Tonsillotomy versus tonsillectomy—a randomized trial regarding dentofacial morphology and post-operative growth in children with tonsillar hypertrophy

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SUMMARY

OBJECTIVES: The primary aim of this study was to analyse two different methods of tonsil surgery, tonsillectomy (TE) and tonsillotomy (TT), regarding post-operative dentofacial growth in children with tonsillar hypertrophy. A secondary aim was to analyse these results in relation to cephalometric standards.

MATERIAL AND METHODS: The study group consisted of 64 subjects (39 boys and 25 girls), mean age 4.8 years ± 4 months. They were randomized to a complete removal of the pharyngeal tonsil, TE, (n = 31) or a partial removal, TT, (n = 33). Pre-operative and 2 years post-operative study material were obtained and analysed. The results were compared with cephalometric standards.

RESULTS: Pre-operative, children with hypertrophic tonsils displayed an increased vertical relation (P < 0.05) compared with cephalometric standards. Post-operative, no significant difference could be detected between the two surgical procedures regarding dentofacial growth. Mandibular growth with an anterior inclination was significant (P < 0.001/TE, P < 0.01/TT) for both groups. An increased upper and lower incisor inclination was noted (P < 0.01/TE, TT). The vertical relation decreased (P < 0.001/TE, P < 0.05/TT) as well as the mandibular angle (P < 0.01/TE, P < 0.001/TT). Reduction was also significant for the sagittal intermaxillary (P < 0.001/TE,TT) relation. These post-operative results, together with a more prognatic mandible (P < 0.05/TE,TT) and chin (P < 0.001/TE, P < 0.01/TT), might indicate a more horizontal direction of mandibular growth.

CONCLUSION: TE and TT yielded equal post-operative dentofacial growth in children treated for hypertrophic tonsils. This result should be considered when deciding upon surgical technique.

Introduction

Tonsil hypertrophy and/or adeno hypertrophy have been of interest for decades within the field of orthodontics.

Earlier research has shown that children with airway obstruction due to tonsillar-/adenoid hypertrophy show a higher percentage of dental and basal malocclusions. An increased frequency of lateral crossbite (Behlfelt, 1990; Hultcrantz et al., 1991; Löfstrand-Tideström et al., 1999; Zettergren-Wijk et al., 2002), increased overjet (Behlfelt, 1990; Pirilä-Parkkinen et al., 2009), reduced overbite (Behlfelt, 1990; Hultcrantz et al., 1991; Pirilä-Parkkinen et al., 2009), shorter lower dental arch (Behlfelt, 1990; Löfstrand-Tideström et al., 1999; Pirilä-Parkkinen et al., 2009), and retroclined lower incisors (Behlfelt, 1990) have been found.

Basal features consisting of a narrower maxilla (Behlfelt, 1990; Löfstrand-Tideström et al., 1999; Pirilä-Parkkinen et al., 2009; Zettergren-Wijk et al., 2002) and increased lower anterior facial heights with retrognatic, posteriorly inclined mandibles have also been shown (Behlfelt, 1990; Linder-Aronson et al., 1986; Zettergren-Wijk et al., 2002; Pirilä-Parkkinen et al., 2010).

Extraoral features consisting of a longer total anterior height and especially a larger anterior lower facial height are sometimes referred to as an adenoid face. However, this facial type should not be seen as a characteristic since it can only be distinguished in approximately one quarter of mouth-breathing children (Linder-Aronson, 1979).

After surgical removal of the obstruction, normalization in dentofacial (Hultcrantz et al., 1991; Zettergren-Wijk et al., 2002, 2006) and craniofacial (Woodside et al., 1991; Zettergren-Wijk et al., 2002, 2006) development has been noted.

The adenoid and the tonsils are a part of Waldeyers ring, the lymphatic tissue of the pharynx. This can be seen as one of the first parts of the immune system since it can react to inhaled or ingested pathogens (Kaditis et al., 2009). During early childhood, there is a natural hypertrophy of
this lymphatic tissue and it has been said to reach its maximum in relation to the pharynx at about the age of 5 years (Linder-Aronson and Leighton, 1983). Thereafter, the lymphatic tissue regresses throughout the teenage years (Abramson et al., 2009). However, the exact timing or the amount of regression is not yet fully clarified, and there also seems to be a difference between children with and without snoring (Arens et al., 2002, Kaditis et al., 2009, Papaioannou, 2013).

