

Evaluation of changes in maxillary arch dimensions, Posterior Transverse Inter Arch Discrepancy (PTID), upper and lower incisor inclination in patients with and without adeno/tonsillectomy: A quasi experimental study

Burhan Showkat^{1,*}, Jayesh S. Rahalkar², Sandeep Jethe³, Ravindra Manerikar⁴

¹Resident, ²Professor and Head, ³Reader, ⁴Professor, Dept. of Orthodontics & Dentofacial Orthopaedics, Dr. D.Y. Patil Dental College & Hospital, DPU Vidyapeeth Pimpri, Pune, India

***Corresponding Author:**

Email: burhan.showkat789@gmail.com

Abstract

The benefits of Adenotonsillectomy on Dentofacial development have been observed both in cross-sectional and longitudinal studies in children and adults. Obstructive hypertrophy of the tonsils and adenoids can lead to facial imbalances, such as horizontal position of the mandible, raised position of the head, low posture of the hyoid bone and anterior inferior position of the tongue. In our study we evaluated the changes in maxillary arch dimensions, posterior transverse inter arch discrepancy, upper and lower incisor inclination in patients with and without Adeno/tonsillectomy. Three groups were formed: Group I:(n=10) = participants indicated for (Adeno/tonsillectomy) but did not proceed with the same. Group II: (n=10) = participants undergoing tonsillectomy. Group III: (n=10) =participants undergoing Adeno tonsillectomy. The duration of study was 20 months.

Result: Maxillary Arch Dimensions increased, PTID decreased, Upper and Lower incisors retroclined when evaluated before and 9 months after Adeno/tonsillectomy procedure, while exactly opposite results were observed in the control group.

Conclusion: All the results suggested that Adeno/tonsillectomy procedures carried out at the right time (pre-pubertal) has overall positive effects on the dental arch dimensions. It prevents many forms of malocclusion from developing on one hand and on the other it also helps in correcting certain forms of malocclusion, if left untreated the obstruction of the airway has deleterious effects on overall facial profile.

Keywords: Adeno/tonsillectomy.

Introduction

It has been observed that after surgery, the mandible has a more horizontal growth direction; open bites and cross bites are corrected, and changes can be observed in the inclination of the maxillary and mandibular incisors, anterior and posterior facial heights, and maxillary arch width.⁽¹⁾

The association between mouth breathing and facial morphology is being reported in orthodontic literature since quite long. Studies also show that alteration in the dental arch dimensions such as the change in the depth of the palatal vault; increased inter-canine and inter-molar distances and change in the position of the incisors are expected to follow the changes in the mode of respiration from nasal to oral.⁽⁵⁾

Hence there is a need to study and compare effect of adeno/tonsillectomy on dental arch dimensions such as posterior transverse inter-arch discrepancy (PTID), upper and lower incisor inclination using study casts and lateral cephalograms, which has not been carried out together simultaneously.

Aim

To evaluate the changes in Maxillary Arch Dimensions, Posterior Transverse Inter Arch Discrepancy (PTID), Upper and Lower incisor inclination in patients with and without Adeno/tonsillectomy.

Objectives of the Study

1. To measure and compare the changes in Maxillary Arch Dimensions, Posterior Transverse Inter Arch discrepancy (PTID), Upper and Lower incisor inclination before and after 9 months in participants undergoing Adeno/tonsillectomy.
2. To measure and compare the changes in Maxillary Arch Dimensions, Posterior Transverse Inter Arch discrepancy (PTID), Upper and Lower incisor inclination before and after 9 months in participants forming the control group.
3. To compare the changes in Maxillary Arch Dimension before and after 9 months within all the participant groups.
4. To compare the changes in Posterior transverse, Inter Arch Discrepancy (PTID) before and after 9 months within all the participant groups.
5. To compare the changes in Upper and Lower Incisor inclination before and after 9 months within all the participant groups.

Materials and Methods

Source of Data: The study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune.

The study is a quasi-experimental study.

Convenient sampling technique was used.

Patients indicated for Adeno/tonsillectomy procedures in Department of ENT were selected for the study.

Participants indicated for Adenotonsillectomy:

Adenoid hypertrophy causing mouth breathing, snoring, nausea, OSA, adenoid faces (i.e crowded upper jaw, Hypoplastic maxilla, protruded upper jaw, high arch palate, pinched in nostrils).

Participants indicated for Tonsillectomy

Chronic tonsillitis having symptoms any one of following:

1. Repeated episodes of sore throat with frequency ranging from 6-7 episodes per year.
2. Repeated episodes of sore throat with frequency ranging from 5 episodes per 2 years.
3. Repeated episodes of sore throat with frequency ranging from 3 episodes per 3 years.

