



FAILURE EVALUATION OF VARIOUS ORTHODONTIC RETAINERS

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ABSTRACT

Orthodontic retainers are referred to as the appliances which are used to hold the teeth in position. These are prescribed to the patients after surgery or any method of realigning the teeth. Orthodontic retainers are the custom-made devices, which are usually made of wires or clear plastic. These can be either removable or fixed retainers. If this retention phase fails, there are chances of relapse. Therefore, this study aims at assessing the stability of orthodontic retainers. This retrospective study was done by collecting data from the patients records. The data was obtained by the records of the patient who visited Saveetha Dental College and Hospitals. The patients who had undergone orthodontic treatment followed by placement of orthodontic retainers were considered for this study. The failure evaluation in all these patients were assessed. This study includes patients who were given different types of retainers [removable, fixed, etc.]. The various retainers were noted and analyzed. Out of 345 patients who were analyzed for the failure evaluation of orthodontic retainers, 184 patients [36.6%] were female and 161 [32.0%] were males. The mean age group of the patients is 24.21. When assessed for the

failure associated with the arch, the upper arch had the highest failure rates of 29.6%, followed by lower arch [27.6%] and in cases of both arch [11.1%]. The various retainers that were given for the patients following the orthodontic treatment includes Hawley's appliance which has the higher prevalence of 56.1%. The failure rates associated with relapse was [2.0%], and the failure associated with breakage includes 0.8%. The cases where there were no failure rates include 65.8%. The prevalence of failure rates of orthodontic retainers was lesser in this study. Most of the retainers were given in the maxillary arch and they were Hawley's removable retainer. In comparison of relapse rates and breakage cases, the relapse rates were higher.

Keywords: failure evaluation, orthodontic retainers, relapse, breakage, removable, fixed retainers

INTRODUCTION

Orthodontic treatment aligns the incorrect or mal-aligned teeth into a normal occlusion. The basic mechanism involved in the fixed orthodontic treatment is the bone formation and resorption taking place alternatively. Low relapse rates can occur if the clinical methods are followed [1, 2]. After the teeth align into a new position, it takes a few months or years for the surrounding tissues to adapt. The corrected teeth when not stabilized with a retainer, there are chances of relapse taking place and the teeth aligning into a new position [3]. Orthodontic tooth movement and its retention is influenced by various factors [4, 5].

Orthodontic retention remains as the final stage of the orthodontic treatment. The goal of these orthodontic retention is to retain the corrected positions of the teeth. This is because the teeth have the ability to return

towards their initial position due to the tension of the tissues surrounding the teeth [6]. Proper retention protocol will help in preventing these relapses after the orthodontic treatment. There is a strong acceptance that the retention phase is crucial for maintaining the treatment results [7].

Removable retainers are used for a longer period of time for the retention phase after orthodontic treatment. The fixed retainers were introduced in the 1970s, aiming at preventing relapse in the mandibular incisor area [8]. The other retainers such as clear essix retainers were introduced later. The modifications of these retainers such as the anterior and the posterior bite plane were also introduced. Previous studies show that the bonded retainers are efficient and reliable retention appliances for long term use [9].

The long-term stability remains as the challenge in orthodontics. Previous studies state that the maximum movement or relapse takes place during the first two years after the treatment and there will be decreased movement of the teeth after 4 years [10]. However, the frequency of relapse rates depends upon the follow-up time. Previous studies reported use of angular photometrics for analysis of soft tissues [11]. The longer term stability of teeth was observed in patients with regular follow up. The dental appearance of the patient also influences the facial and the personality traits of the patient [12]. Negative influence on these would lead to the social and emotional well-being of the individual. The complications associated with the orthodontic retainers are considered as the relapse and the breakage of the appliance. The brackets after its use, are either recycled using inhouse method or the SBS method, among which the sandblasting technique is common [13].