A constriction of the airway can alter the mode of breathing to mouth-breathing and may also generate sleeping disturbances such as snoring and obstructive sleep apnea (Behlfelt, 1990; Agren et al., 1998; Pirilä-Parkkinen et al., 2010). For children, the prevalence of breathing obstruction has been reported to be 4 per cent and obstructive sleep apnea is estimated to affect 0.9 per cent (Löfstrand-Tideström et al., 1999).

The severity of obstruction might have some influence upon the risk of developing malocclusions since children with sleep disordered breathing have been shown to display greater discrepancies than snoring children (Pirilä-Parkkinen et al., 2009). For affected children, basal differences in terms of a narrower maxilla can be seen as early as the age of four. Even at this early age, the frequency of lateral crossbites and frontal open bites is increased (Löfstrand-Tideström and Hultcrantz, 2010).

Tonsil surgery due to sleep disordered breathing is especially common in pre-school age children (Ericsson et al., 2009). The removal of obstructing tonsils and/or adenoid generates a more normalized pattern of craniofacial growth, and research has demonstrated that the greatest post-operative effect can be seen during the first year after surgery (Zettergren-Wijk et al., 2002).

Normalization and a more horizontal direction of mandibular growth have been noted post-operatively compared with controls (Linder-Aronson et al., 1986; Agren et al., 1998; Zettergren-Wijk et al., 2002). Dental normalization has also been stated in terms of incisor inclination and a reduced incidence of lateral crossbites and open bites (Hultcrantz et al., 1991; Pereira et al., 2011; Zettergren-Wijk et al., 2006).

Tonsil removal is one of the most common surgical procedures in Sweden with an estimated 13 000 operations per year. There are two different methods for the procedure—either a total removal of the tonsils, tonsillectomy (TE), or a partial removal of the tonsils, tonsillotomy (TT). For a long period following the introduction of general anesthesia, the dominating operation technique was TE, but in recent decades partial removal has become more frequent. When tonsillotomy/partial removal of the pharyngeal tonsils (TT) is performed, post-operative morbidity is decreased and the risk for readmission due to post-operative bleeding, dehydration or pain is reduced. There is also a shorter recovery period before returning to normal daily activities compared with a total removal of the pharyngeal tonsils (TE). The improvement in obstructive problems has been shown for both procedures when evaluated by the use of questionnaires and clinical examination (Ericsson et al., 2006; Koempsel et al., 2006; Ericsson et al., 2009; Acevedo et al., 2012; Walton et al., 2012), and by several studies with reports of polysomnographic data (de la Chaux et al., 2008; Reilly et al., 2009; Mangiardi et al., 2010).

Earlier orthodontic research regarding tonsillar removal has been conducted on individuals where TE was performed, most likely because this was the dominate treatment technique for a long time. In these studies, TE has been shown to have a positive influence on dentofacial growth in obstructed individuals. It has not earlier been shown that the same positive dentofacial effects can be observed post-operatively after TT, but in children with tonsil hypertrophy it appears that long-term effects after TT are equally good as those from TE with regard to sleep disordered breathing and health, but with less risk for complications (Ericsson et al., 2006; Acevedo et al., 2012; Walton et al., 2012).

From an orthodontic point of view, the question of whether TT generates positive effects comparable to those after a total TE is therefore of utmost interest.

The aim of this study was to compare two different methods of tonsillar surgery, TE and TT, with respect to post-operative dentofacial growth in children with tonsillar hypertrophy. A secondary aim was to analyse the results in relation to cephalometric standards.

Materials and methods

This study was approved by the Human Research Ethics Committee at the Linköping University (No. 03-448). Children included in the study were 4.5–5.5 years old. They all displayed tonsillar hypertrophy and obstructive problems with or without recurrent infections. The extent of obstruction was graded using parental reports of snoring and perceived degree of obstruction. No sleep studies were performed before surgery (in accordance with Swedish praxis for “regular cases”). Exclusion criteria for the study were: treated tonsillitis within 3 months prior to the planned operation, spontaneous recovery from an earlier obstruction, concomitant disease, or non-Swedish speaker.

