

MODERN CLASSIFICATION OF DENTAL ARCHES

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ABSTRACT

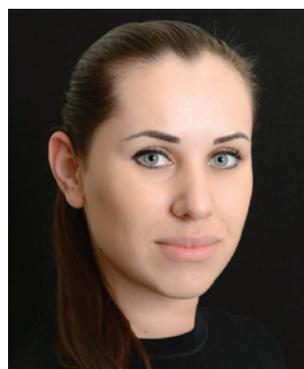
The authors put forward a classification for maxillary dental arch forms, which includes nine major clinical variants. Individuals with mesognathic, brachygnathic, and dolichognathic arch forms demonstrated microdontia, normal teeth size, and macrodontia in permanent molars. Each of the maxillary dental arch forms were characterized by the main biometric parameters, which may prove useful when determining the size of metal arcs implemented at various stages of orthodontic treatment.

Orthodontic literature has studied the shapes and sizes of dental arches for ages now, and a vast number of scientific papers offer the description of ideal arch forms [2, 7, 11, 12].

G.C. Chuck (1932) was the first one to propose a classification for the arch forms, specifying them as narrowed, square and oval ones [4]. At the same time, the classification holds terms referring, on the one hand, to the arches' sizes (narrowed), while on the other – to their similarity with geometric figures, which, above that, do not actually reflect the true shape of the arches (square).

The classifications describing the shape of the dental arches through various mathematical expressions utilize definitions like chain curves, elliptic curves, parabolical, mixed models (ellipse and parabola), conic sections, spline curves, and beta functions [1, 3, 6, 10].

Scientific studies and clinical observations confirm the fact that dental arch forms in humans vary a lot [5, 9]. This diversity does not allow making a search for the ideal arch shape. E.H. Angle proposed that the concept of the ideal arch form should be related to the facial types, namely dolichocephalic, mesocephalic and brachycephalic. During that, it has been proven that the dolichocephalic facial type, more often than not, comes along with narrow and long arches, while in case of the brachycephalic type short and wide arches dominate [8]. Yet, the author offers no morphometric data just like shows no parameters for determining the arch shapes.



This reveals a need for a system-wide approach to ascertaining arch forms, both when diagnosing their shape and size abnormalities and through orthodontic treatment, which prompted this present study.

There has been an analysis conducted regarding the sagittal and transversal sizes in maxillary dental arches in 287 patients (both sexes; in their early adulthood) with physiological occlusion of permanent teeth.

To construct dental arch we used the main points that were set in the middle of the vestibular surface of the incisors' occlusal contour; canines and premolars were used to set the most prominent part in the vestibular contour of the tooth crown' occlusal surface; the most protruding points on the vestibular contour' occlusal surface of the vestibular cusps were marked on the molars (Fig. 1).

The key parameters for dental arches measurement included the arch width, depth and the frontal distal diagonal. When measuring the dental arch, the frontal vestibular point was set amidst the medial incisors on the vestibular surface. The width of the dental

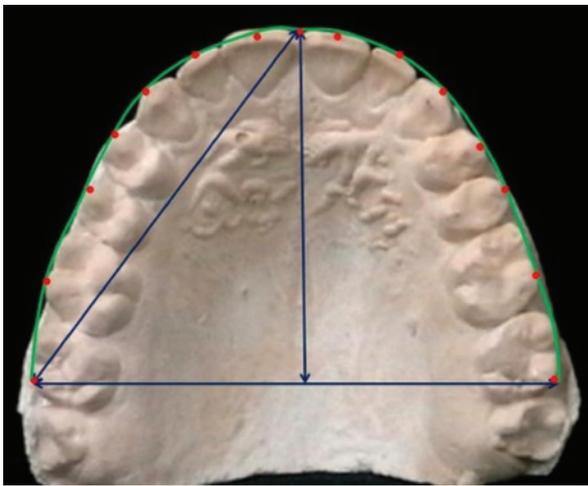


Fig. 1. Maxillary cast model bearing the dots and contours of the dental arch

arch was measured between the second molars at the most protruding points on the vestibular contour' occlusal surface of the vestibular distal cusps. The depth of the dental arch was measured from the frontal vestibular point located on the vestibular surface between the medial incisors of the upper or lower jaw, and up the line connecting the vestibular distal points of the second molars along the projection of the median palatal suture. The arch form was defined through arch index (the ratio between its depth and width).

Estimation of the teeth size implied using the mean module of the molar crowns (half-sum of the first and second molar crowns modules). The crown module was calculated as half-sum of vestibular lingual and mesial distal diameters of the tooth crown. The mean module of the molar crowns of 10.6 to 11 mm was accepted as normal teeth size. Reduced value was

typical of microdontia, while an increase in the same value revealed macrodontia of the permanent molars.

The outcomes have shown that physiological occlusion of permanent teeth came along with three major forms of dental arches identified in accordance with the arch index.

With the dental arch index of 0.74 ± 0.03 the arch form was defined as mesognathic. In case of an index below 0.71, the arch form was viewed as brachygnathic, while an index going beyond 0.77 pointed at the dolichognathic form (Fig. 2).