Previous studies conducted for the assessment of the stability of orthodontic retainers, states that the pre-treatment conditions, post-treatment stabilized occlusion, and the oral hygiene maintenance of the patient will determine the choice of retainer by the specialist [14]. A study conducted based on the long term follow up

of 10 years reveals that 67% of the achieved treatment results after retention was maintained [15]. Previous studies report the use of various aids for the prevention of failure rates [16, 17]. The studies also report the follow up cases after the treatment with these retainers [18, 19]. The overall consensus of the study relies on the fact that there is long term stability of the orthodontic treatment after retention [20].

Therefore, this study aims at assessing the failure rates of the orthodontic retainers which are given during the retention phase of the orthodontic treatment.

MATERIALS AND METHODS

The study was conducted with the approval of the Institutional Ethics Committee [SDC/SIHEC/2020/DIASDATA/0619-0320]. This retrospective study was conducted by obtaining data from patients records and 345 case sheets were reviewed. The data collection was done from the patients who visited Saveetha Dental College and Hospitals.

Inclusion criteria:

1. Patients who underwent retention phase of orthodontic treatment during the period of June 2019 to March 2020.
2. Failure rates due to relapse and breakage assessed through systematic

records of the patient [through notes of the clinician and cross verified with photographs]

3. Follow up periods upto 1 year [till March 2020] were recorded and included in this study.

Exclusion criteria:

1. Patients who had failure rates due to other reasons [who did not undergo retention phase of orthodontic treatment, etc.]

Since this study was conducted in a university setting, the data was easier to retrieve and the time period in which the patient underwent orthodontic treatment is noted. This study involves only a specific population who underwent the orthodontic treatment. This study includes the patients who underwent the retention phase of orthodontic treatment. The approval to obtain the records was obtained from the Institutional Scientific Review Board, Saveetha Dental College and Hospitals.

Data was collected and the case sheets were reviewed. 345 cases were found to be associated with the retainer appliance after orthodontic treatment. Since this study was conducted in a university setting, the data obtained was accurate and proper. The data obtained had the follow up records and this is therefore considered as the accurate record. This provides validity to the study and this

study also provides knowledge about the various retainers, its failure rates. This study will provide awareness to the dental professionals about the failure rates of various orthodontic retainers preferred for the patient. The incomplete data was excluded.

The data was analyzed and imported in SPSS for the statistical analysis of the data. Graphs and charts were prepared based upon the findings and the results were obtained. The age, gender, duration of the orthodontic treatment will be the independent variables and the failures associated with various retainers will be the dependent variables. Since, this study is a retrospective study, correlation and association was performed.

RESULTS

Out of 345 patients who underwent the retention phase of orthodontic treatment, the mean age group of the patients was 24.21. The highest prevalence of age group associated with this study was 24 [9.57%]. The age group who underwent retention phase includes 7 to 55. The distribution of age groups associated with this study is given in **Graph 1**.

Out of 345 cases, the patients who underwent retention phase of orthodontic treatment were mostly females followed by males. The prevalence of females was 53.3% and males were 46.67%. This signifies the higher

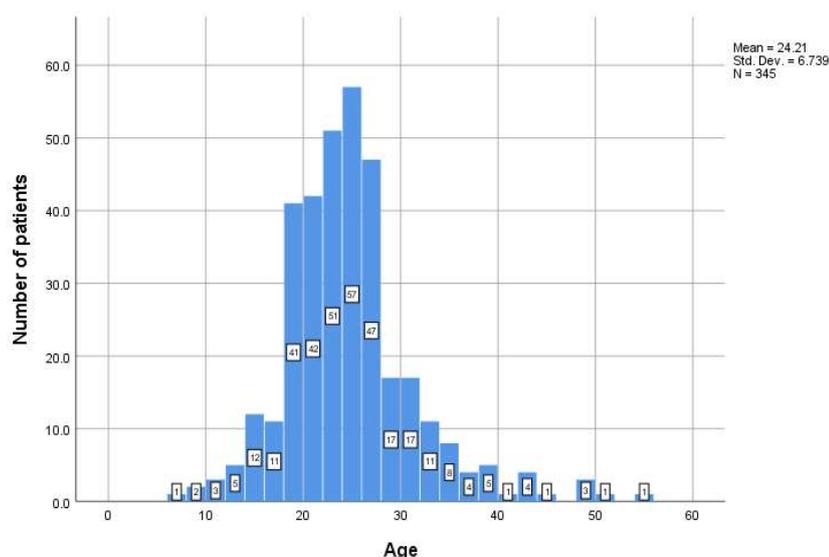
prevalence of females than the males who underwent retention phase of orthodontic treatment. The gender distribution associated with this study is given in **Graph 2**.

