13.6 4	87.22	13.01	0.937 ns
Right non-working side	14.0 6	16.5 4	12.5 8	12.0 3	12.0 7	13.4	0.70 ns	13.45	13.3 5	12.07	13.6 4	13.68	12.1	0.721 ns
Left working side	87.2 3	1.15	89.1 3	14.4 5	88.7 8	13.9 5	0.576 ns	87.76	12.8 8	88.78	13.9 5	88.08	12.67	0.784 ns
Left non-working side	12.7 8	12.1 7	11.0 3	14.8 0	11.0 7	14.0 5	0.612 ns	10.85	14.1	11.07	14.0 5	11.08	13.29	0.973 ns

Mean: Average, Sd: Standard deviation, ns: nonsignificant, p <0.05: *, p <0.005: **, p <0.001: ***

Table 6: Measured Variance Analysis results for evaluating distribution of occlusal force of the occlusion and disclusion times at the beginning of treatment (T0), and at the 6th month (T1) and the change of this parameter between the times in patients with and without extraction treatment.

Occlusion and Disclusion Times														
	Extraction Group							Non-extraction Group						
	T0		T1		T2		P	T0		T1		T2		P
	mean	Sd	mean	Sd	Mean	Sd		mean	Sd	Mean	Sd	Mean	Sd	
Occlusion time	0.33	0.35	0.28	0.15	0.32	0.20	0.276 ns	0.32	0.18	0.29	0.11	0.30	0.15	0.420 ns
Disclusion Time- Right side	2.33	1.22	2.75	1.18	2.56	0.96	0.689 ns	2.66	0.92	2.7	1.2	2.56	1.1	0.812 ns
Disclusion Time- Left side	2.96	1.43	2.88	1.23	2.72	1.18	0.544 ns	2.55	1.05	2.41	1.1	2.7	1.13	0.233 ns

Mean: Average, Sd: Standard deviation, ns: nonsignificant, $P<0.05$: *, $P<0.005$: **, $P<0.001$: ***

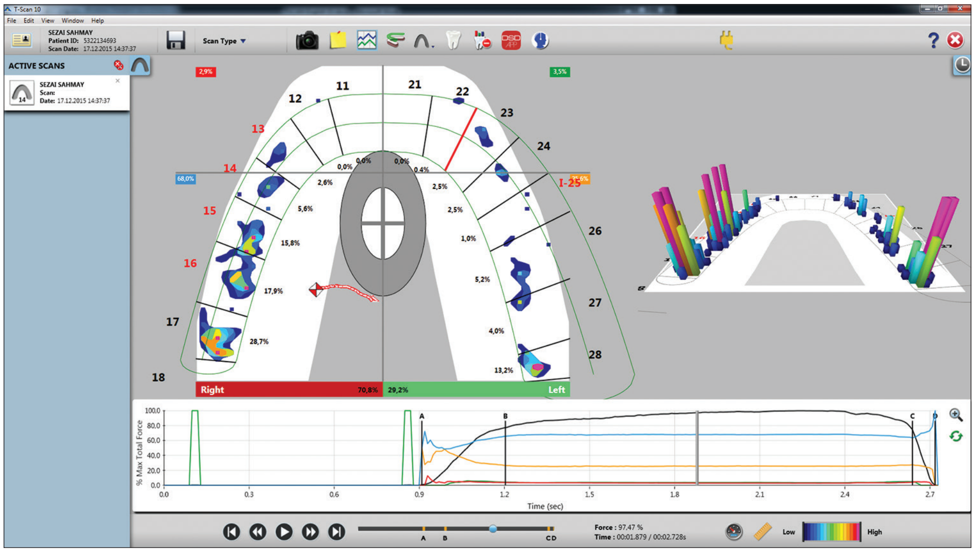


Figure 3: Screenshot of force/timeline, two-dimensional, and three-dimensional graph of maximum occlusal force recording taken.

