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A Retrospective Study Assessing the Frequency of Patient's Requiring TPA/LSA During Orthodontic Therapy- An Institutional Study

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ABSTRACT

TPA, also known as Transpalatal Arch is used as an adjunctive equipment during orthodontic therapy to regulate anchorage in the vertical, transverse and sagittal (antero-posterior) dimensions. TPA have many uses such as space maintenance, retention and molar anchorage after rapid maxillary expansion. TPAs have eminent versatility, appearing as a stand-alone appliance or as an accessory appliance to fixed appliances. Hence the aim of this study is to assess the number of patients who required TPA/LSA during an orthodontic therapy. Retrospective cross sectional study was carried out and the case records of patients requiring TPA/LSA was collected by reviewing patient records and analyzing the data of patients between June 2019- April 2020. The collected data was subjected to Chi-square test for statistical analysis and correlation using the SPSS software. The findings of this study showed female predilection with a percentage of 53% and males with a percentage of 47%. It also revealed that the prevalence of patients requiring TPA during an orthodontic therapy was 32% and LSA was 26%. This study shows that 32.24% of the patients required TPA and 25.75% of the patients also required LSA during an orthodontic treatment and this was found to be statistically significant.

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INTRODUCTION

The transpalatal arch (TPA) is a stainless steel wire which can be used to connect the molars of the maxillary arch during fixed appliance orthodontic therapy to assist with anchorage reinforcement (Almuzian *et al.*, 2015). The mesiobuccal cusp of the maxillary first molars are often displaced in a palatal direction due to which the teeth often appear as rotated. The sequelae of the malposition are that the tooth occupies excessive amount of space within the dental arch and that the buccal cusps occlude with a tendency to a Class II molar relationship (Dahlquist *et al.*, 1996). Malocclusions require precise extraction protocol to avoid excessive space (Felicita, 2017a). Maximum amount of

anchorage is often desirable in the maxillary arch, when the first molars maintain their position in the dental arch and do not move into the extraction site (Zablocki *et al.*, 2008). A low clinical failure rate is a necessary clinical criterion of paramount importance (Samantha *et al.*, 2017). The LSA or Lingual Stabilizing Arch (Figure 2) exerts a continuous force since it is cemented 24 hours a day so the patient cannot remove it. One of the most important functions of Lingual Stabilizing Arch is space maintainence and it acts as a space maintainer when there is premature loss of primary teeth. It also aids in preventing molar mesialization. An expansive, horizontal force from the palatal arch would more rapidly affect the buccal crown tipping than the root movement of the anchorage tooth (Gollner *et al.*, 1993). Early recognition and appropriate therapy can ameliorate the consequences (Viswanath *et al.*, 2015). Transpalatal Arch (Figure 1) stops continued vertical descent of the upper buccal teeth and therefore stops maxillary alveolar vertical growth (Wise *et al.*, 1994). The TPA can either be preformed or it can be made from a stainless steel round wire of proper gauge which will fit into the molar sheaths (Rebellato, 1995).

It has been proven that TPAs efficiently correct the crossbite with zero side effects (Ingervall *et al.*, 1995). During derotation of molars, potential movement of deciduous molars and premolars is feasible because of the transseptal fibres, which may additionally increase the dimension and perimeter of the dental arch (Raucci *et al.*, 2015a). Another version of the TPA is the one with acrylic button (which has generally been named as vertical holding appliance or VHA) that's presumed to use the tongue pressure to restrain the traditional descent of molars throughout the treatment and to be helpful in dominating the vertical development of the upper molars throughout their eruption (Sivakumar *et al.*, 2018; Yañez-Vico *et al.*, 2017).

With this widespread use of bone anchorage devices, which give absolute anchorage, it's become vital to grasp which of our classical devices are able to offer adequate anchorage to contemplate them or not as a treatment possibility. Therefore the aim of our study is to assess the quantity of patients who need TPA/LSA throughout an orthodontic treatment.