When assessed for the failures of orthodontic retainers associated with the arch in which it was given, the highest prevalence was among the maxillary arch, followed by the mandibular arch and both arches. The maxillary arch had the prevalence of 43.19%, the mandibular arch was 40.29% and the retainers given in both the arches was 16.23%. This distribution of area associated with failures is illustrated in **Graph 3**.

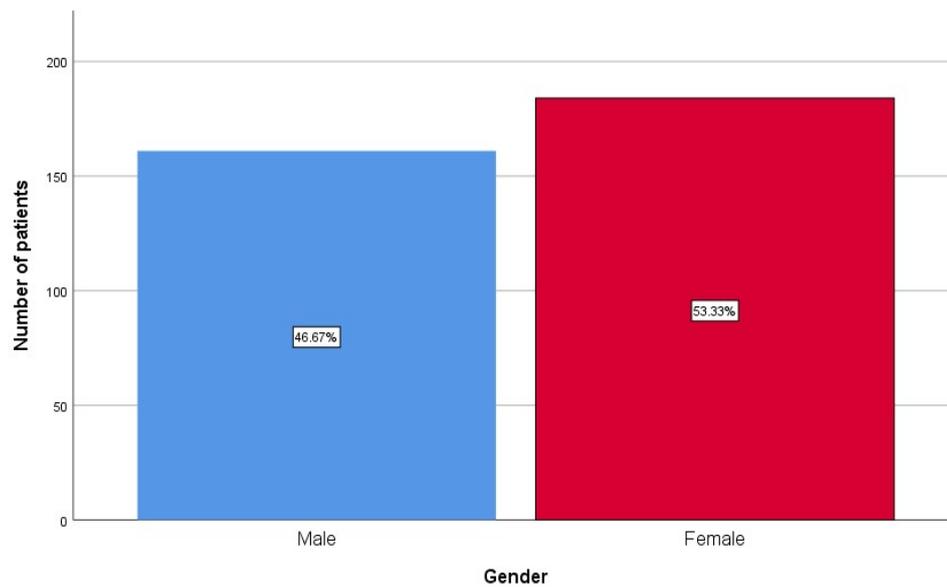
Various retainers are preferred as the appliance of choice during orthodontic treatment. The retainers that were preferred are as follows: Hawley's retainer [81.74%], Fixed retainer [2.03%], Essix retainer

[4.64%], Begg's wrap around retainer [2.61%], Anterior bite plane [1.74%], Posterior bite plane [0.87%], Hawley's retainer with bite plane [2.32%], Others [4.06%]. This shows that the Hawley's retainer was the most preferred appliance by the specialist. The distribution of this appliance of choice in orthodontic treatment is illustrated in **Graph 4**.