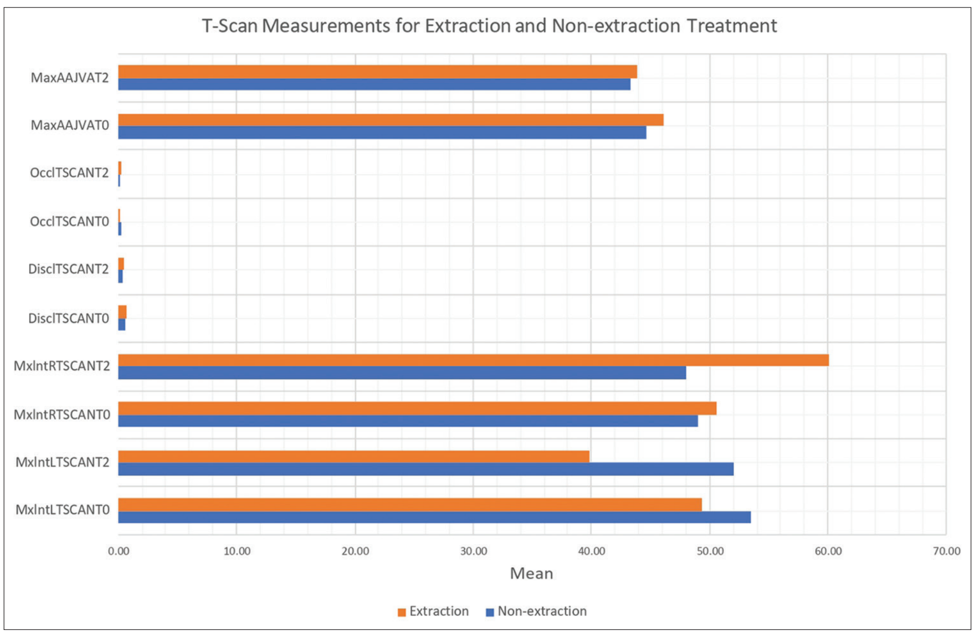


Figure 4: Joint vibration analysis diagram.