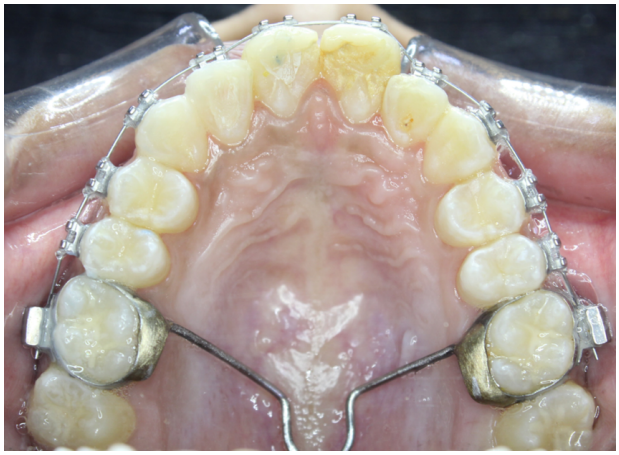


Figure 1: Transpalatal arch in the maxillary arch

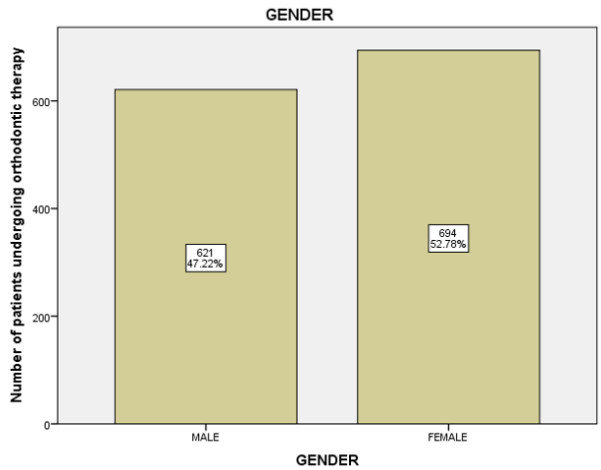
Figure 2: Lingual Stabilizing Arch in the Mandibular arch

MATERIALS AND METHODS

This is a retrospective study regarding patients requiring TPA/LSA during orthodontic therapy, who have visited Saveetha Dental College and Hospitals in between June 2019- April 2020. The approval for this study setting was obtained from the Institution Ethics Board. The sample size of 1301 patients in which sampling bias was minimized with the verification of photos. The study was reviewed by two reviewers and it was cross verified. Inclusion criteria- patients requiring TPA/LSA; Exclusion criteria- incomplete record in the system. The case records of patients requiring TPA/LSA was collected by reviewing patient records and analyzing the data of 86000 patients. The data of these patients were collected and tabulated. It included parameters – Patients ID, Age, Gender, patients requiring TPA, LSA and not applicable. Age was categorized into 9-15 years, 15-20 years, 20-30 years and patients more than 30 years. After further verification by an external reviewer, it was imported to SPSS software by IBM for statistical analysis. Percentage, mean, standard deviation, frequency of parameters were employed in the analysis. Pearson's chi-squared test was employed to reveal the significance between age, gender, severity of fluorosis and teeth involving fluorosis. P-value less than 0.05 was observed to be statistically significant.