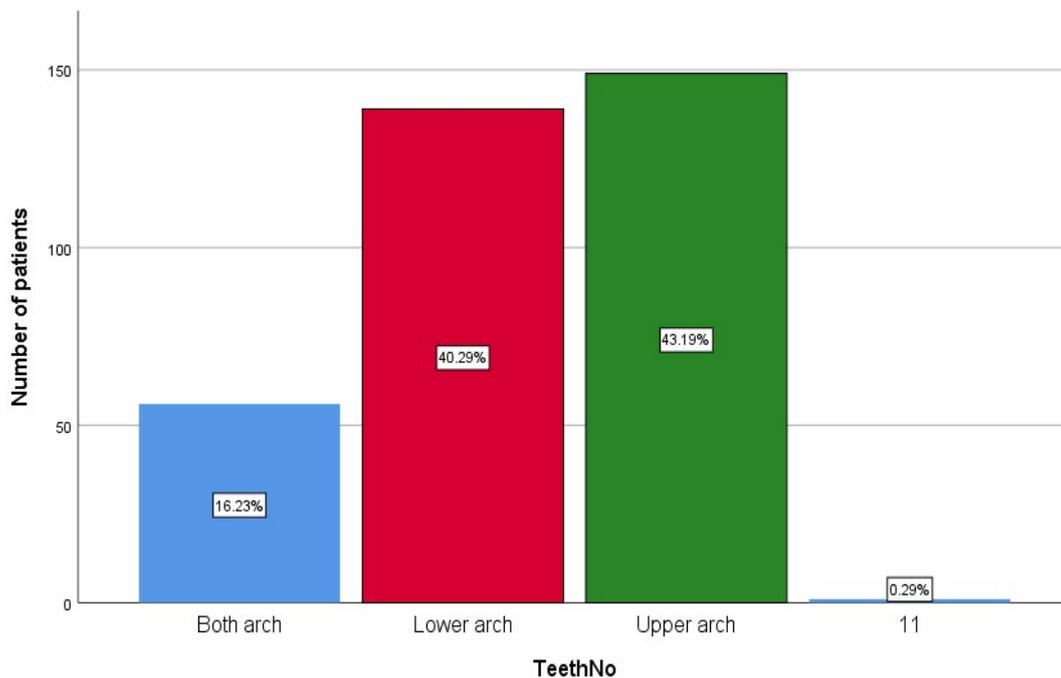
Deriving the failure rates associated with the orthodontic retainers, the stability change associated with relapse was 2.90% and the stability change associated with breakage was 1.16%. There were no failure rates in 95.94% of the cases. This reveals that the failure rates of orthodontic retainers is less according to this study. This distribution of failure rates of orthodontic retainer is given in **Graph 5**.



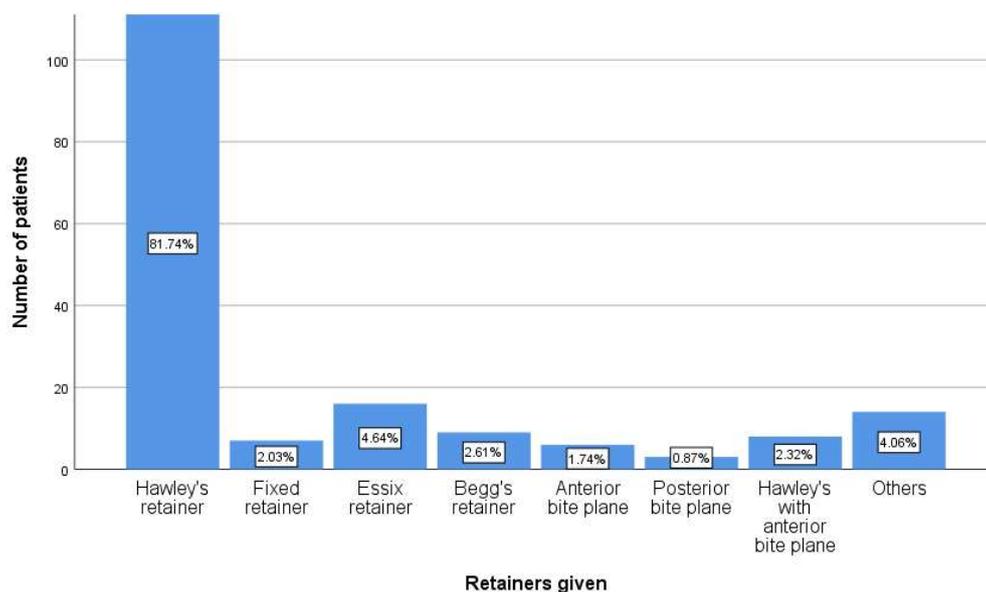
Graph 1: Bar graph representing the age of the patients involved in this study. X axis shows the age of the patients involved in this study and Y axis shows its prevalence. The highest age group involved in this study was 24 [9.57%].