Randomization (a sequentially numbered list generated by a computer) of patients in this study to either TT or TE was performed according to a modification of Zelen’s method (Zelen, 1981), from an existing waiting list for tonsil surgery. The modification of Zelen’s method was that after randomization to both surgery groups the families were asked for their informed consent in order to participate in the study. Prior to enrolment, the children’s caretakers received written information about the study and the type of surgery their child would receive. If they declined, they were excluded. A diagram of the study enrolment, exclusion and dropouts is presented in Figure 1.
A total of 67 children were operated according to the outcome of randomization (32 TE and 35 TT). The results regarding post-operative pain, morbidity and well-being of these children are presented in Ericsson et al. (2009). The additional dropouts for this present study were 1/TE and 1/TT related to the fact that the parents declined to put the child through the extra effort required with cephalometric X-ray and impressions for study models. One last child (TT) declined impressions for study models and X-ray at the orthodontic visit and was therefore also excluded.

In the present study, 64 children were finally enrolled pre-operatively, and no one was lost to the 2 year follow-up (Figure 1). At the time of surgery, the patients were 4.8 years ± 4 months. The group treated with TE consisted of 31 children (10 girls, 21 boys). TT was performed on 33 children (15 girls, 18 boys). For 58 of the children (28 TE and 30 TT) the adenoid had either been removed earlier or was removed, based upon clinical decision, at the same time as the tonsil surgery was performed.

TE was performed using cold knife and blunt dissection and TT was performed ad modum Hultcrantz (Ericsson and Hultcrantz, 2007) with Ellman 4.0 MHz Surgiton Dual Radio wave Unit (Ellman International Oceanside, New York). The protruding parts of the tonsils (TT) were removed parallel with the tonsillar pillars. Adenoidectomy was performed using a ring knife. All surgery was performed by the Ear, nose, throat (ENT) clinic’s usual, experienced otolaryngologists (one university hospital and two ENT clinics at county hospitals) within the same region of Sweden.

The study material consisted of a clinical orthodontic screening, impressions for study models, cephalometric X-ray and extraoral photographs. The subjects were examined at two different clinics (one university hospital and one county hospital). The lateral cephalograms were taken in a standardized manner. The child’s head was oriented in a natural position and fixed parallel to the film. Teeth were in intercuspidal position. The cephalostats used were Arcosphere® (Mediel, Gothenburg, Sweden) and Ortoceph® OC200D (Instrumentarium Dental, Tuusula, Finland). Since two different cephalometric instruments were used, each radiograph was adjusted for the difference
in magnification. Material was obtained pre-operative and 2 years post-operative.

Results related to the study model analysis will be presented elsewhere.

The cephalometric data from the study groups were compared with the standard cephalometric values for a Swedish population provided by Thilander et al., 2005. The reference data derives from a semi-longitudinal growth study displaying cephalometric standards in relation to gender and age. For 5-year olds, the standardization group consisted of 47 children (20 boys, mean age 5.1 ± 0.4 and 27 girls, mean age 4.9 ± 0.3) and, for 7-year olds, of 83 children (37 boys, mean age 7.4 ± 0.4 and 46 girls, mean age 7.4 ± 0.4). All these children were judged to have a normal Class I molar/canine relationship and normal vertical and transverse relations. There was no crowding or history of orthodontic treatment.

Since reference data is available for boys and girls in relation to age, a comparison was possible not only with regard to surgical method, but also in relation to gender.

Measurement and analysis

A total of 128 cephalograms were analysed using of the computer program Facad® (Ilexis AB, Linkoping, Sweden). All analyses were carried out by the same operator (JK) who was blinded as to treatment allocation until the data had been analysed. The definition of reference points were those stated by Björk (1975). Reference points and lines are displayed in Figure 2 and calculated variables in Table 1.

Statistics

SPSS version 18.0 (IBM, Portsmouth, UK) was used for statistical analysis. Descriptive data are presented as mean ± standard deviation (SD). Post-operative change within the study group was established by a paired sample t-test and independent sample t-test was used for comparing between surgery methods. In order to adjust for confounders from surgical method and gender an ANOVA with repeat measures was used. The Holm-Bonferroni correction (Holm, 1979) was applied when appropriate to account for multiple testing. Differences between the population in this study and the comparative population supplied by Thilander et al. (2005) were tested using independent sample t-test. All statistical tests were two tailed, with alpha set at 0.05.

