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EVALUATION OF OCCLUSION IN PATIENTS TREATED ORTHODONTICALLY WITH FIXED APPLIANCES

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Abstract: Introduction: Orthodontic correction is a growing reality of treatment used by the Brazilian population to improve the aesthetics and function of the masticatory system. Unlike decades past, aesthetics now predominates over function and the demand for corrective treatments, among which orthodontic treatment is very common in dental offices. The question is: what happens to the occlusion of these patients after orthodontic treatment is completed and what happens to the function of the masticatory system? **Method:** Eighteen young people were selected for this research, ten female 55.55% and eight male 44.45% undergraduate dentistry students at the University of Vale do Itajaí who had completed treatment with fixed braces. The occlusion of these patients was evaluated as well as contacts and trajectories. Initially, manipulation was performed in centric relation and maximum intercuspation, followed by evaluation of laterality and protrusion movements. The subjects' occlusion was evaluated and the data recorded in the occlusion clinics' medical records. All were manipulated in centric relation and if there was resistance to manipulation they were subjected to deprogramming with an occlusal appliance of the Michigan type for a period of 8 weeks. Five of them needed to be deprogrammed. Then, the lateral movements of the mandible were evaluated to record the presence of occlusion guides on the working side or even occlusal interferences on working or balancing sides. The collected data, recorded in tables, were subjected to percentage analysis with the aim of reproducing the occlusion profile of patients who had undergone orthodontic treatment, being compared and discussed with reports found in research in the literature. **Results:** The results obtained were distributed: in centric relation 07 subjects 38,88% of the sample presented bilateral contact in posterior teeth, 03 subjects 16,66% had contact between 16 X 46 teeth, 03 16,66% contact between 14 X 44 teeth. The other 05 who participated in the research, presented unilateral contacts between the teeth 15 X 46 (01) 5.55%, 16 X 46 (01) 5.55%, 14 X 44 (01) 5.55%, 45 X 16 (01) 5.55% and 25 X 36 (01) 5.55%. In maximum intercuspation, 12 subjects (66.66%) presented contact in all teeth, 02 subjects (11.11%) in all posterior teeth, 02 subjects (11.11%) only in molars and the other 02 (11.11%) in incisors. In the lateral movements 03 (16.66%) presented canine guide, 06 (33.33%) guide in group, 02 (11.11%) canine and group guidance, one on each side, 02 (11.11%), partial canine guidance and interference, and 03 (16.66%) partial group guidance and interference. In the protrusion movement was observed that in 12 subjects (66.66%) of the sample all the incisors, maintained contact during the trajectory of the mandible, in 02 subjects (11.11%) of the cases only the central incisors, guided the trajectory and in 01 case, (5.55%) there was some occlusal interference. **Conclusion:** in this study it was concluded that even when the treatment achieved an aesthetic result that satisfied the patient, significant occlusal instability was detected at the end of the orthodontic treatment. The aesthetic result in most cases masks the functional importance, compromising the aesthetic longevity achieved. It is imperative that awareness be given to an occlusal evaluation before completing any orthodontic treatment.

Key words: Malocclusion, dental movement, dental occlusion, orthodontic treatment, fixed braces, centric relation, lateral movements.

Introduction

The appreciation of the aesthetic in recent years has increase greatly among both, the female and male population. Not only have medical interventions, such as plastic surgery, brought hundreds of patients to doctors' offices as they have become popular, but treatments that improve dental aesthetics have also brought dozens more to orthodontics' offices. It is unequivocal that this fact is related to the technical-scientific agreement of dentistry and the consequent reduction in the cost of treatments in this specific area. Orthodontic has gained ground, becoming a popular specialty and today, it is difficult to find someone who has never used orthodontic braces. Even a functional occlusion, when achieved at the end of orthodontic treatment, can change over time. Arponen et al. (2022) reported in a study that after 2 years from the end of treatment the share of acceptable occlusions was 64% as assessed using the occlusal morphology and function index (OMFI). Dental aesthetics has been the main reason for seeking orthodontic treatments in recent years, making this dental specialty one of the most sought after by patients. Little importance is given to function, and treatment often fail due to a lack of consideration. Well-positioned teeth often do not reflect stable occlusions, and therefore can fail due to migration, fractures and even structural loss, jeopardizing the aesthetic result achieved. Orthodontists have dedicated efforts to provide treatment in which aesthetic and function are in harmony (LOPES et al. 2006). The occlusal pattern will determine the functionality and harmony of the system, thus avoiding trauma due to premature contact which would result in tooth wear, bone loss with migrations and even tooth loss. The ideal in orthodontic treatments is reconciling aesthetics and function, which is not always possible. Orthodontic treatment can produce an acceptable functional occlusion if, the teeth are moved to positions that accommodate and not interfere, with jaw movements Cordray (1996), however, according to (Ash e Ramfjord 1996), this ideal occlusion is only imaginary and rarely seen in civilization and even achieved with orthodontic treatments. The objective of this study is to perform a functional analysis of patients who were treated orthodontically and, observing the occlusal contacts in centric relation, maximum habitual intercuspation and the guides, in laterality and protrusion movements. All the subjects of this research will be informed in the results and, when necessary, will be advised to seek treatment from a specialist in occlusion.