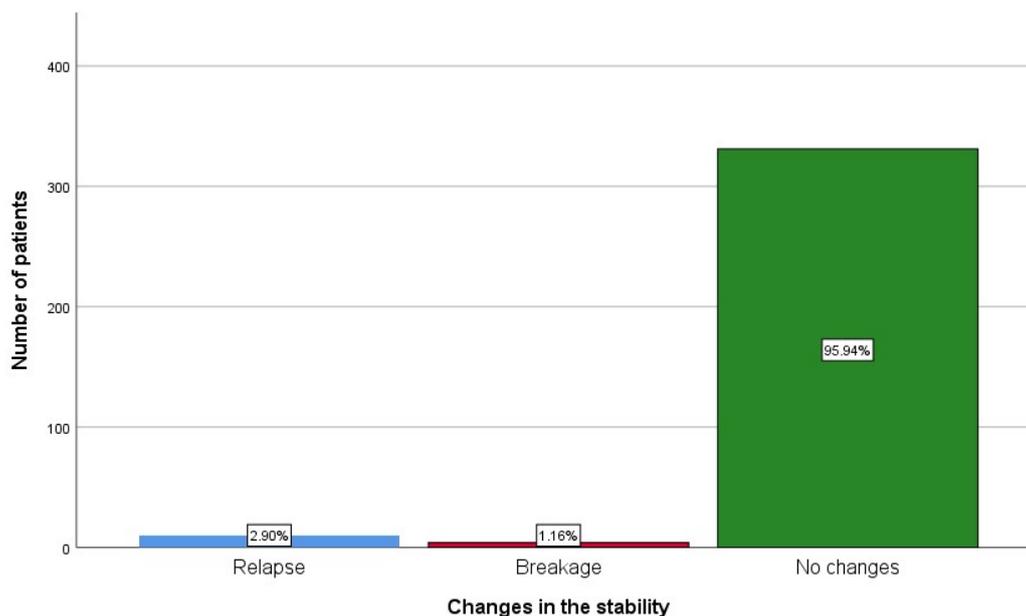
Graph 2: Bar graph representing the gender distribution of the patients involved in this study. This graph reveals higher prevalence of females [53.33%] than the males [46.67%]. X axis represents the gender of the patient and Y axis represents the number of patients involved.



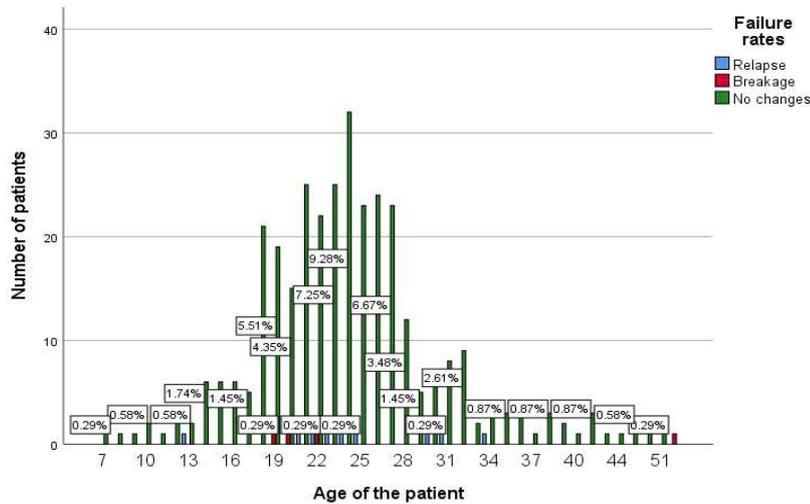
Graph 3: Bar graph representing the arch in which the orthodontic retainer was given. X axis shows the arch in which the retainers were given and Y axis shows the number of retainers given. The graph shows higher placement of retainers in the upper arch [43.19%] than the lower arch [40.29%], both arch [16.23%] and 11 [0.29%].