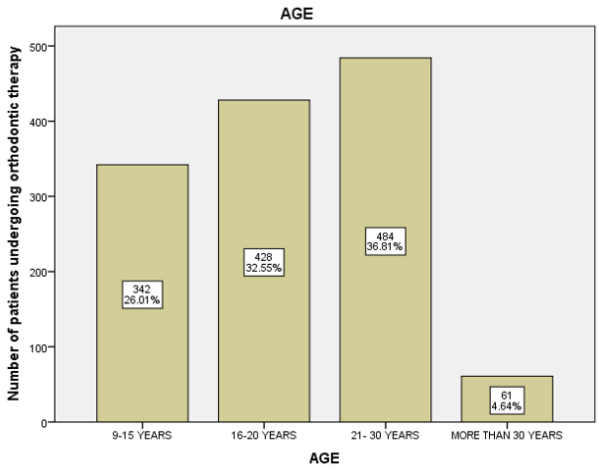
RESULTS AND DISCUSSION

The findings of this study showed 47% of the study population were males and 53% of the patients were females [Graph 1]. It was found that 37% of the patients were 21-30 years old, 32.5% were between 16-20 years, 26% were between 9-15 years and only 7% were more than 30 years old [Graph 2]. When checked for the frequency of patients requiring TPA and LSA, it was found that 424 patients [32%] out of 1301 patients requiring TPA [Graph 3] and 335 patients [26%] required LSA [Graph 4]. On doing chi-square test; between age and requirement of TPA, it was found that highest number of patients requiring TPA [12%] belonged to the age group 21-30 years [Graph 5]; between age and requirement of LSA, it was found that the highest number of patients requiring LSA [9.5%] were again between 21-30 years [Graph 6]. On correlating gender and requirement of TPA, it was found that 233 [18%] females and 191 [14.5%] males required TPA [Graph 7]. On correlating gender and LSA, it was found that 195 [15%] females and 140 [11%] males required LSA during an orthodontic therapy [Graph 8]. Although none of the above findings were found to be statistically significant. On doing Chi-square test between requirement of TPA along with LSA, it was found that among the patients requiring TPA, almost 25% of them also required LSA [Graph 9]. This was found to be statistically significant p-value 0.0<0.05.

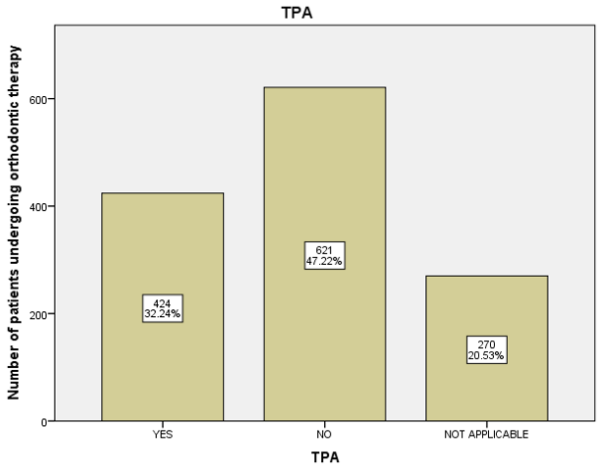


Graph 1: Bar graph depicting the frequency distribution of requirement of TPA/LSA among different genders

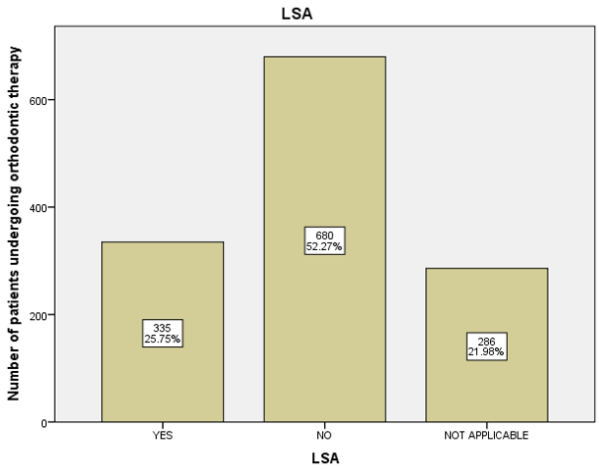
Orthodontic treatment involves the application of forces that are continuous in activity on as several areas of the dentition as attainable and dealing in the direction during which the teeth are to maneuver (Dinesh, 2013). The binding relationship



