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Effect of the lower third molars on the lower dental arch crowding

Šidlauskas Antanas, Trakinienė Giedrė

SUMMARY

Increasing lower dental arch crowding with the age is a recognized clinical problem, and one that has become more apparent in recent years as more adults retain their teeth longer. One of the theories is that the erupting third molars push anterior teeth forward and cause their crowding. On the other hand, a number of studies found no correlation between lower third molars and lower incisor crowding. Because of all these contrasting findings this study was started to re-evaluate correlation between third molars presence and lower dental arch crowding. The study group consisted of 91 subjects with an average age 21.01±4.13 years. The individual, quantitative and cast-based analytical registration of crowding was based on the measurements of mesiodistal width of teeth and related to the length of the appropriate segment of the lower dental arch. No statistically significant third molar presence-specific differences were recorded in the lower dental arch crowding between the groups with erupted, unerupted and agenesis of third molars.

Although differences between the groups were not statistically significant, some tendency for crowding in the anterior part of lower dental arch was more expressed in the groups with the presence (erupted 0.57 mm and unerupted 0.74 mm) of third molars, than with agenesis (surplus space 0.03 mm). Nevertheless, the present study do not provide enough evidence to incriminate third molars as being the only or even major etiologic factor in the late lower dental arch crowding.

Key words: crowding, third molars, lower dental arch.

INTRODUCTION

The role of the lower third molars in the lower incisor crowding has been debated for more than a century. Increasing lower dental arch crowding with the age is a recognized clinical problem, and one that has become more apparent in recent years as more adults retain their teeth longer (Figure 1).

One of the theories is that erupting third molars push anterior teeth forward and cause their crowding. Bergstrom and Jensen (1) demonstrated that there was more crowding in the quadrant with a third molar present than in the quadrant with a third molar missing. Vego (2) longitudinally examined 40 individuals with lower third molars present and 25 patients with lower third molars congenitally absent. The conclusion was that the erupting lower third molars can exert a force on the neighboring teeth.

On the other hand, a number of studies found no correlation between lower third molars and lower incisor crowding. Lindquist and Thilander (3) removed the impacted molar on one side while the no extraction side was used as a control. The findings after 3 years indicated that removal of lower third molars did not relieve anterior crowding. Pirttiniemi et al. (4) evaluated changes in the dental arches of adults in the third decade of life after the removal of all third molars. The dimensions of the lower dental arch showed a small, but significant, increase one year after the removal of all the third molars. But the changes in the lower anterior region during that year were not significant. The study concluded that the extraction of an impacted third molar allows at least the second molar drift posteriorly and laterally, but it has minimal effect on the anterior part of the dental arch. Southard (5) measured proximal contact tightness between the mandibular teeth in cases with bilaterally unerupted third molars. The measurements were taken before and after the unilateral removal of one third molar. They found that surgical removal of the lower third molar did not have a significant effect on contact tightness.

The most interesting data have been gained from the studies of the patients who received orthodontic treatment with premolars extractions. The incidence as well as the severity of mandibular incisor crowding increased during adolescence and adulthood in both the normal untreated individuals as well as the orthodontically treated patients with premolar extractions, after all retention was discontinued. Fastlicht (6) found that in orthodontically treated subjects 11% of the cases had third molars but 86% had crowding. Little et al. (7) observed that 90% of the extraction cases that were well treated orthodontically ended up with an unacceptable amount of lower incisor crowding. Kaplan (8) found that presence of third molars does not produce a greater degree of lower anterior crowding or rotational relapse when retention is ceased after orthodontic treatment.

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Fig. 1. The lower dental arch crowding is an essential feature of the completed permanent dentition over the age of 17 years

Because of all these contrasting findings this study was started to re-evaluate correlation between the lower third molars presence and lower dental arch crowding.

MATERIALS AND METHODS

The study group consisted of 91 subjects with an average age 21.01± 4.13 years. The criteria for inclusion to the study:

– age at least 17 years;
– complete lower dental arch (except third molars);
– no orthodontic treatment before records collected;
– good state of care of the lower teeth with no artificial dental crowns;
– good quality orthopantomograms and plaster casts available.