Method

The research was cross-sectional with primary data analysis. The sample in this study, consisted of 18 students of both sexes, who had undergone orthodontic treatment with fixed appliances selected from among the students of the Undergraduate Dentistry Course at the University of Vale do Itajaí, UNIVALI. Everyone was informed about the research and signed a Free and Informed Consent Form. Initially, an interview was performed to obtain information about the motivation for orthodontic treatment. Information was then recorded about signs and symptoms that the subjects may have had before undergoing orthodontic treatment. These were then compared with the current clinical condition of the research subjects. While performing the occlusal evaluation, the centric and eccentric movements of the mandible were observed in detail, such

as the type of contact in centric relation, whether they were bilateral and simultaneous, and, in lateroprotrusive movements, the presence of occlusion guides, whether canine or in a group as recommended by Martins Filho and Molleri (2007) or if there were occlusal interferences on the working or balance side. Manipulation in centric relation, when necessary, was preceded by neuromuscular deprogramming with a device recommended by Lucia (1964), for its correct recording. The collected data were subjected to percentage analysis and reproduced in the form of column graphs as presented in the research. This analysis gathered information on the occlusion profile of patients, who underwent and completed orthodontic treatment, data that is important for outlining the results from the point of view of occlusal harmony. The study results were communicated to the research subjects, primary regarding the presence of occlusal interferences that could potentially cause damage to the masticatory system. They could then be referred to a specialist for adjustment of these occlusal interferences. This study was approved by the Research Ethics Committee of the University of Vale do Itajaí, UNIVALI.

Results

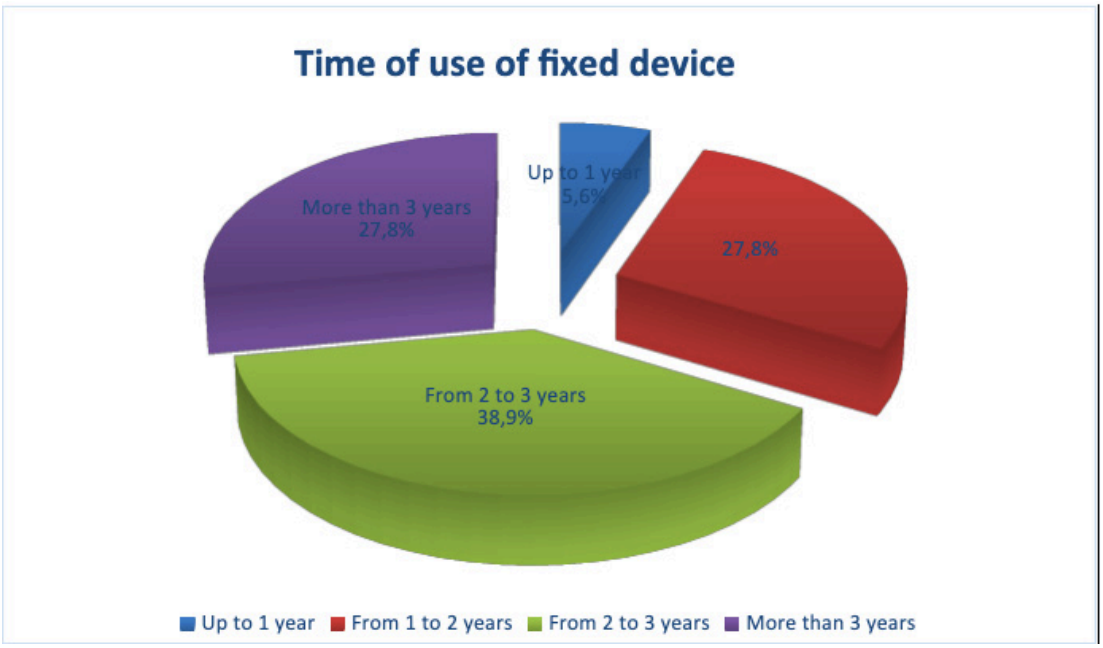
The occlusal evaluation was performed on 18 subjects, 8 males and 10 females aged between 20 and 30 years, all students of the dentistry course at UNIVALI. Of these,100% of the research subjects reported that the main reason for orthodontic treatment was aesthetics. After completing the orthodontic treatment, 16 research participants (88.89%) reported being satisfied with the aesthetic result while 2 subjects (11.11%) were not satisfied with the result. Of all the subjects evaluated, relapsed was recorded in 5 subjects (27.77%) of cases, in the period of 1 to 5 years after treatment with fixed appliances. Regarding the time of use of fixed devices, only 1 participant (5.55%) used the device for up 1 year, 5 of them (27.77%), used it from 1 to 2 years, 7 (38.88%) from 2 to 3 years, and the last 5 (27.77%) above 3 years.