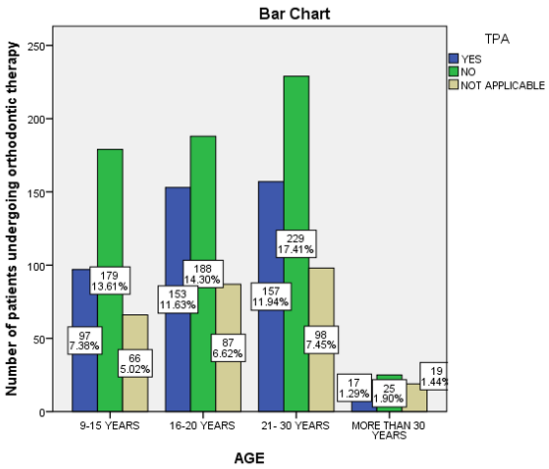
Graph 2: Bar graph depicting the frequency distribution of requirement of TPA/LSA among different Age groups of patients



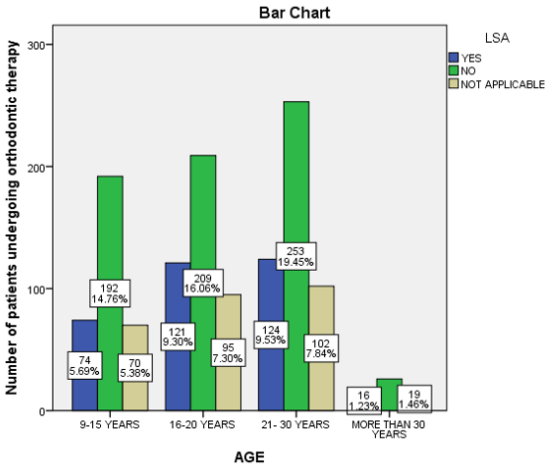
Graph 3: Bar graph depicts the frequency distribution of requirement of TPA among the patients



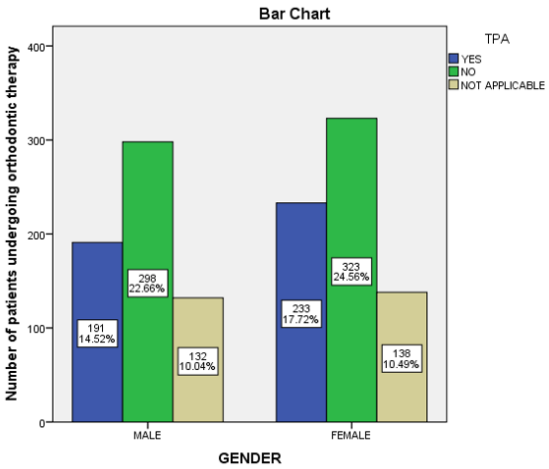
Graph 4: Bar graph depicts the frequency distribution of patients requiring LSA among the total patients



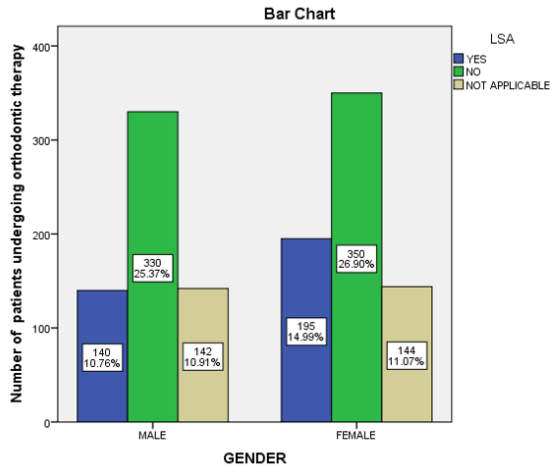
Graph 5: Bar graph depicts the association between Age and the number of patients requiring TPA