Participants having recurrent episodes of acute otitis media and participants with hypertrophy of tonsil causing airway obstruction, difficulty in speech and deglutition were also included in the study.

Three groups were formed which included patients selected from the department of ENT having complications of enlarged Adenoids and Tonsils

Group I: (n=10) = participants indicated for Adeno/tonsillectomy) but did not proceed with the same

Group II: (n= 10) = participants undergoing Tonsillectomy.

Group III: (n=10) = participants undergoing Adeno tonsillectomy

Inclusion Criteria: All the subjects included, had their permanent central incisor erupted and obstructed nasal breathing.

Exclusion Criteria: All the subjects were excluded from the study if they had any of the following features:

1. Subjects with history of previous orthodontic treatment.
2. Subjects with history of sucking habit at the beginning of treatment.
3. Subjects with history of congenital and developmental disorders.
4. Physically and mentally challenged subjects.
5. Subjects with history of trauma.

Method of Data Collection

Preparation of Cast

Impressions were made of the dental arches using alginate impression material (Neocollide) and casts were poured using orthokal dental stone Type - III (Kalabhai). Maxillary and mandibular arch dimensions and posterior transverse inter arch discrepancy (PTID) were measured using a Digital Vernier Calipers on study casts. The duration of the study was 20 months.

Following parameters will be checked on the cast:

I. Maxillary dental arch dimensions which included the following measurements:

1. **Maxillary inter canine width:** distance measured between the most cervical lingual portion of right and left canine. The landmark was placed on the gingival margin of the teeth.
2. **Maxillary inter molar width:** distance measured between the central fossa of right and left 1st molars.
3. **Maxillary dental arch length:** distance measured between the midpoint of central incisors and a tangent line touching the mesial surface of right and left 1st molars. It denotes sagittal dimensions from anterior reference point to posterior surface.
4. **Maxillary arch perimeter:** the contour of maxillary arch, measured from the mesial surface of right 1st molar to the mesial surface of left first molar passing over the central fossa of molars, tips of canines, and incisal edge of incisors. It denoted the shape of arch, connecting the mesio lingual cusp tips of right and left first molars.
5. **Palatal depth:** measured from the deepest point in the palate to a line connecting mesio-palatal cusp tips of right and left first molars.

II. Posterior Transverse Inter Arch Discrepancy (PTID):

measured as the difference between maxillary inter molar width and mandibular inter molar width (inter-molar width=Distance between the central fossa of right and left first molar).

Preparation of lateral cephalogram:

Lateral cephalogram of all the sample subjects were taken using the same X-ray machine (Planmeca Proline XC Dimax3) in natural head position at 68kvp and 10 mA with the teeth in aximum intercuspation and lips at rest. All the lateral cephalograms were traced by a single operator on a 50µm lacquered polyester papers using a 0.3 mm 2H lead pencil in a standardized manner to avoid inter-operator variations incisor inclination was expressed by angular and linear dimensions on cephalogram.

III. Upper and lower incisor inclination were measured which included the following parameters:

1. UI to SN: Angular relation between upper incisor and SN plane.
2. UI to NA: Angular and linear relation between upper incisor and NA plane.
3. LI to NB: Angular and linear relation between lower incisor and NB plane.
4. LI to MP: Angular relation between lower incisor and MP plane.
5. UI to PP: Angular relation between upper incisor and Palatal Plane.

6. UI to LI: Angular relation between upper incisor to Lower incisor.
7. Linear measurement between pterygoid vertical (PTV) to the most prominent part of upper and lower incisors.

All the above readings were checked pre-surgery (T0) and 9 months post Adeno/tonsillectomy surgery (T1).

In control group at (T0) and 9 months after (T1).

Results

One-way ANOVA and post-hoc analysis were used to compare all the pre-treatment values (T0) of all the three groups and all post-treatment values (T1) of all the three groups.

The results indicated that there was not much difference between all the three groups at pre-treatment time interval indicating that tonsils and adenoids had its deleterious effects on the dental arch.

One-way ANOVA and post-hoc analysis also showed that there was a statistically significant difference between the Control group, Tonsillectomy and Adenotonsillectomy group at post-treatment (T1) time interval. Indicating positive effects of adenotonsillectomy surgery on the dental arch dimensions.

However, there was not much difference when comparison was done between adenotonsillectomy and tonsillectomy surgical groups post-treatment (T1) indicating, both had a positive effect on the dental arch.

Discussion

Obstruction of the pharyngeal airway due to enlarged tonsils/adenoids is not uncommon and this obstruction has well documented deleterious effects.

