REVIEWS

Dent. Med. Probl. 2015, **52**, 3, 336–340
ISSN 1644-387X

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Intercanine Width – Review of the Literature

Szerokość międzykłowa – przegląd piśmiennictwa

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A – research concept and design; **B** – collection and/or assembly of data; **C** – data analysis and interpretation; **D** – writing the article; **E** – critical revision of the article; **F** – final approval of article

Abstract

Correct diagnosis and a detailed orthodontic treatment plan are responsible for therapeutic success. One of the most important assessed parameters with a strong influence on the orthodontic treatment plan is intercanine width. This parameter is mostly defined as a distance between cusp tip points of the right and left canines. All dental arch dimensions, including intercanine width, are dynamic values and change significantly with the development of individuals. The distance between canines tends to increase with the greatest changes taking place during the eruption of incisors, until complete permanent dentition or, according to some other authors, till the eruption of permanent canines and first premolars. The parameters of dental arch never become stable. These findings suggest that, though age-related changes occur after adolescence at a significantly slower rate and begin inverse, they take place during the entirety of adult life. It is also well proven that the distance between canines depends not only on patient's age. Its value is also strongly affected by gender, ethnicity, and whether the individual dental arch shape. Shape and dimensions of dental arches achieved during the treatment process are one of the most important aspects of treatment. Every change of the width or the lower dental arch form generates a tendency to return toward its pretreatment conditions and a malocclusion relapse occurring. The maintenance of original, unchanged intercanine and intermolar width is therefore critical to the stability of orthodontic treatment (**Dent. Med. Probl. 2015, 52, 3, 336–340**).

Key words: relapse, dental arch, canines, malocclusion.

Słowa kluczowe: nawrót wady, łuk zębowy, kły, wada zgryzu.

It is impossible to carry out any orthodontic treatment without conscientious and reliable diagnosis. That is why we can state that a correct diagnosis and a detailed orthodontic treatment plan are responsible for therapeutic success. As a standard before starting active treatment, most orthodontists undertake a series of intra- and extraoral photographs, pantomographic x-rays and cephalometric analysis of lateral radiographs as well as plaster model diagnostics and analysis. On orthodontic diagnostic models most frequently considered measurements are: the anterior arch width, posterior arch width, intercanine distance, the curve of Spee's depth, overbite and overjet [1]. Plaster analysis is required to answer the question whether it is possible to expand the dental arch, and whether the results of treatment achieved this way will be stable, specifically whether it is possible to interfere with the intercanine and intermolar width and induce permanent changes after treatment. These questions are particularly important in borderline cases, without clear indications of other analyzed parameters in the course of nonextraction treatment or as an example treatment requiring extraction of the four premolars.

Therefore, intercanine width remains one of the most important assessed parameters exerting a strong influence on the orthodontic treatment plan. The aim of this study was thus a review of available literature related to the changes occurring within intercanine distance during

orthodontic treatment, as well as its impact on the stability of the therapy results.

There are some subtle differences in the definitions of the intercanine width reported by various authors. De la Cruz et al. [2] define this parameter as a distance between cusp tip points of the right and left canines. Heiser et al. [3] define describing the intercanine width as a distance in millimeters between canine cusp tips or estimated cusp tips in the event of the abrading of tooth surfaces in the maxillary and mandibular arches. The definition presented by Paulino et al. [4] is similar. They describe the upper and lower intercanine distance as a linear distance between the cusps of contra-lateral canines or, in the case of presenting evidence of wear, the distance between the centres of the worn surfaces. One of the authors measuring the intercanine width in deciduous dentition is Gardner and Chaconas [5]. They said that this parameter could be measured between the cusp tip center of one deciduous canine to the other. During the phase of tooth change when permanent canine teeth are not presented and milk teeth are no longer still present in the mouth, the intercanine distance is an estimate.