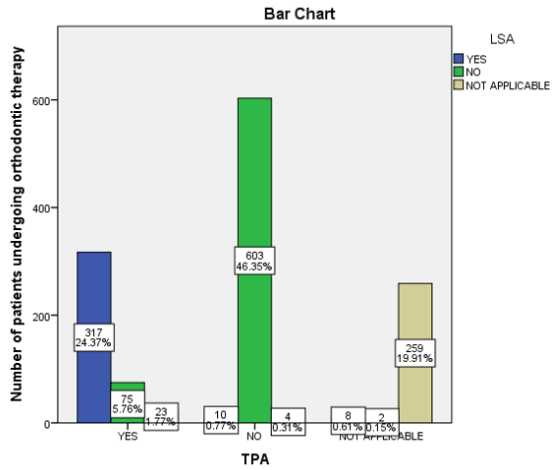
Graph 6: Bar graph depicts the association between Age and the number of patients requiring LSA



Graph 7: Bar graph depicts the association between gender and the number of patients requiring TPA



Graph 8: Bar graph depicts the association between gender and the number of patients requiring LSA



Graph 9: Bar graph depicts the association between the number of patients requiring TPA and LSA

between orthodontic treatment and facial esthetics has made the facial outline an important guideline for the treatment planning (Krishnan *et al.*, 2018). The fundamentals of orthodontics is that teeth move through the alveolar bone when adequate forces are delivered (Krishnan, 2015). Orthodontic extrusion of the tooth can be done by several ways with several advantages and disadvantages (Felicita, 2017a). The TPA are often used as an adjunct during treatment to assist control the movement of the maxillary first molars in 3 dimensions (Vikram *et al.*, 2017), including producing molar rotation and uprighting, preserving transverse dimensions posteriorly during treatment and maintaining leeway spaces during the transition of the dentition (Shetty *et al.*, 2019). Other devices like Mini screws are successfully used as temporary anchorage devices for producing various tooth movements (Jain, 2014). It is difficult to

realize the acceptable moment-to-force ratio when employing a transpalatal arch (Kumar *et al.*, 2011), because each plan to adjust the magnitude of the instant by modifying the torque bends automatically influences the lateral force (Baldini and Luder, 1982). The wire is bent to adapt closely to the palate. Six bendings could also be required and three of them are obligatory (to adapt to the shape of the palate, to adapt to the torque of the molars, and to adapt to the rotation of the molars (Sivamurthy and Sundari, 2016). The opposite three are needed in a number of the cases: bending the top of the TPA, which can be held with the pliers, in order that it doesn't traumatise the palatal mucosa and doesn't irritate the tongue (Moutaftchiev and Moutaftchiev, 2009). A study shows that presence of a TP A induces only minor changes within the dental and periodontal stress distributions (Bobak *et al.*, 1997). A previous study states that TPA isn't an appropriate full anchorage device and doesn't provide large amount of protection on the anteroposterior position, inclination, and extrusion of the maxillary first molars for canine retraction following extraction (Kecik, 2016). Using TPA in mixed dentition followed by fixed appliances was successful in significantly increasing dental arch dimension and perimeter (Felicita, 2017b), and therefore the changes remained stable after a mean of 6.7-year follow-up (Raucci *et al.*, 2015b). Although previous studies suggested that the adjunctive use of TADs should be significantly favored over the only use of TPA as an anchorage device during retraction when accurately stipulated (Diar-Bakirly *et al.*, 2017). Results of previous studies show that TPA alone doesn't reduce anchorage loss when used with continuous arch mechanics owing to the very fact that different and unequal moments are often applied with TPA, as in cases of unilateral arch expansion (Alhadlaq *et al.*, 2016). Transpalatal arch poses the danger of coming on the brink of the palatal tissue and getting embedded within the palatal tissue (Samantha *et al.*, 2017), hence the "U" loops are often adjusted by constriction of the loops to stay the transpalatal arch faraway from the palatal tissues (Kumar *et al.*, 2014). Evaluation of growth pattern plays a major role in diagnosis and treatment planning (Rubika *et al.*, 2015).