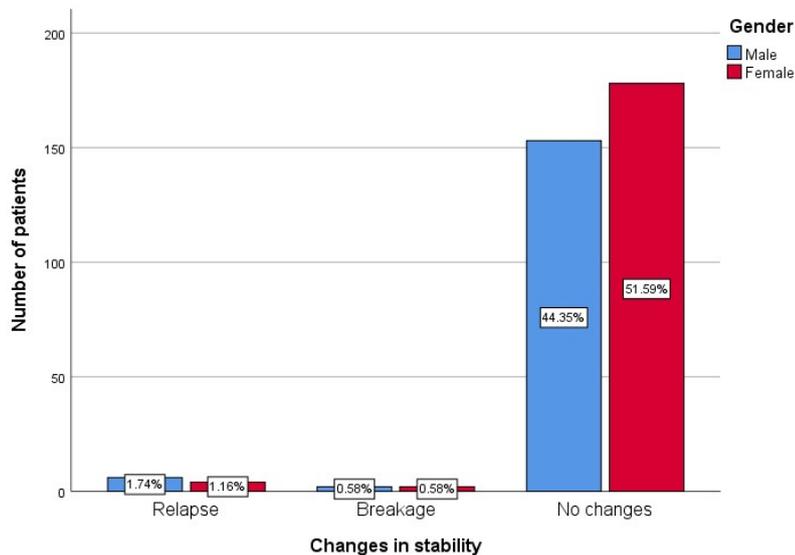
Graph 4: Bar graph representing the various retainers that were given for the retention phase of orthodontic treatment. X axis shows the various retainers used and Y axis shows the number of patients who were treated with various retainers. This graph shows that the highest retainer preferred was hawley's retainer [81.74%] than the others.



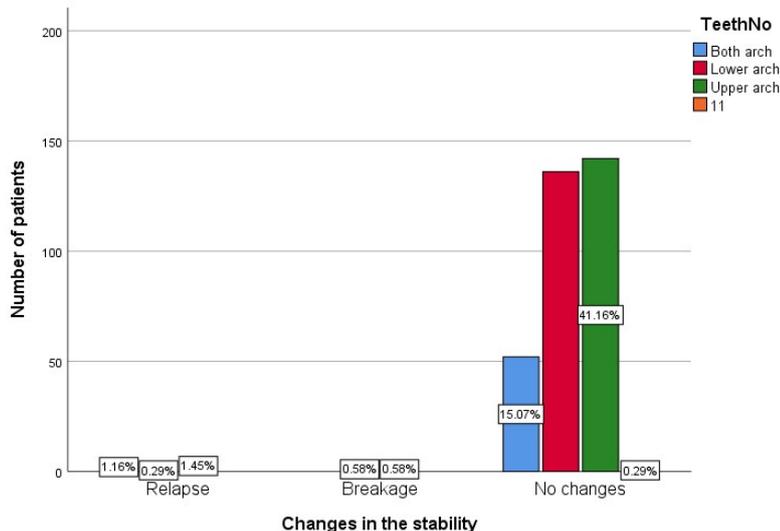
Graph 5: Bar graph representing the failure rates associated with orthodontic retainers. X axis shows the failures associated with the given retainers and Y axis shows the failure rates. The graph shows that there were no failures in 95.94% of the patients and the others show relapse rate [2.90%] and breakage [1.16%].