Dental Arch Development

All dental arch dimensions are dynamic values and change significantly with the development of individuals [6–11]. According to Bishara et al. [7] the greatest increases of total arch length occur during the first two years of life and this trend is progressing until the period of greatest growth ends. They have also observed that the arch length increases until 8 years of age in the mandibular arch and 13 years in the upper one and then continues to decrease gradually until age 45. Some authors have found that many arch parameters increase until permanent dentition is complete and reverse changes occur between early and mid adulthood [8, 12, 13]. In a study performed by Barrow and White [13] increase of dental arch width has been found from 4 to 17 years of age and this change occurred by the end of transition from primary to the permanent dentition. However, this does not mean that after the age of maturity all parameters stabilize and changes completely cease to appear. Although to a much lesser extent, changes in dental arch dimensions occur throughout life [6, 8]. These changes in dental arch width, depth and length are decremental and this finding concerns all individuals: untreated as well as orthodontically treated patients [6].

These observations refer also to intercanine width. The distance between canines tends to increase with age until maturity with the greatest alterations taking place during the growth phase [4, 10]. One of the first authors studying the distance between canines were Barrow and White [13] and Moorrees [14]. They observed a rapid increase of intercanine width from 5 to 8 or 9 years of age and a decrease after 14 years of age [13]. According to Moorrees [14] this distance is the greatest at the beginning of permanent dentition and decreases from the age of 10 to 12.

Knott [10] compared the distance between cuspids at four stages of dentition: during a complete deciduous dentition; mixed dentition when six permanent teeth (the first molars and four incisors) and six milk teeth in each arch were presented; early permanent dentition with all 28 permanent teeth (mean age 13.6 years) and late permanent dentition (young adult) about 10 years after eruption of the last second molar (mean age 25.9 years). She noted that the greatest changes of intercanine width occur in the mandibular arch just before the eruption of permanent canines. The difference between the values measured in the last two groups appeared already to be not statistically significant. Therefore, it can be concluded that the intercanine distance remains stable after puberty and achieving complete permanent dentition or according to some other authors after eruption of permanent canines and first premolar teeth [4]. The average value of intercanine width in the primary dentition is approximately 25.2 mm in the mandible and 28.8 mm in the maxilla. In permanent dentition, the distance between cuspids achieved respectively an average of 24 and 31 mm [12]. However, the differences between the intercanine width in deciduous and permanent dentition result not only from development of the dentofacial complex. Permanent canines while erupting, set slightly more external – labially in the dental arch than were set in the appropriate milk teeth [15]. On the other hand, other findings indicate that the parameters of dental arch never become stable. These findings suggest that though age-related changes occur after adolescence at a significantly slower rate, they take place during the entirety of adult life [4, 6–8]. Moreover, from this moment all observed changes begin to inverse – the intercanine width has a tendency to constrict which is particularly noticeable in the lower arch [4, 6–8, 16].

It is also well proven that the distance between canines depends not only on patient's age. Its value is also strongly affected by gender, [4, 6, 8, 10, 16] ethnicity [17], and on the individual dental arch shape. Canines are set differently in an ovoid arch (the widest between the cuspids), in a square arch or in one which tapers and is narrow between the

canines [18]. Independently, all dental arch dimensions are slightly greater in males than in females [6–8]. Men also present greater variability of these values [4] and age-related changes are in their cases more pronounced [6]. Furthermore, it is established that there exists a strong correlation between the interalar distance and intercanine width, especially when considering square and ovoid arch forms [18]. This finding is particularly important in terms of smile and facial aesthetics. Because the canines are set on the largest curvature of the dental arch they possess a lip holding function. Their position in the arch and the arch form determines also the width of other front teeth. It is a useful guide in prosthodontics to select the proper upper anterior teeth during restoration planning.