Error of measurement

Twenty cephalometric X-rays were re-measured, by the same operator (JK), after an interval of at least 3 weeks. The error of the method could be measured using the formula stated by Dahlberg (1940), see Figure 3.

The measurements of NL/NSL and ANB showed the greatest error with a variation of 0.8 and 0.5 degrees, respectively. For all remaining angular measurement the calculated errors were 3 per cent or less.

Results

TE versus TT

Pre- and post-operative cephalometric analysis showed no significant differences between the two tonsil surgical groups even when adjusted for gender. For the two surgical procedures, pre- and post-operative cephalometric variables are shown in Table 1. For both operation methods, the variables SNA, NSBa and NL/NSL showed no significant difference from baseline to the 2 year post-operative control. Decrease for the vertical angular measurements, ML/NL (P < 0.001/TE, P < 0.05/TT) and Ar–tGo–Gn (P < 0.01/TE, P < 0.001/TT), was significant for both TT and TE. Mandibular inclination as measured by ML/NSL showed a significant reduction (P < 0.001/TE, P < 0.01/TT) for both groups. This, together with the increase for the variables SNB (P < 0.05/TE,TT) and SNPog (P < 0.001/TE, P < 0.01/TT) might indicate a more horizontal direction of mandibular growth.

Post-operative reduction was also significant for the ANB-angle (P < 0.001/TE,TT) whereas the inclination of both upper and lower incisors increased (P < 0.01).
Table 1  Comparison of pre- and post-operative cephalometric variables for tonsillectomy (TE) versus tonsillotomy (TT).

<table>
<thead>
<tr>
<th></th>
<th>TE (n = 31)</th>
<th>Post‡</th>
<th>P-value‡ pre/post</th>
<th>TT (n = 33)</th>
<th>Post‡</th>
<th>P-value‡ pre/post</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>81.3 ± 3.7</td>
<td>80.8 ± 3.7</td>
<td>0.188</td>
<td>82.0 ± 3.3</td>
<td>82.5 ± 3.5</td>
<td>0.474</td>
</tr>
<tr>
<td>SNB</td>
<td>76.2 ± 3.0</td>
<td>77.0 ± 2.8</td>
<td>0.020*</td>
<td>76.8 ± 2.8</td>
<td>78.2 ± 2.6</td>
<td>0.021*</td>
</tr>
<tr>
<td>ANB</td>
<td>5.1 ± 2.3</td>
<td>3.9 ± 2.2</td>
<td>&lt;0.001***</td>
<td>5.2 ± 2.3</td>
<td>4.4 ± 2.2</td>
<td>0.001***</td>
</tr>
<tr>
<td>SNPog</td>
<td>76.0 ± 3.0</td>
<td>77.6 ± 3.0</td>
<td>&lt;0.001***</td>
<td>76.7 ± 2.9</td>
<td>78.3 ± 2.6</td>
<td>0.004***</td>
</tr>
<tr>
<td>NSBa</td>
<td>131.5 ± 5.0</td>
<td>131.0 ± 5.1</td>
<td>0.411</td>
<td>150.5 ± 4.1</td>
<td>130.4 ± 4.4</td>
<td>0.790</td>
</tr>
<tr>
<td>ML/NL</td>
<td>37.8 ± 4.4</td>
<td>35.5 ± 4.6</td>
<td>&lt;0.001***</td>
<td>37.2 ± 4.5</td>
<td>35.6 ± 3.6</td>
<td>0.002**</td>
</tr>
<tr>
<td>NL/NSL</td>
<td>5.8 ± 2.8</td>
<td>6.3 ± 2.7</td>
<td>0.243</td>
<td>5.2 ± 2.9</td>
<td>4.9 ± 2.5</td>
<td>0.433</td>
</tr>
<tr>
<td>ML/NL</td>
<td>32.0 ± 3.8</td>
<td>29.2 ± 4.8</td>
<td>&lt;0.001***</td>
<td>32.0 ± 4.3</td>
<td>30.8 ± 4.0</td>
<td>0.029*</td>
</tr>
<tr>
<td>Interincisal</td>
<td>144.6 ± 10.4</td>
<td>133.7 ± 11.7</td>
<td>&lt;0.001***</td>
<td>146.3 ± 10.2</td>
<td>133.0 ± 12.8</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>ILs/NSL</td>
<td>91.4 ± 6.9</td>
<td>99.9 ± 8.5</td>
<td>&lt;0.001***</td>
<td>91.8 ± 7.0</td>
<td>100.3 ± 9.1</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>ILs/ML</td>
<td>86.3 ± 6.7</td>
<td>90.9 ± 7.2</td>
<td>0.006**</td>
<td>84.7 ± 6.4</td>
<td>91.2 ± 6.9</td>
<td>&lt;0.001***</td>
</tr>
<tr>
<td>Ar–tGo–Gn</td>
<td>130.7 ± 6.1</td>
<td>128.6 ± 5.9</td>
<td>0.006**</td>
<td>131.4 ± 5.8</td>
<td>128.7 ± 4.9</td>
<td>0.001***</td>
</tr>
</tbody>
</table>

