

A Retrospective Study Assessing the Frequency of Friction type Retraction Mechanics in Patients Undergoing Pre Adjusted Edgewise Therapy

Research Article

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Abstract

Tooth movement occurs by various mechanisms. Force is the basic component when a tooth is retracted or slides through the arch wire is called friction mechanics. Use of elastic modules with signature wire, elastic chains, closed coil springs are used in friction mechanics whereas in frictionless mechanics, force is generated intrinsically, by incorporation loops in archwire energy stored in loops are released in slow and continuous manner. The objective of the study is to evaluate the frequency of friction type of mechanics used for space closure in patients undergoing preadjusted edgewise therapy. A retrospective study was conducted on patients who visited the department of Orthodontics from March 2019 to March 2020. Records of the patients who underwent preadjusted edgewise therapy were taken from the electronic data base. Case sheets were evaluated. The compiled data was statistically analysed with SPSS software. In this study we can contemplate that friction based retraction mechanics were more prevalent than frictionless mechanics in preadjusted edgewise therapy. The results of the study show maximum frequency in friction type mechanics.

Keywords: Friction; Frictionless; Pre Adjusted Edgewise; Retraction; Orthodontics.

Introduction

Orthodontic tooth movement depends on mechanical forces that stimulate biological responses within periodontium [1]. Proper magnitude of force during orthodontic treatment will result in optimal tooth movement [2]. Space closure in a straight wire appliance helps in moving the teeth by sliding preadjusted edgewise brackets over sliding mechanics or loop mechanics [3]. Orthodontic tooth movement during space closure may be performed with two different types of mechanics. The first is the Frictionless method, which consists in bending loops on stainless steel (SS) or titanium molybdenum (TMA) wires, which causes the tooth or group of teeth to move due to the force to moment ratio generated during the activation of the loops. It is called "frictionless mechanics" because the brackets and tubes do not slide along the

archwire. The other space closure mechanics used in Orthodontics is the Friction mechanics or Sliding Mechanics (SM), which involves the actual sliding of brackets and tubes along the wire.

Friction is a force that resists relative motion of two objects in contact [4]. Static frictional force is the smallest force needed to start motion of solid surfaces that were previously at rest with each other. Whereas kinetic frictional force is force that resists sliding motion of one solid object over another at a constant speed. In orthodontics, as the tooth moves in the direction of applied force in the direction of applied force, kinetic friction occurs between bracket and archwire [1].

Friction generated by interaction of an archwire and bracket is influenced by bracket position, bracket width, interbracket distance,

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slot size, archwire type, archwire size, second order angulation, degree of torsion, ligation and weather environment is wet or dry [5-11].

The ligation method of the bracket can satisfactorily influence friction between the bracket and archwires. Several studies have shown that self ligating brackets result in a significant reduction in friction compared with conventional tied siamese brackets [12-16].

In this study, the aim is to evaluate the frequency of friction type retraction mechanics among the patients undergoing preadjusted edgewise therapy in Saveetha Dental College.

Materials And Methods

Study Setting

This study is a university setting study in Saveetha Dental College. The pros of the study include, flexibility of the study and less time consumption. The cons of the study include - it is limited to a certain population. Preadjusted edgewise patients were randomly selected for the study. Approval was obtained from the Institutional Ethical Committee, 2 examiners were involved in the study.

Sampling

It is a retrospective study. Data was collected from June 2019 to March 2020. Totally 371 case sheets were revealed. Cross verification of data for error was done by presence of additional reviewers and by photographic evaluation. Simple random sampling was done to minimize sampling bias.

Data Collection/Tabulation

Data of all the patients who underwent preadjusted edgewise

therapy who received friction and frictionless mechanics were collected from the record keeping software. Data was entered in excel in a methodical manner and was imported to SPSS, incomplete data was excluded from the study.

Statistical Analysis

IBM SPSS 2 software was used for data analysis. Independent variables include - age, gender and dependent variables include friction and frictionless. Descriptive and inferential statistics were used. Descriptive statistics include the frequency of distribution of patients age, gender and inferential less include the chi square.