Individuals with physiological occlusion of permanent teeth mostly demonstrated the mesognathic type of the dentoalveolar arch, which was found in $56 \pm 4.5\%$. The dolichognathic type was found in $36 \pm 4.5\%$, while the brachygnathic type in $28 \pm 4.5\%$ of all the patients studied.

In the cases with the normal size of the permanent teeth combined with the mesognathic arch, the length of the dental arch (the sum of mesial distal diameters of 14 teeth) averaged 112.6 ± 3.62 mm, the width of the arch between the second permanent molars was 57.5 ± 2.8 mm, while the depth of the arch was as long as 43.1 ± 2.8 mm. The arch index was 0.75 ± 0.03 . The mean module of the molar crowns was 0.8 ± 0.2 mm. The average measure of the frontal distal diagonal was 51.8 ± 2.8 mm. In the brachygnathic type combined with the normal size of the permanent teeth, the dental arch length (which is the sum of the mesial distal diameters of 14 teeth) averaged 110.2 ± 2.87 mm, the width of the dental arch between the second permanent molars being 62.23 ± 2.8 mm, and the depth of the arch was 42.1 ± 2.8 mm. The arch index proved to be significantly lower than that in patients with mesognathic type of the dental arch and was equal to 0.68 ± 0.03 . The mean module of the molar crowns was 10.75 ± 0.15 mm. The frontal distal diagonal was, on average, 52.2 ± 2.8 mm. The dolichognathic dental arches typically revealed enlarged sagittal sizes, and reduced transversal sizes, if compared with the mesognathic type of the arch. The width of the dental arches was 59.83 ± 2.8 mm, the depth being 47.45 ± 2.8 mm. Given that, the arch index was 0.82 ± 0.03 .

In microdontia of the permanent teeth, the typical point making it different from normal sized arches was that the arch length (the sum of the mesial distal diameters of 14 teeth) was significantly lower in all forms of the dental arches surveyed. In mesognathic type the arch length was 103.22 ± 2.8 mm, in the brachygnathic type – 100.78 ± 2.8 mm, while in the dolichognathic it was 105.3 ± 2.8 mm. Due to that, there was a significantly smaller size in the frontal distal diagonal, which in case of mesognathia was equal to

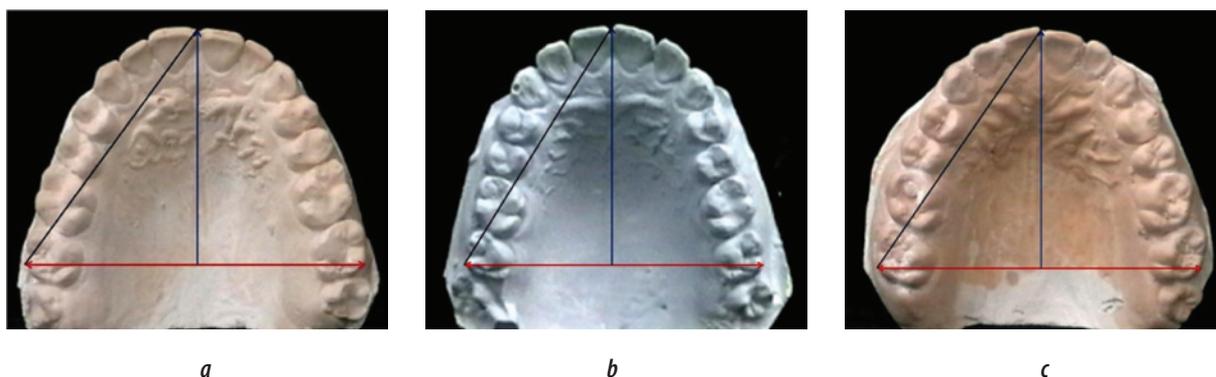


Fig. 2. Major types of dental arches: mesognathic (a), dolichognathic (b), and brachygnathic (c)

48.72±2.8 mm, in brachygnathia – 48.21±2.8 mm, and in dolichognathia – 51.15±2.8 mm. At the same time, the arch index was basically not different from that in people with a normal teeth size and was typical of mesognathia, brachygnathia, and dolichognathia.

People with macrodontia of the permanent teeth manifested significant elongation of the dental arch and the frontal distal diagonal. In the mesognathic type of the arch its length was 103.22±2.8 mm, in the brachygnathic type – 100.78±2.8 mm, and in the dolichognathic type – 105.3±2.8 mm. The frontal distal diagonal in mesognathia made up to 48.72±2.8 mm, in case of brachygnathia – 48.21±2.8 mm, while in case of dolichognathia it was 51.15±2.8 mm.

Therefore, physiological occlusion of permanent teeth demonstrated nine major variants of the dental arches. Individuals with the mesognathic, brachygnathic, and dolichognathic types of the dental arches revealed microdontia, normal teeth size, and macrodontia of the permanent molars. Each dental arch form had its typical biometric parameters, which could help detect the size of metal arcs, used through various stages of orthodontic treatment.

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