‡Mean ± SD.

*Paired t-test with Holm-Bonferroni correction.

**P < 0.05; ***P < 0.01; ****P < 0.001.

\[ S_i = \sqrt{\frac{\sum d^2}{2n}} \]

\( s_i \) = the error of measurement
\( d \) = the difference between the two measurements and \( n \) = the number of double determinations

Figure 3  Formula Dahlberg, 1940.

The 2 year follow-up showed the same changes for boys and girls for each surgical method group (TE and TT). The difference from baseline to post-operative control showed a slight difference between TE and TT regarding ML/NL (\( P = 0.061 \)) for girls, but no significance after Bonferroni correction. Post-operatively, tonsillectomized girls displayed a more posterior inclination of the maxilla and therefore a tendency towards greater decrease of the ML/NL-angle compared with TT girls (Table 2).

Tonsil surgery versus cephalometric standards

The study group was divided not only with regard to surgical procedure but also with regard to gender to enable a comparison between the subjects and the standard cephalometric values for a Swedish population provided by Thilander et al. (2005).

The pre-operative measurement for ML/NL in respective gender group was the only cephalometric measurement that differed compared with cephalometric standards (\( P < 0.05 \)), showing a larger ML/NL angle for children with tonsillar hypertrophy.

Post-operative cephalometric values differed compared with aged-related standards regarding ML/NL (\( P < 0.05 \)) for TT girls and incisor inclination (\( P < 0.01 \)) for TT boys.

Discussion

When this study was initiated, 36 families out of 118 invited, declined enrolment before surgery. This is to be expected when randomization is performed prior to the invitation to the study (Zelen, 1981). Since the overall percentages of dropouts were about the same for TE and TT, no extra analysis of them as group was regarded as necessary. However, since TT has gained increasing popularity among ENT doctors, it is reasonable to assume that more parents know about the method and its possible benefits. Perhaps this explains why only families in the TE group did not accept the randomized choice. The reason for declining to participate was not explained by 16 families. Another 14 families who denied participation referred to the extra visits due to research. How many of these dropouts that were related to an objection related to the dental visit is not known.

Later in the enrolment, two additional dropouts were due to the specific fact that the families declined screening at the pre-operative orthodontic visit. The final dropout was one child who would not cooperate at the pre-surgical orthodontic visit. For the majority of children, the adenoid had either been removed earlier or was removed, based upon clinical decision, at the same time as the tonsil surgery was performed. This is not optimal from a research point of view, but the clinical reality is that the patient must receive what is considered to be optimal health care. Since most of the children underwent adenoidectomy, the effect of that procedure can be considered to be equal for both groups, meaning that any post-operative differences are related to the difference in tonsillar surgery.

This study could not include a control group since that would have generated a group of children with symptomatic tonsillar hypertrophy that would have been denied

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operation in order to serve as controls. To match our group regarding dentofacial development to a group without tonsillar hypertrophy could not be done due to ethical considerations, since there is no motivation for subjecting individuals assumed to be healthy to cephalometric X-ray. However, earlier work has been published that is considered to provide cephalometric standard values (Thilander et al., 2005). Although no information is available regarding tonsillar hypertrophy/obstruction problems for those on which these so-called standards are based, they can still serve as a basis for discussion.

Pre-operative

Earlier research has shown that children with obstruction problems display a greater frequency of basal and dental malocclusions compared with controls (Behlfelt, 1990; Hultcrantz et al., 1991; Zettergren-Wijk et al., 2002, 2006; Pirilä-Parkkinen et al., 2009, 2010).