Results And Discussion

Out of 371 patients, 317 (85.4%) underwent friction type retraction mechanics whereas only 55 (14.8%) underwent frictionless mechanics. On analysing age distribution among friction mechanics, 65.2% of the population were from 18-35 years age group (Figure 1). This was followed by 31.6% were among the 9-17 year age group and only 3.2% were from the 36-55 age group. Gender distribution among friction mechanics shows females prevalence than males with 55.4% of population (Figure 2). While assessing the association of age with friction and frictionless mechanics, 18-35 age group were more prevalent with 55.7% and 9.5% respectively. P Value > 0.05 (Figure 3). On analysing association of gender with friction and frictionless mechanics. Females were prevalent in friction mechanics with 47.3%, whereas males were more prevalent in frictionless mechanics with 8.6% (Figure 4).

One of the primary focuses of the search for ideal conditions for orthodontic tooth movement (OTM) is the reduction of friction at the bracket-wire-ligature interface in certain stages of treatment. Therefore, lower but still sufficient to promote OTM forces could be used. When the orthodontic wire slides through the bracket slot and the tubes, some resistance to sliding always

Figure 1. Bar graph shows the age distribution among the samples chosen. The X axis represents the age (in years) and the Y axis represents the percentage distribution of study population. It can be inferred from the graph that more number of patients received friction based retraction mechanics in pre edgewise therapy at the age of 9-20 years (Light blue) compared to other age groups.

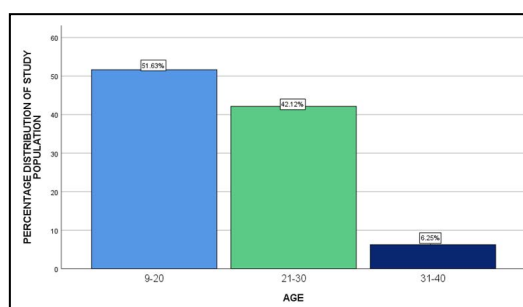


Figure 2. Bar graph shows the frequency of patient distribution on the basis of gender. The x-axis represents the Groups based on gender and the Y axis represents the percentage of patients in each group. It can be inferred from the graph that the maximum number of patients in the study population were females (Blue).

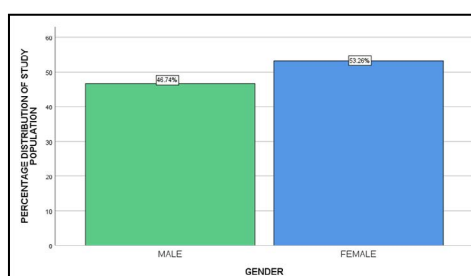


Figure 3. Bar graph shows the association between age group and the different types of retraction mechanics used in the study population. The X axis represents age and the Y axis represents the number of patients. Majority of the patients had undergone friction type of retraction mechanics in the age group of 9-20 years. The Chi-square test was done. p value - 0.294 (p > 0.05), hence statistically not significant.

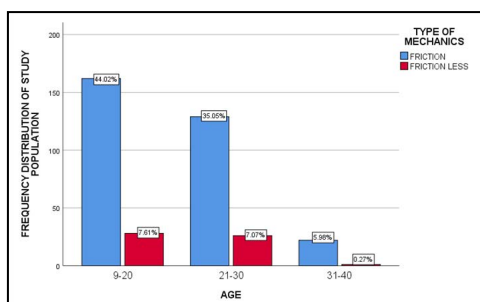
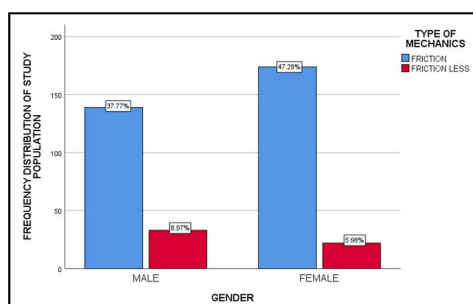


Figure 4. Bar Graph shows association between gender and frequency of distribution of study population. The X axis represents gender and the Y axis represents the number of patients. It can be inferred that the majority of the patients of study population type of retraction mechanics for their orthodontic treatment. Among them, females were the most common to undergo friction type retraction mechanics for their orthodontic treatment. Chi-square test was done. p value - 0.033 (<0.05), hence association between gender and type of retraction mechanics are statistically significant. 0.294 (p > 0.05), hence statistically not significant.



takes place at the bracket/wire interface. This phenomenon is observed during leveling and alignment, space closure and even during torque expression at the end of treatment.