Studies suggest that normalization of mode of respiration in children results in dento-facial growth similar to nasal breathers.⁽¹⁾ Literature tells us that narrowing of the maxillary and mandibular dental arch, 'C' shaped palate, increased inter canine and inter molar width, increased over jet are the features observed in nasal obstructed children. The aim of the present research was to evaluate the changes in maxillary arch dimensions, posterior transverse inter-arch discrepancy and upper and lower incisor inclination in patients with and without adeno/tonsillectomy. In the present study three groups were formed in which one was the control group and two were Adeno/tonsillectomy surgical groups. The control group included subject who were indicated for adeno/tonsillectomy procedures but did not proceed with the same. The three groups were studied over a period of 9 months and comparison was done between the three groups.

In our study we used two diagnostic aids namely, dental casts and lateral cephalograms. The duration of study was 9 months which was ideal to study the changes taking place during pre-pubertal stage.

Studies suggest that obstructed children had deeper palatal depth, shorter dental arch, prevalence of lateral cross bite.⁽¹¹⁾ In our study we found that there was a statistically significant change in the transverse width of the maxillary arch. There was a decrease in inter-canine and inter-molar width in the control group and an increase in the Adeno/tonsillectomy group. In the Adeno/tonsillectomy group the maxillary arch width which was constricted initially, had a statistically significant increase, probably due to the change of mouth breathing pattern to nasal breathing and an altered position of the tongue, which changes the muscular balance between the tongue and the cheeks. There was also a slight decrease in the depth of the palate in the Adeno/tonsillectomy group, which suggests that patients' muscular balance improved. While in the control group there was further constriction of the maxillary arch, probably due to continued mouth breathing and there was slight increase in the palatal depth.

Studies suggest that Adeno/tonsillectomy brings about changes in dental arch dimensions.⁽⁴⁾ It was found that the maxillary dental arch length and arch perimeter increased significantly after Adeno/tonsillectomy surgical intervention which could probably be a result of better balance between the tongue and cheeks and change of breathing pattern. While in the control group there was not much difference when compared with the surgical groups related to maxillary dental arch length which increased in control group also, this may however be coincided with the natural growth and eruption of teeth which takes place frequently in the selected age period. However, there was a statistically significant decrease in maxillary arch perimeter in the control group obviously due to continued mouth breathing and altered tongue posture suggesting that there would be total tooth material excess resulting in crowding this in future would lead to both tooth size and arch length discrepancy.

As a result, there was a change in posterior transverse inter-arch discrepancy (PTID) which got slightly reduced in the Adenotonsillectomy and Tonsillectomy groups suggesting there would be reduction in cross-bite while in the control group there was increase in posterior transverse inter arch discrepancy suggesting that there would be an increase in crossbite tendency. The benefits of adeno/tonsillectomy on dentofacial development have been observed both in cross-sectional and longitudinal studies in children and adults.

Both angular and linear measures of the mouth breathing group were far from the clinical normality in the beginning of the study, which may indicate that the normalizing of the respiratory pattern, brought about by Adeno/tonsillectomy surgery possibly favored the posture and functioning of the oro-facial muscles, with a consequent morphological balance and improvement in dental positioning. Dental findings revealed that

there was a significant difference in the positioning and anteroposterior angle of the incisors, and also on the overbite, with all the values tending towards clinical normality after surgery.

The present study showed that Adenotonsillectomy brought about benefits in relation to dental occlusion, as it favors the morpho-functional development of the face. Literature tells us that assessment of dental measures between mouth breathers and nasal breathers involving the position of incisors has controversial results.^(1,3,4,7-9) In our study when we compared the angular and linear positioning of upper and lower incisors in relation to SN plane, Mandibular plane, Pterygoid vertical (PTV) it was found that in both adeno/tonsillectomy groups there was a statistically significant decrease in proclination of incisors improving the facial profile, while in the control group it was noted that there was a statistically significant increase in the proclination of the incisors resulting in worsening of the profile. It can be concluded that it could be a result of normalization of respiratory pattern brought about by Adeno/tonsillectomy.

The results of the present study revealed that there was a change in the breathing pattern, better balance between the oro-facial muscles. The position of the tongue changed concomitantly after the breathing pattern changed.

Adeno/tonsillectomy improves the breathing pattern and as it improves the inclination of incisors it has a good effect on esthetics, studies suggest that children with nasal obstruction have vertical growth¹⁰ and that Adeno/tonsillectomy procedure can aid in preventing this growth relation which has a positive impact on the overall confidence of an individual.