Regarding the number of times, the research subjects used the fixed devices, 15 subjects (83.33%) used the device only once, while 3 of these subjects (16.66%) used it twice. Regarding Angles' classification, 15 subjects (83.33%) presented class I, 1 subject (5.55%) class II and 2 of them (11.11%) class III. Among the subjects manipulated in centric relation (CR), the following dental contacts were found: (table 1).

In lateral and lateroprotrusive movements of the mandible, the following contacts were found (table 3).

The subjects were also instructed to perform protrusion movements while keeping the jaw slightly closed. The following contacts were recorded (table 4).

Of the 18 subjects evaluated, 4 of them (22,22%) presented muscle tension in the masseter and temporal region, 3 of them (16.66%) related frequent headaches. 2 of them (11.11%) both male, had cracked teeth being that in one of them the teeth 13,14 and 43 and in the other subject the teeth 33,34,35,43,44,45. Four subjects (22,22%) had deep bite, 2 (11.11%) had crowding in the lower anterior teeth. Two subjects (11.11%) were difficult to manipulate in centric relation due to strong muscle tension. One subject (5.55%) had frequent temporomandibular joint pain and 2 of them (11.11%) had signs and symptoms of temporomandibular dysfunction.



Graph 1 Time of use of fixed device

Involved teeth	Quantity (percentage)
16 x 46	3 (16,66%)
15 x 46	1 (5,55%)
26 x 36	1 (5,55%)
14 x 44	3 (16,66%)
45 x 16	1 (5,55%)
25 x 35	1 (5,55%)
25 x 36	1 (5,55%)
Bilateral contact	7 (38,88%)

Table 1 Dental contacts found in centric relation (CR)

Involved teeth	Quanttity (percentage)
All teeth	12 (66,66%)
Except premolars	2 (11,11%)
Except incisors	2 (11,11%)
More contacts in posterior teeth	0 (0,00%)
More contacts in anterior teeth	2 (11,11%)

Table 2 – Dental contacts found in maximum intercuspation (MI).

Guide type	Quantity (percentage)
Canine guide	3 (16,66%)
Group guide	6 (33,30%)
Canine and group (one on each side)	2 (11,11%)
No guides	2 (11,11%)
Canine guide with interference	2 (11,11%)
Group guide with interference	3 (16,66%)

Table 3 – Contacts found in lateral movements of the jaw.

Protruding contacts	Quantity (porcentage)
All incisors touch	15 (83,33%)
Only the central incisors touch	2 (11,11%)
Occlusal interference record	1 (5,55%)

Table 4 Contacts found in protrusion movements of the jaw.