The position of the third lower molars was evaluated on the study models and orthopantomograms. The mandibular dental arch was examined clinically and with the reference to plaster casts. Crowding was measured on the plaster casts for twelve teeth using metal gauge with a 1/10 mm scale and with tips sharpened to a point. The greatest mesiodistal width of teeth crowns was measured and related to the length of the dental arch (Figure 2, A). The difference between the sum of mesiodistal widths of teeth crowns and dental arch length values yielded the space deficit in the lower dental arch.

To assess influence of third molars on crowding additionally the right and left side of the mandibular dental arch were examined in every subject separately. All half's of lower dental arches were divided into 3 groups according to the position of third molars: first group consisted of subjects with erupted, second group – with unerupted and third group – with agenesis of third molars. The individual, quantitative, analytical registration of crowding was based on modified segmented arch analysis proposed by Lundstrom (9). Modification included newly defined segments. The lower dental arch length was measured in the anterior, buccal segments and in the all-over half of the dental arch (Figure 2, B). The crowding was calculated for every separate lower dental arch segment.

To determine the measurement error, 20 casts selected randomly have been analyzed by the same investigator at different time-points. The repeated measurement errors did not occur systematically and were within range of ± 0,5 mm per segment, they were considered negligible with respect to the present investigation.

RESULTS

The study results indicate that in general lower dental arch crowding is an essential feature of the completed permanent dentition (Figure 3). Lack of space was detected in almost 90 percent of the cases. Crowding more than 5 mm was registered in 23.3 percent of subjects and the mean value of crowding in the lower dental arch was 3.11±2.74 mm.

The results of the study to assess influence of third molars on the lower dental arch crowding are given in the Table1. Since the values measured for the lower dental arch crowding failed to approximate normal distribution in the group with agenesis of third molars, the central variable tendency of these variables was represented by the median rather than arithmetic mean. No statistically significant third molar presence-specific differences were recorded in the lower dental arch crowding between the groups with erupted, unerupted and agenesis of third molars.

Although differences between the groups were not statistically significant, some tendency for crowding in

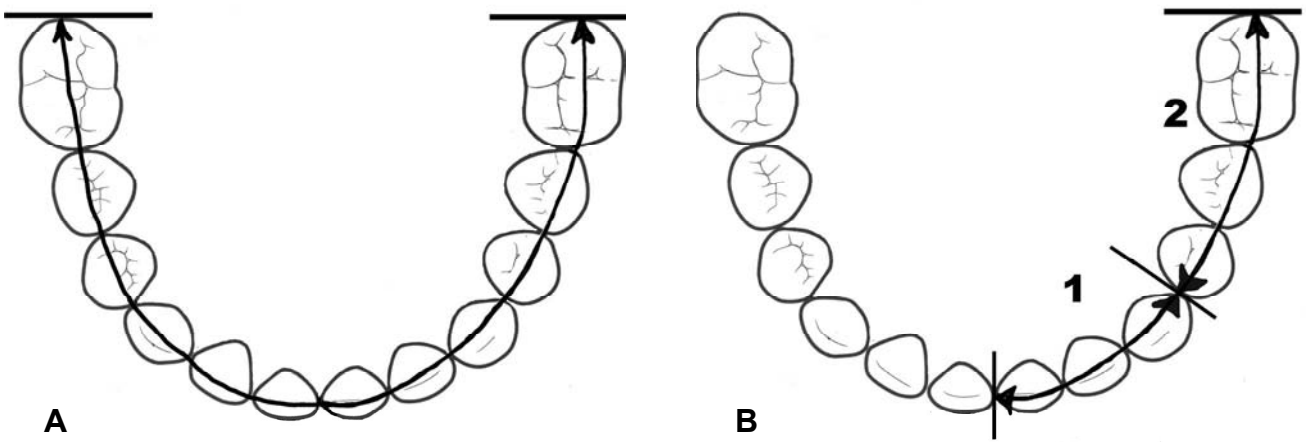

Fig. 2. Lower dental arch length: A – for twelve teeth; B – anterior segment (1), posterior segment (2).