The use of various sorts of transpalatal arches with different load-deflection rates renders it difficult to urge familiar with the quantity of compensatory bends necessary for the specified tooth movement and will thus be avoided (Baldini and Luder, 1982). The medical community has reused its metal instruments since the very beginning (Kamisetty, 2015). Transpalatal arch has been modified for various purposes. Low-placed transpalatal arch (TPA) is employed in cases requiring molar intrusion but it might cause indentations of the U loop on the dorsum of tongue, thus causing discomfort and irritation to the patient (Mehta *et al.*, 2014). A study done on modifications of TPA (Thomas *et al.*, 2017) suggests that the modified TPA are often effortlessly removed and reactivated and may be converted to regular TPA once the specified expansion is achieved (Felicita, 2018).

India may be a large country, its inhabitant being multiethnic (Felicita *et al.*, 2012). This study may be a retrospective study with a little number of cases. More prospective controlled clinical trials could also be needed to verify these results with a bigger sample size and varied distribution of cases.

In Graph 1, the gender of the patients is represented in the X-axis and the number of patients undergoing orthodontic treatment is represented in the Y-axis. Majority of the patients who required TPA/LSA were males followed by females. In Graph 2, the age of the patients is represented in the X-axis and the number of patients undergoing orthodontic treatment is represented in the Y axis. Majority of the patients who required TPA/LSA belonged to the group of 21-30 years followed by patients in the group of 16-20 years and the rest were in the group of 9-15 years old. In Graph 3, the number of patients requiring TPA is represented in the X-axis and the number of patients represented in the Y axis. Majority of the patients did not require TPA which is followed by the number of patients requiring TPA. In Graph 4, the number of patients requiring LSA is represented in the X-axis and the number of patients undergoing orthodontic therapy is represented in the Y-axis. Majority of the patients did not require LSA which is followed by patients requiring LSA. In Graph 5, the age of the patients is represented in the X-axis and the number of patients requiring TPA during orthodontic therapy is represented in the Y axis. Among the total study population, the majority of the patients requiring TPA belonged to the group of 21-30 years, followed by patients in the group 16-20 years and 9-15 years group. Chi-square test, p value -0.101 (>0.05) hence, statistically not significant. In Graph 6, the age of the patients is represented in the X-axis and the number of patients requiring LSA during orthodontic therapy is represented in the Y axis. Among the total study population, the majority of the patients requiring LSA belonged to the group of 21-30 years, followed by patients in the group 16-20 years and 9-15 years group. Chi-square test. P-value-0.167 (>0.050), hence statistically not significant. In Graph 7, the gender of the patients is represented in the X-axis and the number of patients

requiring TPA during orthodontic therapy is represented in the Y-axis. Among the total study population, the majority of the patients requiring TPA were females as compared to male patients. Chi-square test, p value- 0.535>(0.05) hence, statistically not significant. In Graph 8, the gender of the patients is represented in the X-axis and the number of patients requiring LSA during orthodontic therapy is represented in the Y axis. Among the total study population, the majority of the patients requiring LSA were females as compared to male patients. Chi-square test,p value- 0.078>(0.05) hence, statistically not significant. In Graph 9, the number of patients requiring TPA is represented in the X-axis and the number of patients requiring LSA during an orthodontic treatment is represented in the Y axis. The above graph shows that among the patients requiring TPA, 24.3% also required LSA. Chi-square test, p value -0.00(<0.05) hence, statistically significant.

CONCLUSION

This study concludes that the frequency of TPA/LSA is more in females(53%) than males (47.2%), majority of the patients (37%) belongs to the age group 21-30 years and that almost all patients requiring TPA (24.3%) also required LSA (statistically significant). Transpalatal arches and Lingual stabilizing arches are productive appliances so as to regulate the posterior sectors and improve the torsion of the molars. They allow the practician in getting an additional stable occlusion without the requirement for additional assistance from bone anchorage.

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The authors declare that they have no funding support for this study.

Conflict of Interest

The authors declare that there is no conflict of interest for this study.

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