Discussion

Detofano and Telles (2006) stated that orthodontic treatment is one of the most performed nowadays in view of the growing appreciation of aesthetics and the need to improve chewing. In this study, 18 were evaluated 8 male and 10 female, all of whom stated that the reason was aesthetics although 12 of them (66.66%) also reported improvement in function. This fact is in line with the study of Kuramae et al. (2002), who stated that the search for occlusal stability should be the main reason for orthodontic treatment, but what predominates is the need for aesthetic. Arponen et al. (2022) also reported that 96% (49 out of 51 patients) were satisfied with the treatment results one year after the treament ended but 2 years later the percentage of satisfied patients fell to 92%. After completing the orthodontic treatment 16 subjects (88.88%), were satisfied with the results, which is very close to the results cited by the authors above.

To Traebert and Marcenes (2002) most of the occlusal problems reported by people are related to appearance. No type of malocclusion was statistically associated with dissatisfaction with chewing, showing that this problem, in the way it was evaluated, did not present a perceptible physiological impact for these individuals. This may be because people generally associate problems only with pain. Of all subjects evaluated, relapse was recorded in 28.7% of cases (5 subjects) in a period of 1 to 5 years after treatment. Macedo at al. (2009) stated that retention and stability after orthodontic treatment constitutes one of the greatest challenges faced by orthodontists, this being the only way to maintain dental alignment after treatment. Zacbrisson's study et al. (1998) stated that in rotational relapse a common error in orthodontics occurs, like the incomplete correction of all the rotation of the initial malocclusion. According Kuramae et al. (2002) all orthodontic treatments have the potential for instability, as the gingival and periodontal tissues are affected by the treatment and therefore require time to be organized. After the braces are removed, factors related to growth-related changes

can affect the treatment outcome. Soft tissues exert pressure on unstable teeth, which can cause relapse. Masticatory forces must be directed along the long axis of the teeth to prevent movement and relapse. This is the most common error in orthodontics: incomplete correction of the tooth rotation. They conclude that relapse is multifactorial and difficult to assess and that orthodontically moved teeth often return to their original positions. Establishing contact points and correcting all tooth rotation are important factors in maintaining occlusal stability. This study compiled these statements about relapse because there were cases where the retainer was not used correctly and was removed prematurely. The affected teeth were in the space between the canines and were always rotated. Subjects who experienced relapse also reported that their teeth returned to their pre-treatment position. Regarding the duration of use, only one subject used the device for up to 1 year. All others used it for up to 2,3 and more years (graph 1). There are no reports in the literature of an ideal time for a complete treatment, as this should vary depending on the severity of the case. Among the subjects manipulated in centric relation (CR), the following contacts were recorded (table 1): in 3 of them (16.66%) the teeth involved in the contact were 16X46. In another 3 subjects (16.66%) the contact occurred on teeth 14X44. In another 4 subjects, contacts were found in teeth 15X46, 26X36, 45X16 and 25X35 with each of these contacts representing (5.55%) of the cases. In the last 7 subjects, bilateral contacts were found in posterior teeth, which is ideal for this position. According to martins Filho and Molleri (2007), simultaneous bilateral contacts in posterior teeth allow for a distribution of forces without overloading an individual tooth. When the mandible was moved to maximum intercuspation (MI), the following contacts were identified: in 2 subjects (11.11%) contact occurred on all teeth except in premolars; in another 2 subjects (11.11%) contact occurred on all teeth except the incisors; in another 2 subjects contacts were more frequent on anterior teeth, and in 12 subjects (66.66%) contacts occurred on all teeth, which is ideal according to Camargo et al. (2007). The authors state that is consensus among researchers that a fundamental principle for occlusal stability is the greater number of contacts in centric position in this case, maximum intercuspation (MI) which results in less stress supported by each tooth and consequently less wear on the contact surface. Assessing laterality movements, the following contacts were recorded: in 3 subjects (16.66%) canine guidance was found, in 6 subjects (33.33%) group guidance, in 2 subjects (11.11%) canine guidance on one side and group guide on the other, in another 2 subjects (11.11%) there was partial guidance on the canine followed by interference; in 3 of these subjects (16.66%) the guidance started in a group and then interference occurred; in the last 2 of these subjects there was no type of guidance. These results differ from Al-Nimri et al. (2010), which recorded the following dinamic occlusal pattern: lateral guidance, 24.5% of subjects had bilateral group function and 18.1% had mixed canine guidance and group function. While at the 3 mm positions, the guidance pattern changed to a predominantly canine guidance. Fifty percent of subjects had bilateral canine guidance. Jil et al. (2025) relate in their rat model of histological observations that directly applying orthodontic forces to treat teeth with low occlusal function may trigger the release of inflammatory factors in