This study conveys that obstruction of the airway by tonsils and adenoids should be treated surgically in the pre-pubertal stage because it is the stage when an individual is rapidly growing and such an obstruction has deleterious effects on the development of the face and dentition. Such obstruction in breathing, forces the individual to breathe through mouth which itself can cause worsening of the overall dental arch dimensions. Hence early surgical intervention would prevent any worsening and also correct already present deformities to a certain extent.

Conclusion

The results of our study showed that adeno/tonsillectomy surgery increased the width of maxillary arch (Inter canine and molar width) which was due to the mode of breathing changing the patient from mouth to nasal breather. There was an increase in palatal depth suggesting a better oro-facial muscular balance. Posterior transverse inter arch discrepancy reduced which would prevent crossbite. The maxillary dental arch length and arch perimeter reduced which

would reduce crowding tendency. The proclination of incisors got reduced.

In our study we found that:

1. Maxillary Arch Dimensions increased, Posterior Transverse Inter Arch discrepancy (PTID) decreased, Upper and Lower incisors retroclined when evaluated before and 9 months after Adeno/tonsillectomy procedure.
2. Maxillary Arch Dimensions decreased, Posterior Transverse Inter Arch discrepancy (PTID) increased and Upper and Lower incisors proclined when evaluated before and 9 months in control group.
3. Maxillary Arch Dimension before and 9 months after adeno/tonsillectomy surgery showed significant increase as compared to control group indicating positive corrections achieved with Adeno/tonsillectomy surgery.
4. PTID before and 9 months after Adeno/tonsillectomy surgery showed significant decrease as compared to control group indicating positive transverse corrections achieved with adeno/tonsillectomy surgery.
5. Comparison of the changes in Upper and Lower Incisor inclination before and 9 months after Adeno/tonsillectomy surgery showed significant decrease in proclination as compared to control group indicating positive corrections achieved with Adeno/tonsillectomy surgery.

All the above results suggest, if Adeno/tonsillectomy procedures are carried out at the right time (pre-pubertal) has positive effects on the dental arch dimensions. Studies suggest that there are many anomalies associated with mouth breathing⁽¹²⁾ and that adeno/tonsillectomy prevents many forms of malocclusion from developing and also helps in correcting certain forms of malocclusion. If left untreated the obstruction of the airway has deleterious effects on overall facial profile. Hence early diagnosis and surgical intervention is necessary.

References

1. Horizonte B, Gerias M. Dental arch dimensional changes after adenotonsillectomy in pre-pubertal patients. *Am J Orthod & Dentofac Orthop* 2014;145:461-468.
2. Pereira S R A, Bakor S F, Weckx L L M. Adenotonsillectomy in facial growing patients, spontaneous dental effects. *Braz J Otorhinolaryngol* 2012;78(2):111-7.
3. Subtelny JD. Oral respiration: facial mal development and corrective dentofacial orthopedics. *Angle Orthod* 1980;50:147-164
4. Zettergren-Wijk L, Forsberg C, Linder-Aronson S. Changes in dentofacial morphology after adenotonsillectomy and tonsillectomy in young children with osa. *Eur J Orthod* 2006;28:319-26.

5. Pereira S R A, Bakor S F, Weckx L L M. Adenotonsillectomy in facial growing patients, spontaneous dental effects. *Braz J Otorhinolaryngol* 2012;78(2):111-7.
6. Linder-Aronson S, Woodside DG, Hellsing E. Normalization of incisor position after adenoidectomy. *Am J Orthod* 1993;103:412-427.
7. Mattar SE, Valera FCP, Faria G, Matsumoto MA, Anselmo-Lima WT. Changes in facial morphology after adenotonsillectomy in mouth-breathing children. *Int J Paediatr Dent* 2011;21:389–396.
8. Kallunki J, Marcusson A, Ericsson E. Tonsillotomy versus tonsillectomy—a randomized trial regarding dentofacial morphology and post-operative growth in children with tonsillar hypertrophy. *Eur J Orthod* 2014;46:471–478.
9. Williams K, Mahony D. The effects of enlarged adenoids on developing malocclusion. *J Pediatr Dental Care*. 2007;13(3):20-29
10. Pereira S R A, Bakor S F, Weckx L L M. Adenotonsillectomy in facial growing patients, spontaneous dental effects. *Braz J Otorhinolaryngol* 2011;77(5):600-4.
11. Lofstrand- Tiderstrom B et al. Breathing obstruction in relation to cranio facial and dental arch morphology in 4 years old children. *Eur J Orthod* 1999;21:323-32.
12. Goldsmith JL, Stool Se .George Catlin's concept on mouth breathing as presented DR Edward H Angle. *Angle Orthod* 1994;64:75-8.