Significance of Intercanine Width for Treatment Stability

In literature new conceptions and techniques of treatment detailing various possibilities to move teeth and set them within the jaw bones better, faster or more precisely still appear. However, at the same time some doubts and limitations come into view. One of the most important but also slightly controversial aspects of treatment is the shape and dimensions of dental arches achieved during the treatment process. This issue has been discussed for a considerable length of time. The dominating opinion is the absolute necessity of fulfilling the condition which allows reaching stable treatment effects and maintaining patient's original intercanine and intermolar width in the lower arch [2, 3, 5, 19, 20]. Every malocclusion is substantially stabilized by balanced muscular forces and the key determinant of the position of teeth harmonious with muscles are the mandibular canine and first molar positions [21]. The treatment plan provided after the active phase of therapy stabilized by balanced muscle forces results should therefore be based on original canine and first molar positions in the lower jaw. The new arch should be built around them, especially around intact intercanine width [19]. Strang [21] proved additionally that treatment results will also be stable in the case of treatment requiring extraction of first premolars when canines are moved distally into premolar extraction space. As a result there appears some expansion of the distance between canine teeth because of their new more buccal position. However, this location of canines does not significantly affect the tendency to relapse. However, in their publications, for example, Walter [22, 23] and Steadman [24] presented just the opposite point of view, refuted earlier findings that intercanine and intermolar widths shall be inviolate. They found that achievement of permanent widening or lengthening of the dental arch is possible. Provided, however, that despite the method of treatment, the leads to achieving a functional and muscular balance. Regardless of the treatment method, the stability of postretention results is actually determined by many varying factors. Beyond the intact muscle balance there are, for example, functional and emotional habits, dysfunctions, growth or development of boney, muscular and nervous tissues [24]. Nevertheless, changes of intercanine width in any case should not be too significant. Expansion possibilities are not limitless.

More recent studies mostly again emphasize the importance of maintaining unchanged intercanine width [3, 4, 25]. They proved that the expansion of dental arch creates strong postretention predispositions for it to regress toward its pretreatment conditions [2, 3, 9, 15]. Particularly the increase of distance between canines in mandibular arch tends to relapse malocclusion [3]. Changes made in the maxilla are in fact dependent on those made in the lower jaw – the upper arch and the positions of upper teeth are governed by the mandibular arch form and conditions existing in the opposite arch [21]. Most authors indicate that the change of intercanine width during orthodontic treatment and the postretention period is not affected by the type of therapy [26–30]. In both extraction and nonextraction cases the intercanine distance is expanded during treatment but with subsequent tendency to return to or almost to its original pretreatment dimension. Burke et al. [29] accomplished a meta-analysis summarizing the results of 26 papers that deal with the longitudinal stability of postretention mandibular intercanine width. The study assessed the different malocclusions according to Angle classification treated by various methods. The findings of this study indicate that mandibular intercanine distance has a tendency to increase for about one to two millimeters in each malocclusion during treatment with expansion of the dental arch as well as with extraction of premolars. However, during postretention period this distance contracts again and returns to approximately its original pretreatment dimension. Posttreatment instability of the new canines' position can be a result of induced during active treatment changes in the conditions of periodontal tissues surrounding the teeth, especially periodontal fibers [25]. During the retention period, when the new position of ligaments is still not fully stabilized, teeth moved during treatment are

particularly susceptible to various types of force. Set in their new position canines adapt later to some extent to the environment subject to muscle activity [16, 24, 25]. Some meaning may also have the change of long axes of canines which become more vertical, thereby decreasing the distance between the tips of right and left canines [16]. An important role in retention is also derived from the occlusion achieved. Improper functional relationships of teeth, overfunction or pounding of the mandibular canines by the maxillary ones can significantly contribute to the change of relation between cuspids [19]. However, there was no noticed effect of the erupting third molars on change of the intercanine width [15].

Summarizing, every change of the width or the lower dental arch form generates a tendency to return toward its pretreatment conditions and to a malocclusion relapse. This conclusion relates especially to crowdings of lower incisors [2]. The maintenance of original, unchanged intercanine width in the mandibular arch is consequently critical to the stability of orthodontic treatment. However, this is not a guarantee of postretention stability and does not give one hundred percent protection against relapse. Indeed, in terms of effective retention treatment many other factors play a role, such as position, shape and size of incisors, the condition of periodontal tissue, residual growth, occlusion after treatment or third molars [25]. The type and length of retention should therefore be preceded by a thorough analysis of these factors as well as an analysis of the number of teeth moved, the distance that these teeth have been moved, swiftness of treatment and the occlusion in general. No less important is of course the cause of the malocclusion, the age of the patient and the condition of surrounding tissues which should be also taken into consideration during planning the retention phase of the treatment [19, 31].

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Conflict of interest: None declared

Received: 06.01.2015
Revised: 03.05.2015
Accepted: 10.05.2015