Despite the undesirable effects that friction may cause in some stages of the orthodontic treatment, there are other clinical situations in which the presence of friction is beneficial such as when the orthodontist wants to use a group of teeth as a larger anchorage unit or during torquing at the finishing stage of treatment.

In our study, friction mechanics were more prevalent than frictionless mechanics with 85.4% of the population.

Whereas a study by McLaughlin et al showed that friction reduces efficiency of fixed appliances during space closure which results in the need for applying more force to achieve desired results. Mild forces are more effective for conserving anchorage. Keeping reciprocal forces low, facilitating easy release of binding forces [17].

Ligation method of bracket can influence friction between the bracket and archwire. Conventional ligation methods apply a force to the archwire pushing it against the depth of the slot, therefore increasing friction. Not all self ligating brackets behave in the same way. Active self ligating brackets showed higher frictional forces compared with passive self ligating brackets (Damon SL2 SDS), when the archwire was greater than 0.017 inches [12-16, 17]. This difference in friction is due to the presence of spring clip closing the slot and contacting the archwire when this is greater than 0.017 inches.

A study evaluated the friction resistance offered by rectangular stainless steel orthodontic archwire when exposed to intra oral environment for about 6 weeks during the final sequence of leveling and alignment stage [18].

The presence of friction is inappropriate in many clinical situations. There are various factors influencing friction such as biological and physical factors. The biological factors that influence friction are often overlooked by orthodontists. Such as the accumulation of debris over the wire surface and the brackets may be as important as the type of material used when friction in orthodontics is considered. The physical factors that influence friction formation are more frequently investigated than the biological factors. They should be carefully taken into consideration during the different stages [19].

Whereas a study about frictionless stage of space of closing mechanics can be beneficial to incorporate in specific cases, especially those presenting with large overjet, protrusion and deep bite. Finishing in relatively full sized arch wires allows the practitioner to deliver optimal results [20].

Previously investigators have conducted various studies related to orthodontic diagnosis and treatment and their association with mini implants [21-23]. GMP based orthodontic bonding adhesives [24], bisphosphonates [25] forces and apparatus used in forces determination [26-28], recycling methods and sleep apnea [29, 30], craniofacial relation [31, 32], enamel conditioning [33] dilacerated and impaction tooth [34].

This retrospective study was conducted to evaluate the pattern of distribution of friction type mechanics in patients undergoing pre edgewise therapy. Friction mechanics were superior to frictionless mechanics in terms of rotational control and dimensional maintenance of the arch. Frictionless mechanics were shown to be more effective at reducing tipping and extrusion. Therefore, a good understanding of how friction may impact the clinical development of the orthodontic therapy, the variables that increase

friction and how they can be better controlled is very important to the orthodontist who wishes to improve his or her clinical skill and consistently provide better services to the patients

Conclusion

Within the limitations of the study in our study, we contemplate that friction based types of retraction mechanics are more frequently used as compared to frictionless methods for space closure in patients undergoing pre adjusted edgewise therapy.

Author Contributions

First author, Vaishnavi Sivakali Subramanian performed the data collection by reviewing patient details, filtering required data, analysing and interpreting statistics and contributed to manuscript writing.

Second author, Dr. Remmiya Mary Varghese contributed to conception of study title, study design, analysed the collected data, statistics and interpretation and also critically revised the manuscript.

Third author, Dr. Aravind Kumar.S participated in the study and revised the manuscript. All the three authors have discussed the results and contributed to the final manuscript.

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