and without fixed orthodontic treatment.[17-19] In our study, the distribution of forces in the teeth varied between 0% and 40%, and the greatest force was concentrated on the first molars, followed by the second molars and first premolars, respectively. The lateral incisors were subjected to the least amount of force. Okeson[20] has stated that occlusal forces are affected by several factors such as age, sex, skeletal morphology, and malocclusion and that the first molars are subjected to the greatest force during chewing. Qadeer *et al*.[6] compared the occlusal strength parameters in 25 individuals with Angle class I relationship with and without orthodontic treatment using T-Scan III, and in both groups, the largest amount of force was concentrated on the second molars, followed by the first molars and second premolars, respectively. They reported the lateral incisors being subjected to lesser forces. They also stated that the distribution of forces on the teeth within the arch varied between 0% and 35%. These findings correspond to the results of our study. In our study, there was no significant change between T0 and T1 in terms of force per tooth. Moreover, the occlusal forces were distributed equally in the right and left jaws, and there was no significant change in the occlusal force distribution in the right and left jaws between T0 and T1. In another study, the occlusal forces observed in the right and left hemispheres demonstrated a balanced distribution not exceeding 50% for one side.[21] The findings in these studies are consistent with the results of our research. In another study conducted by Giray and Sadry using T-Scan, JVA, and JT, the 6-month result of the study performed in 43 experimental groups did not find any findings that would raise the suspicion of temporomandibular disorder (TMD), and it was observed that the duration of disclusions was shortened. However, at the end of the study, it is recommended to check the JVA values with occlusion analysis at the beginning and the end of orthodontic treatments.[8] They also recommend that these studies be conducted by researchers for a longer period and with more individuals. However, the higher number of cases in this study shows a difference from the results of the study conducted by Giray and Sadry.[17] The study, which was conducted for 6 months or less, and this study, which covered 12 months, was conducted in the same clinic, but independently with different duration and individuals. Therefore, although the working environment and the test material used and the study results are very similar, the differences in the working process suggest that there may be changes in the quality of orthodontic treatment. However, the similarities in the results are quite striking. In the study conducted by Henrikson *et al*.,[22] orthodontic treatments with and without extraction were considered important in terms of the prevalence of TMD, and it was stated that the changes in occlusion during orthodontic treatment may have an important role in terms of TMD. In our study, even though there was no significant difference between the duration of disclusion and occlusion, as Henrikson *et al*. have stated, group-based changes should be approached more protectively in terms of TMD.[22] Considering the results of our study, it was determined that the occlusal force distributions observed in the right anterior, left anterior, right posterior, and left posterior quadrants, and right and left hemi-jaws in the treatment group at T0,T1, and T2 were similar to those of the individuals with Angle class I relationship (non-extraction group). Studies have reported that in healthy individuals, the incidence of group-function occlusion is higher than that of canine-sparing occlusion.[23] Moreover, it has been stated that the non-working side contacts observed in individuals who have undergone orthodontic treatment are similar to those of healthy individuals who have not undergone treatment, with a higher incidence of group function occlusion pattern in the former, compared to canine-protected occlusion.[24] There is no previous study in the literature investigating the change in the distribution of forces on the working and non-working sides during fixed orthodontic treatment in individuals with extraction cases.[25] In our study, no statistically significant difference was observed in the non-extraction group between T0, T1, and T2 in terms of force distribution on the working and non-working sides. The time from the first tooth contact to maximum intercuspation during the closing movement is defined as the occlusion time.[26] In our study, it was observed that the occlusion time was 0.33±0.35, 0.28±0.15 ve 0.32±0.20 0.18 s in the T2 time. In addition, no statistically significant difference was observed between the extraction group at T0, T1, and T2, and the non-extraction group, in terms of the occlusion times. A longer occlusion time (ideal occlusion time is desired to be <0.2 s) indicates the presence of premature contact during closure and negatively affects occlusal stability.[11,15] In contrast, Qadeer *et al*.[6] have stated that the average occlusion time was 0.38 s in individuals who underwent orthodontic treatment and 0.41 s in individuals who did not undergo orthodontic treatment. These results are consistent with the results of our research. In a study evaluating the relationship between the duration of disclusion and the maximum bite force, it was reported that greater bite forces were observed in individuals whose disclusion duration was reduced to <0.5 s.[12] In our study, no statistically significant difference was observed in the treatment group between T0 (with and without extraction) and T1 in terms of disclusion times. Based on the results of our study, the period of disclusion was longer than normal in individuals who underwent orthodontic treatment. Kerstein and Radke[27] have reported that the presence of group function contacts on the working side prolongs the disclusion time. Hence, the observation of group function occlusion pattern in the individuals included in our study was a factor of prolonged disclusion time. When evaluated together with the results of our study, this research shows that canine-sparing occlusion can protect the person from developing TMJ. Our result is supported by some studies. Some other studies have reported that occlusal guidance does not affect TMJ disorders. Butler *et al*.[28] found no relationship between lateral occlusal guidance and joint sounds and muscle tenderness in their study with 56 patients. Roberts *et al*.[29] compared individuals with disc displacement and normal disc position and found no difference in terms of occlusal guidance. Runge *et al*.[30] evaluated the relationship between joint sounds and occlusion in their study on 226 pre-orthodontic individuals. They did not find any relationship between working or non-working side contacts and joint sounds. The most striking result obtained with T-Scan is Qadeer *et al*.[6] and the fact that the number of cases studied in this study is much higher, and the inclusion of the control group in the timeline supports the robustness of this result. It was evaluated as what caused it. However, the high significance of the results obtained with JT in all comparisons ($P < 0.001$) indicates that the reason for the changes in the chewing pattern during orthodontic treatment may be orthodontic treatment and supports the study by Kerstein and Radke.[31] Another factor that draws attention to all three methods is that the increase in the frequency values of the chewing pattern and TMJ sounds in the 6th month of orthodontic treatment changes significantly and positively in the 12th month of the treatment. This shows that orthodontic treatments are the most risky period in terms of deterioration in the joint around the 6th month.