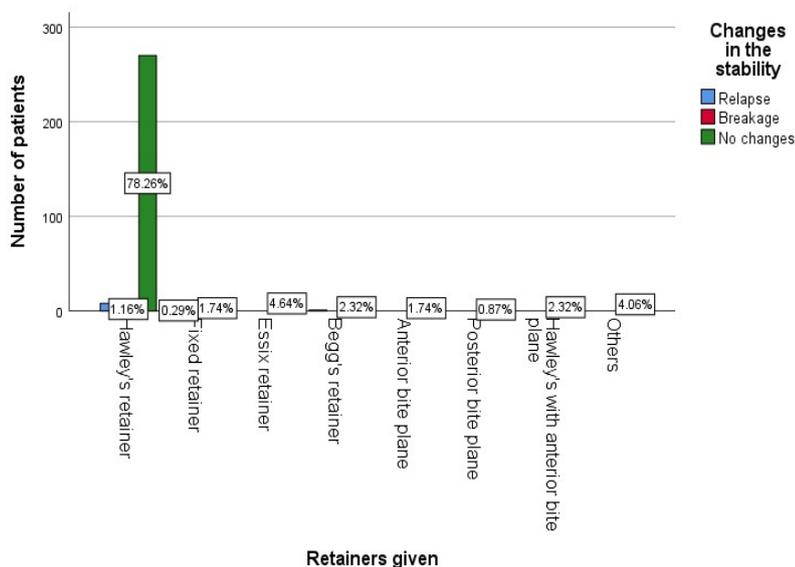
Graph 6: Bar graph representing the association of age with the failure rates of the orthodontic retainers. X axis represents the age of the patient and Y axis represents the number of patients. The graph shows that there were relapse and breakage rates [0.29%] in the age groups of 19 to 22. There were no failure rates in the other age groups. There were no failure rates after the orthodontic treatment in a higher number of cases. However, this was statistically significant (Pearson’s chi-square test; p value=0.001 - significant).



Graph 7: Bar graph representing the association of gender of the patient with the stability of orthodontic retainers. X axis represents the changes in the stability and Y axis represents the number of patients. There were no changes in the stability of retainers in 51.58% of the females than males [44.35%]. However, this was statistically not significant (Pearson’s chi-square test; p value=0.684 - not significant).



Graph 8: Bar graph representing the association of the arch in which the retainers were given with the failure rates of retainers. X axis represents the changes in the stability and Y axis represents the number of patients. There were no changes in the stability of retainers in relation to the upper arch in 41.16% of the patients than in the lower arch and both arch [15.07%]. However, this was statistically not significant (Pearson’s chi-square test; p value=0.339 - not significant).



Graph 9: Bar graph representing the association of various retainers given with the failure rates of retainers. X axis represents the various retainers given and Y axis represents the number of patients. There were no changes associated with the hawley’s retainer [78.26%] than the other retainers given. However, this was statistically not significant (Pearson’s chi-square test; p value=0.905 - not significant).

DISCUSSION

The present study conducted for the failure evaluation of various orthodontic retainers reported the following. The mean age group was 24.21. Out of 345 cases, there was a higher prevalence of females than the male. The retainers given in maxillary arch were higher than the mandibular arch and in cases where retainers were given in both the arches. The most preferred appliance of choice was Hawley's removable retainer. Most of the cases reported no failures after the treatment with orthodontic retainers.

The mean age group of the patients who underwent the retention phase of orthodontic treatment according to this study was 24.21. The age group ranged from 7 to 55 years. In a study conducted by Almuqbil *et al*, for the patient's compliance and reasons for noncompliance in post retention relapse, the mean age group of the patients were 21.56 [21]. However, the study states that the age groups of the patients remain as a not well understood concept and more studies should be conducted for its etiology. The study which is in contrast with the present study is the one conducted by Marcos Jimmy *et al.*, for the prevalence of diastema post retention [22]. The study reveals the higher prevalence of diastema in the age groups of 14 years. This was reported as due to the development

of occlusion in the later stages. The consensus is that the studies in relation to the association of age and failure of orthodontic retainers prevails in a lesser phase and states that the etiology is not well understood.