periodontal tissues, thereby leading to excessive absorption of the alveolar bone. The results of the histological study by immunoenzymatic analysis (ELISA) support this conclusion. Martins Filho and Molleri (2007) define canine guidance as a lateral or lateroprotrusive trajectory of the mandible guided by the concavity of canines. When, in this lateral trajectory, the slopes of the premolars and molars participate in the movement along with the canines, the group guide is established. The effectiveness of contact should decrease from anterior to posterior, with the greatest contact always occurring on the most anterior tooth, in this case, the canine. Therefore, even in group guidance, the canine plays a predominant role. In subjects where canine guidance does not occur, fractures or wear on the teeth interfering with lateral movements were observed. An unbalanced occlusion with eccentric early contacts might be associated with damage to the tooth structure, periodontal adverse effects or, in the worst scenario, longitudinal root fractures. A balanced occlusion is likewise among the goals of orthodontic treatment that, in cases of complex malocclusions, is inevitably associated with abundant changes of occlusal contacts (Fritz at al.2025) For the protrusion movement, the following contacts were recorded: in 15 subjects of the research (83.25%) all incisors touched during the trajectory of the mandible, in 2 subjects (11.11%) only the central incisors, and in a single case (5.55%) there was interference in this movement. For Martins Filho and Molleri (2007), the protrusion movement is an important movement for grasping and cutting food; this movement rarely has only an anterior component but also a lateral one, which makes this function more effective. Of the 18 subjects evaluated, 4 of them (22.22%) presented muscle tension in the masseter and temporal muscle region. Conti (2009), states that is very common for patients from other medical specialties to be referred for treatment of pain or dysfunction in the temporomandibular region (TMDs). These are generally adolescents or young adults who present with some type of skeletal or dental malocclusion. Many orthodontists report clinical improvement in these cases after the start of orthodontic treatment. Masci et al. (2013) concluded in an electromyographic study of orthodonticaly treated and untreated subjects that electromyographic activity (EMG) performed during isometric clenching and during chewing that the treatments did not significantly affect electromyographic values, indicating that the treatments did not significantly alter, positively or negatively, the neuromuscular condition of the patients. The authors observed that subjects at rest that had been treated orthodontically for a class II division 1 bite did not have neuromuscular balance that was on par with Control subjects supports prior suggestions that there are many patients in orthodontically treated population that continue to have neuromuscular dysfunction. These subjects also reported having bruxism or clenching at night 2 of them (11.11%) both male, had cracked teeth, the first having teeth 13,14,43 and the second having teeth 33,34,35 and 43,44,45, these being the teeth that interfered with canine guidance. Four other subjects (22.22%) had deep bite, and in 2 of them (11.11%) crowding of the lower anterior teeth was observed. Zabricsson et al. (1998) reported that rotational relapse is due to an error in not completely correcting the rotation of malocclusion, therefore the teeth in rotation. These subjects had their braces removed before the expected treat-

ment time. Considering resistance to manipulation in centric relation, 2 subjects (11.11%) presented strong resistance due to muscle tension, 1 subject (5.55%) reported frequent pain in the TMJ, 2 subjects, (11.11%) showed signs of temporomandibular dysfunction, and 3 subjects (16.66%) reported frequent headache. Bosio (2004) reports that temporomandibular dysfunction, a multifactorial disease, is the sum of terms used to describe symptoms of various biological causes. This fact was observed in this research because those subjects who presented complaints had worn, cracked teeth and exhibited interferences in centric positions and movements.

Conclusion

The aesthetic result in orthodontic treatments was achieved by almost all subjects analyzed. Since aesthetics was the primary reason for seeking treatment, little attention was paid for functional aspects. Analysis of centric relation contacts showed that only 38.88% of subjects presented bilateral and simultaneous contacts in posterior teeth. In maximum intercuspation, (44.45%) did not have contact in all teeth. In lateral movements, (38.90%) showed interference in the guidance process. In protrusive movement, the best result, (83.25%), presented anterior guidance. The study concludes that failure to perform an occlusion evaluation with fixed appliances can result in unstable occlusion with a high probability of relapse. This can influence the aesthetic outcome of the treatment.

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