When comparing boys and girls in this study to the gender standards for 5-year old children, a significant pre-operative difference was shown between those in the standard population and those in our study groups regarding the vertical dimensions, measured as ML/NL. The children diagnosed with tonsillar hypertrophy displayed a larger vertical inter-jaw relationship, a finding which is consistent with earlier research (Behlfelt, 1990; Zettergren-Wijk et al., 2006; Pirilä-Parkkinen et al., 2010). Even if such might have been expected, no other pre-operative differences could be detected regarding cephalometric variables. One explanation for this finding could be that the children in this study were a bit younger than children in earlier research studies; perhaps it was too soon for them to display potentially divergent traits in their vertical dentofacial growth.

Post-operative

The two tonsil surgery methods showed a significant post-operative decrease in the vertical dimension, measured as ML/NL and mandibular angle, a finding which also coincides with earlier research (Hultcrantz et al., 1991; Agren et al., 1998; Zettergren-Wijk et al., 2002, 2006). No difference in post-operative status regarding ML/NL or mandibular angle was seen between the two surgical methods. Together with the increase for both SNB and SNPog in the two groups, a more horizontal direction of post-operative mandibular growth might be indicated.

Cephalometric dental measurement in this study also revealed a post-operative improvement in both upper and lower incisor inclination. One must keep in mind that the study was conducted during the transition from deciduous to permanent incisors; however the incisor proclination was significantly increased post-operatively.

Post-operative results compared with gender standards for 7-year old children displayed a difference on two measurements. TT girls showed a wider ML/NL angle and boys treated with TT displayed more retroclined incisors compared with aged-related standards.

The individual transition from deciduous to permanent incisors may have played a role in the latest finding. This, together with the fact that incisor inclination did not differ post-operatively between the two surgical methods, could indicate that the finding could depend on the sample size of tonsillotomized boys.

Regarding the persisting difference in ML/NL for TT girls, it would have been desirable to have had a longer follow-up. It has been shown that the dentofacial differences after adeno-/tonsillectomies in children with obstructive sleep apnea is erased 5 years after the operation (Zettergren-Wijk et al., 2006). A 5 year follow-up would detect whether
this post-operative difference regarding ML/NL for TT girls compared with standards persists or diminishes with time. A difference regarding NL/ML might thus be of less clinical importance when comparing the two surgical procedures as whole.

Airway obstruction due to hypertrophic tonsils and/or adenoid might generate severe symptoms for the child, both physical and mental. No clear correlation has been shown for tonsils/adenoidal size and the severity of symptoms (Agren et al., 1998), which means that patient history and subjective symptoms are of utmost importance when identifying children with problems. TT and TE have been shown to yield equivalent results in treating obstructive problems, even though most studies have not been included results from pre-operative and post-operative polysomnography (Walton et al., 2012).

The mechanisms for the more normalized post-operative dentofacial growth are probably not yet fully understood. The dominate theory on this has been based upon muscles and function. The post-operative enabling of nasal breathing alters the position of the tongue and head, changing the muscular balance in the face area; this has been said to change the pattern of growth (Linder-Aronson, 1979). However, a complete explanation might be more complex. It has also been hypothesized that the altered secretion of growth hormone due to sleeping disturbances caused by obstruction may play a role in craniofacial growth (Peltonäkä, 2007). The effect of growth hormone on mandibular growth has been demonstrated (Forsberg et al., 2002; Kjellberg and Wikland, 2007) as well as the effect adenotonsillectomy may play on the secretion of growth hormone (Bar et al., 1999; Vontetsianos et al., 2005). Future research might provide a more multifactorial explanation for the characteristic pattern of growth seen in children with upper-airway obstruction.

When comparing TE and TT, in future research, it would be desirable to include larger sample-sizes; the potential need for longer periods of observation (more than 5 years) should also be addressed.

Conclusion

Children with hypertrophic tonsils displayed increased vertical relations, expressed as ML/NL, compared with age-related standards. Post-operatively, it appeared that TT yielded results equal to those of TE with regard to dentofacial growth. Benefits of TT compared with TE include less pain, fewer post-operative complications and a more rapid recovery—factors that should be considered when the decision is made that a patient is in need of tonsil surgery.

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