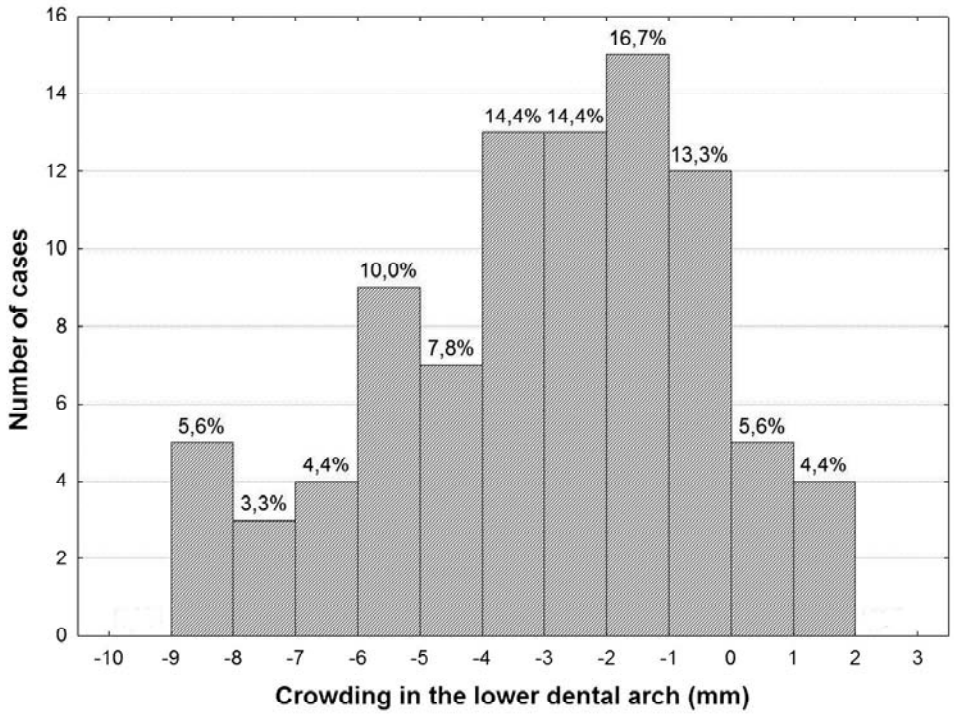

Fig. 3. Distribution in percent of the lower dental arch crowding (mm)

the anterior part of lower dental arch was more expressed in the groups with the presence (erupted 0.57 mm and unerrupted 0.74 mm crowding accordingly) of third molars, than with agenesis (surplus space 0.03 mm). The great variation of crowding was registered in all groups with the widest range in the anterior segment of the lower dental arch, from 11.60 mm crowding till 2.40 extra-spaces in the group with unerupted third molars.

DISCUSSION

It seems to be generally accepted that dental arch length starts to decrease after eruption of the second molars and incisor irregularity appears during the teenage years (9, 10, 11). Bishara et al. (12, 13) evaluated the changes in the lower incisors position between 12 and 25 years of age, and then re-evaluated the same subjects at 45 years of age. They found an increase in the tooth size-arch length discrepancy with age. The average dental arch length reduction between 12 and 25 years was 2.7 mm in males and 3.5 mm. in females. This is in agreement with the results of our study. We found that in general it is about 3 mm crowding in the lower dental arch when third molars are present. It is apparent therefore that if dental arch dimensions are reduced, dental crowding must increase. Factors responsible for dental arch reduction may vary from one person to another, and many factors, acting together or at different stages of development, may contribute to lower dental arch crowding. There are several theories constructed on evidence based data, trying to explain late lower dental arch and especially lower incisor crowding.

The first group of the studies is related to the problems associated with the jaws growth. It is some evidence that lower jaw is growing forward more than the upper jaw and the lower basal bone more than alveolar bone. If the mandibular incisors are not free to move forward because of the restraining influence of the upper arch, it is likely that they will become retroclined and crowded (14, 15, 16). Bjork (17) claimed that extreme degrees of mandibular growth rotation could result in increased crowding. When the mandible rotated upward and forward, the paths of eruption of all the teeth were displaced in a mesial direction, resulting in "packing" of the lower anterior segment. In extreme downward and backward rotation, the lower incisors become retroclined through their functional relationship with the upper incisors. The posterior teeth are not guided distally in their eruption, and crowding develops anteriorly.