The gender distribution associated with the failure rates according to this study was higher in females than males. This reports higher prevalence of females than the males. The study conducted by Ricky *e et al.*, states that the changes associated with orthodontic retainers depends upon the patient's cooperation. The gender distribution of the patient is not considered [23]. There is no previous literature which emphasizes the gender of the patient associated with the stability of the orthodontic retainers. The other study conducted by Dalya Al *et al.*, reported that there are various biological changes associated with the stability changes and depends on the soft tissue factors and digital habits of the patients [24]. The consensus is that the failure rates of orthodontic retainers associated with gender was not conducted earlier and this remains as statistically insignificant.

The association of the appliance of choice preferred by the specialist as the orthodontic retainer reported that the Hawley's retainer as the most preferred appliance of choice, according to this study. In the study

conducted by Marielle *et al.*, for the rationale for retention following orthodontic treatment, states that the commonly used retainers are the bonded cuspid to cuspid retainers which are the fixed retainers. The advantage of this is the excellent flexibility in maintaining the physiological tooth movement and the stability is readily achieved [25]. According to the study conducted by SJ Littlewood *et al.*, The most commonly preferred removable retainer is the Hawley's retainer, which is in conjunction with the present study [26]. The study states that the fixed retainer is indicated in cases of midline diastema and after the prosthodontic management.

Comparing the failure rates of orthodontic retainers in the area where it is given, it was reported that the upper arch had the highest prevalence, according to this study. A study conducted by Sheldon Peck *et al.*, states that the changes associated with the orthodontic retainers varies considerably according to the patient factors and the soft tissue considerations. And it is less likely dependent upon the arch in which the retainers were given [27]. The study conducted by Gomez *et al.*, stated the use of lingual fixed retainer on the mandibular area. The mandibular incisor area is more likely to be prone for relapse rates, therefore, the appliance of choice plays a role here [28].

The failures associated with the orthodontic retainers suggested that there are failures due to relapse and breakage of the retainers. However, there were higher cases where there were no failures. The study conducted by Anil P. Ardeshna *et al.*, for the fixed retention in orthodontics reveals lesser stability changes associated with the orthodontic retainers [29]. Various factors play a role in these, which are the oral hygiene maintenance, patient cooperation, soft tissue factors and so on. The study conducted by Steinnes *et al.*, states that the relapse rate was only 14% in association with the retainers given [30]. There were no contradictory studies in association with the present study. The overall consensus is that the failure rates of the orthodontic retainers is very less and associated with individual case factors.

Previous studies conducted on the obstructive sleep apnea reveals that it could be related with the systemic diseases of the individual [31]. These stability changes can be associated with growth patterns. Previous studies report the gonial angle for assessing the growth pattern [32]. The stability changes can vary in the arch which has dilacerated roots and with partial impactions [33]. The study conducted for the craniofacial relation reports that the stability changes can occur

according to the relation of the cranium [34]. Previous studies were also conducted for the failures after extrusion of the Ellis class fractures [35].

Limitations:

This study has the following limitations,

1. Limited population was covered. Patients who visited Saveetha Dental College and Hospitals were only considered.
2. The evaluation of time period and follow up were not conducted for all cases and hence it was excluded.
3. Follow up was within 1 year due to lesser data availability.

Future studies:

The future studies should be conducted more on the failure rates of the various orthodontic retainers. The future studies should include long term follow ups. The retainers should be improved in their efficiency of providing stability post orthodontic treatment. Limited studies were conducted on the association of gender and the stability of orthodontic retainers.

CONCLUSION

Within the limits of this study, it is concluded that the orthodontic retainers had higher strength and the failure rates of it was lesser when assessed for a follow up period of 1 year. In cases, where there were failures, it was associated with breakage of the retainers.

This study reported that the most preferred appliance of choice was Hawley's retainer. The failure rates were mostly associated with the retainers given in the maxillary arch compared to the mandibular arch. Although evidence and best treatment protocols to prevent the failure rates are available in the literature, each clinician's clinician approach will be affected by the patient factors such as the non acceptance towards the retainers.

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