Limitation of the study

With this study, researchers who are considering to conduct research on a similar subject, dividing the extraction cases only as upper or lower/upper, and taking the occlusal records to cover the beginning, inter-treatment, and end-of-treatment periods, to prevent complications such as joint disorders and asymmetry due to early contacts, occlusal change has a long-term effect. It is recommended to follow up, increase the number of individuals included in the study and create groups with different malocclusions, thus evaluating the effects of different orthodontic treatments on occlusion and recurrence.

CONCLUSION

It was observed that the number of occlusal contact points increased in the first 12 months during extraction fixed orthodontics and in individuals who received non-extraction treatment, at the beginning of the treatment and the 6th and 12th months; occlusal force distribution for each tooth region, occlusal force distribution for the right anterior, right posterior, left anterior and left posterior quadrants, and occlusal force distribution for the right half jaw and left half jaw, force distribution for the working and non-working sides in lateral movements, occlusion, and disclusion. There was no significant change in the parameters of the occlusal time parameters, the occlusal force distributions in the right and left half jaws were symmetrical, the right and left disclusion times were longer than the normal values, the group function occlusion pattern was observed, and the force distributions formed on the working and non-working sides in these individuals were similar to individuals with natural dentition. It has been determined that the T-scan III system is a useful clinical tool in the evaluation of occlusion during orthodontic treatment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Moss JP. The soft tissue environment of teeth and jaws. experimental malocclusion: Parts 2 and 3. Br J Orthod 1980;7:205-16.
2. Roth RH. The maintenance system and occlusal dynamics. Dent Clin North Am 1976;20:761-88.
3. da Silveira TG, Caracas HC. Perception of the relationship between TMD and orthodontic treatment among orthodontists. Dental Press J Orthod 2015;20:45-51.
4. Klages U, Rost F, Wehrbein H, Zentner A. Perception of occlusion, psychological impact of dental esthetics, history of orthodontic treatment and their relation to oral health in naval recruits. Angle Orthod 2007;77:675-80.
5. Sultana MH, Yamada K, Hanada K. Changes in occlusal force and occlusal contact area after active orthodontic treatment: A pilot study using pressure-sensitive sheets. J Oral Rehabil 2002;29:484-91.
6. Qadeer S, Yang L, Sarinnaphakorn L, Kerstein RB. Comparison of closure occlusal force parameters in post-orthodontic and non-orthodontic subjects using T-Scan III DMD occlusal analysis. Cranio 2016;34:395-401.
7. Uzuner FD, Odabasi H, Acar S, Tortop T, Darendeliler N. Evaluation of the effects of modified bonded rapid maxillary expansion on occlusal force distribution: A pilot study. Eur J Dent 2016;10:103-8.
8. Trpevska V, Kovacevska G, Benedeti A, Jordanov B. T-scan III system diagnostic tool for digital occlusal analysis in orthodontics a modern approach. Pril (Makedon Akad Nauk Umet Odd Med Nauki) 2014;35:155-60.
9. Nota A, Tecco S, Cioffi C, Beraldi A, Padulo J, Baldini A. Occlusion time analysis in military pilots affected by bruxism. Sci Rep 2019;5;9:1408.
10. Baldini A, Nota A, Cozza P. The association between occlusion time and temporomandibular disorders. J Electromyogr Kines 2015;25:151-4.
11. Lee SM, Lee JW. Computerized occlusal analysis: Correlation with occlusal indexes to assess the outcome of orthodontic treatment or the severity of malocculusion. Korean J Orthod 2016;46:27-35.
12. Sierpinska T, Kropiwnicka A, Kuc J, Jacunski P, Gołębiewska M. The influence of occlusal morphology on occlusion time. Cranio 2017;35:101-9.
13. Bozhkova TP. The T-SCAN system in evaluating occlusal contacts. Folia Med (Plovdiv) 2016;58:122-30.
14. Wang C, Yin X. Occlusal risk factors associated with temporomandibular disorders in young nadults with normal occlusion. Oral Surg Oral Med Oral Pathol Oral Radiol 2012;114:419-23.
15. Araújo TM, Caldas LD. Tooth extractions in orthodontics: First or second premolars? Dental Press J Orthod 2019;24:88-98.
16. Peck S. Extractions, retention and stability: The search for orthodontic truth. Eur J Orthod 2017;39:109-15.
17. Giray B, Sadry S. Modifications in Class I and Class II Div. 1 malocclusion during orthodontic treatment and their association with TMD problems. Cranio 2021;39:65-73.
18. Qadeer S, Abbas AA, Sarinnaphakorn L, Robert B. Comparison of excursive occlusal force parameters in post-orthodontic and non- orthodontic subjects using T-Scan® III. CRANIO® 2016;34:395-401.
19. Agbaje JO, Van de Casteele E, Salem AS, Anumendem D, Shaheen E, Sun Y, *et al*. Assessment of occlusion with the T-Scan system in patients undergoing orthognathic surgery. Sci Rep 2017;7:5356.
20. Okeson JP. Criteria for optimum functional occlusion. In:

Okeson JP, editor. Management of Temporomandibülar Disorders. Amsterdam, Netherlands: Mosby, Elsevier. 1993. p. 95-110.
21. Koval S. T-scan occlusal analysis after adult orthodontic treatment. J Clin Orthod 2016;50:466-75.
22. Henrikson T, Nilner M, Kural J. Signs of temporomandibular disorders in girls receiving orthdontic treatment. A prospective and longitudinal comparision with untreated Class II malocclusion and normal occlusion. Eur J Orthod 2000;22:271-81.
23. Ogawa T, Ogimoto T, Koyano K. The relationship between non-working-side occlusal contacts and mandibular position. J Oral Rehabil 2001;28:976-81.
24. Francova K, Eber M, Zapletalova J. Functional occlusal patterns during lateral excursions in young adults. J Prosthet Dent 2015;113:571-7.
25. Aung PT, Kato C, Abe Y, Ogawa T, Ishidori H, Fujita A, *et al*. Functional analysis of rhythmic jaw movements evoked by electrical stimulation of the cortical masticatory area during low occlusal loading in growing rats. Front Physiol 2020;11:34.
26. Sim HY, Kim HS, Jung DU, Lee H, Han YS, Han K, *et al*. Investigation of the association between orthodontic treatment and temporomandibular joint pain and dysfunction in the South Korean population. Korean J Orthod. 2019;49:181-187.
27. Kerstein RB, Radke J. Masseter and temporalis excursive hyperactivity decreased by measured anterior guidance development. Cranio 2012;30:243-54.
28. Butler JH, Folke LE, Bandt CL. A descriptive survey of signs and symptoms associated with myofascial pain dysfunction syndrome. J Am Dent Assoc 1975;90:635-9.
29. Roberts CA, Katzberg RW, Tallents RH, Espeland MA, Handelman SU. Correlation of clinical parameters to the arthrographic depiction of temporomandibular joint internal derangements. Oral Surg Oral Med Oral Pathol 1988;66:32-6.
30. Runge ME, Sadowsky C, Sakols EI., BeGole A. The relationship between temporomandibular joint sounds and malocclusion. Am J Orthod Dentofacial Orthop 1989;96:36-42.
31. Kerstein RB, Radke J. Average chewing pattern improvements following disclusion time reduction. Cranio 2017;35:135-51.

How to cite this article: Gözler S, Sadry S. Examination of chewing performance with extraction and non-extraction fixed orthodontic treatment – A prospective clinical 1-year study. APOS Trends Orthod, doi: 10.25259/APOS_19_2022