Table. Comparison of the lower dental arch crowding between the groups with erupted, unerupted and agenesis of third molars

Group	Crowding (mm)															Significance level (p)
	1. Erupted n = 88					2. Unerupted n = 85					3. Agenesis n = 9					
Segment of the lower dental arch	Mean	SD	Median	Max	Min	Mean	SD	Median	Max	Min	Mean	SD	Median	Max	Min	
Anterior	0.57	1.12	0.55	3.00	+2.00	0.74	1.77	0.30	11.60	+2.40	+0.03	0.96	+0.50	1.80	+1.10	$p_{1.2} = 0.46$ $p_{1.3} = 0.12$ $p_{2.3} = 0.20$
Posterior	0.95	1.36	0.75	5.10	+2.10	0.98	1.20	0.90	5.30	+2.10	0.81	0.71	0.80	1.60	+0.70	$p_{1.2} = 0.90$ $p_{1.3} = 0.76$ $p_{2.3} = 0.69$
Over-all half	1.50	1.77	1.50	6.10	+2.20	1.70	2.20	1.50	12.9	+2.30	0.78	1.33	0.50	2.90	+1.20	$p_{1.2} = 0.58$ $p_{1.3} = 0.22$ $p_{2.3} = 0.22$

+ value indicate surplus space in the dental arch.

Late mandibular growth changes also may bring the lower incisors into a different soft tissue environment. Subtelny and Sakuda (18, 19) compared patients who were orthodontically treated and developed lower incisor crowding with patients who did not. They found out a strong tendency to maintain the original intercanine width in the last-mentioned group. The crowded cases had a narrower intercanine width before treatment, which returned to its original dimension after treatment expansion. They claimed, that as the mandible increases in size, the lips exert greater pressure than the tongue creating a lingually directed force, that counteracted by mesial forces, causes incisor crowding.

There are evidences that periodontium condition may influence stability of the lower incisors. Proffit (20) claimed that a slight imbalance between the tongue on one side and the lips and cheeks on the other is normally present. He suggested that the teeth are stabilized against this slight imbalance by forces produced in the periodontal membrane by active metabolism. The destructive changes in the periodontium may allow for unbalanced muscular forces produce some pressure on the lower incisors. Laskin et al. (21) suggested that hormonal changes during adolescence or pregnancy might cause increased plasticity of bone. Bone loss as a result of aging or periodontal disease may allow teeth to move under pressures that they previous resisted. These factors are more likely to be the cause of crowding that develops in latter life, after a period of relative stability, than responsible for increasing crowding during the teenage years. Southard at al. (22) demonstrated the presence of a continuous force in the mandibular dentition, acting to maintain proximal contacts in state of compression. This force was increased after occlusal loading. They found significant correlations between interproximal force and mandibular anterior malalignment and concluded that periodontal forces could contribute to the development of late lower arch crowding.

The explanation of late lower incisors crowding from the biomechanical stand point have been presented by Ihlow et al. (23, 24). Each dental contact they classified as a joint, so that the complete dental arch is a coupled series of joints. The dental arch horizontally represents a linked chain in which two convex articular surfaces are in contact and are tensioned by the dentogingival and dentoalveolar fibrous tissue. Joints composed of convex-convex surfaces are in mechanically unstable position under compression. Brodie (25) suggested that with every stroke of mastication, the upper incisors receive a separating impulse, whereas the lowers tend to come into closer contact. So, this compression might cause the teeth to slip past each other, especially in the incisal region. Experiments on plaster models show that the dimensional stability of an articulated arch is considerably increased when a concave and a convex articular surface are in contact. Using the striping method, the modern dental arch might gain stability similar to that achieved with the Stone Age man abrasion process.

Finally we need to remember differences in the individual tooth crown size. Crowding is slightly more common in persons whose teeth have large mesiodistal dimensions than those with smaller teeth. Peck & Peck (26, 27) found that well aligned lower incisors were significantly smaller mesiodistally and significantly larger bucco-lingually than those of controls.

So, crowding of the lower incisors is a multi-factorial phenomenon that involves a decrease in arch length, increased tooth size and abnormal shape, narrowing of the intercanine dimension, biomechanical peculiarities of tooth contacts and mandibular growth changes occurring in adolescence. The influence of third molars on the alignment of the anterior dentition is controversial. The present our study and many other citied above, do not provide enough evidence to incriminate these teeth as being the only or even major etiologic factor in the late incisor crowding.

CONCLUSIONS

1. The lower dental arch crowding (mean value 3.11 mm) is an essential feature of the completed permanent dentition over the age of 17 years .
2. The third molars do not create statistically significant difference of crowding in the lower dental arch, when compare subjects with the agenesis, removed and present third molars.
3. The recommendation to extraction third molars in the lower jaw has to have justifiable reason and can't be solely based on the doubtful rationale to minimize present or future crowding of the lower anterior teeth.

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