

# ARCH FORMS AMONG DIFFERENT ANGLE CLASSIFICATIONS

## A – STUDY

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### ABSTRACT

*The aim of the study was to find out the type of arch form amongst different Angle classifications attending the orthodontic department of Sardar Begum Dental College and Hospital, Peshawar. Consideration of the arch form is of paramount importance, because it is imperative that the arch form should be examined before embarking upon the treatment as this gives valuable information about the position into which teeth can be moved if they are to be stable following treatment. It was a prospective cross-sectional study carried out on a total of 120 individuals irrespective of gender having Angle's class I, II or III occlusion. The results revealed that the most prevalent arch form among the individuals of the sample was of the tapered variety i.e., 49.2% irrespective of the Angle classification while ovoid and square arch forms were 2<sup>nd</sup> and 3<sup>rd</sup> in the prevalence order i.e., 29.2% and 21.2% respectively. The study emphasizes that consideration should be given to the arch form specific for the particular individual.*

**Key words:** Arch form, Angle classification, Orthoform™ templates, SBDC,

### INTRODUCTION

Arch form refers to the overall configuration of the dental arch and this takes into account symmetry, roundness, elongation and convexity. Characteristics of arch form are, Radius of curvature of the labial segment, the intercanine width and the intermolar width.<sup>1</sup> Various definitions of the dental arch have been used in the studies of arch forms. Currier defined three curves, an outer curve based on cusp tips and incisor edges, a middle curve based on fossae and fissures and cingulae and an inner curve based on inner aspects of teeth. Thus arch shapes vary according to the landmarks chosen to represent the teeth.<sup>2</sup> Other modifications to define arch form have also been presented. Sampson<sup>3</sup> provided a statistical model for describing the average shape of the arch form as well as its variation in the population by applying arcs of conic sections on the sample of sixty six dental arches. Pont's index was established by Pont<sup>4</sup> in 1909 to predict maxillary dental arch width from the sum of the mesiodistal diameters of the four maxillary incisors. Chuck<sup>5</sup> in 1932 classified arch forms as tapered, square and ovoid.

The present study is aimed to categorize arch forms in different Angle classifications in patients reporting to this department, because it is imperative that the arch form should be observed before treatment commences as this provides valuable information about the position into which teeth can be moved, if they are to be stable following treatment. Arch form also has an important role in esthetics, space availability and periodontal health.

### METHODOLOGY

This was a prospective study carried out on a total of 120 individuals in the orthodontic department of Sardar Begum Dental College and Hospital, Peshawar over a period of 6 months. All consecutive individuals reporting to the unit regardless of the gender were included in the study. They were divided into individuals having class I, II or III malocclusion and selected through a non-probability (convenient) sampling technique. Inclusion criteria for this study was individuals with un-crowded mandibular dental arches with all permanent teeth present from right first molar to left first molar which were fully erupted. Those individuals

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with caries, trauma, attrition of the occlusal surfaces of the teeth, asymmetric mandibular arch forms, missing teeth, prosthetic replacements, severely crowded/ spaced lower arches and periodontally compromised dentition were excluded from the sample. Dental casts made up of white orthodontic stone were prepared for each patient. Photocopies of the occlusal surfaces of 120 mandibular dental casts were obtained with photocopier Panasonic model fp 7824 on white papers.

TABLE 1: DIFFERENT ARCH FORMS AND ANGLE CLASSIFICATIONS

Angle classification	Tapered	Ovoid	Square
Class I (55)	23(41.8%)	18(32.7%)	14(25.4%)
Class II Div 1 (52)	30(57%)	13(25%)	9 (17.3%)
Class II Div 2 (5)	3(60%)	1(20%)	1(20%)
Class III (8)	3(37.5%)	3(37.5%)	2(25%)
Total n=120	59(49.2%)	35(29.2%)	26(21.2%)

(percentages applicable along the rows)

TABLE 2: CHI-SQUARE TESTS OF ANGLE'S CLASSIFICATIONS AND ARCH SHAPES

	Value	df	p-value
Pearson Chi-Square	3.464	6	.749

Inter canine widths from the cusp tips of left canine to the right canine and intermolar width from the mesiobuccal cusp tip of left first molar to the right first molar were obtained on each dental cast with the help of Boley gauge and then transferred to the photocopied images of the dental casts with the help of pencil dots. Three types of arch forms i.e tapered, square and ovoid were used to categorise the sample. For this purpose Orthoform™ templates by 3M Unitek Fig (1) were used. The templates were overlaid on the photocopied images of the lower arches taking care of the midline and considering the pencil dots on the canines and molars. Arch forms were chosen according to the best fit method. To eliminate error of recording the arch form each case was judged three times by two examiners.

## RESULTS

A total of 120 individuals were recruited in the study, amongst them 32% were male and 68% were female (Fig 2), with the male to female ratio of 0.47: 1. The highest number of individuals in the sample were having Angle class I occlusion which was noticed in 45.8% of the sample n= 55 Fig (2). In this group tapered arch form was found with the highest frequency of 41.8% followed by ovoid arch form 32.7% and square arch form 25.4%. Angle class II division 1 comprised 43.3% of the sample (n=52) and in this group tapered arch form is again of the highest frequency i.e., 57% followed by ovoid arch form 25% and 17.3% with square

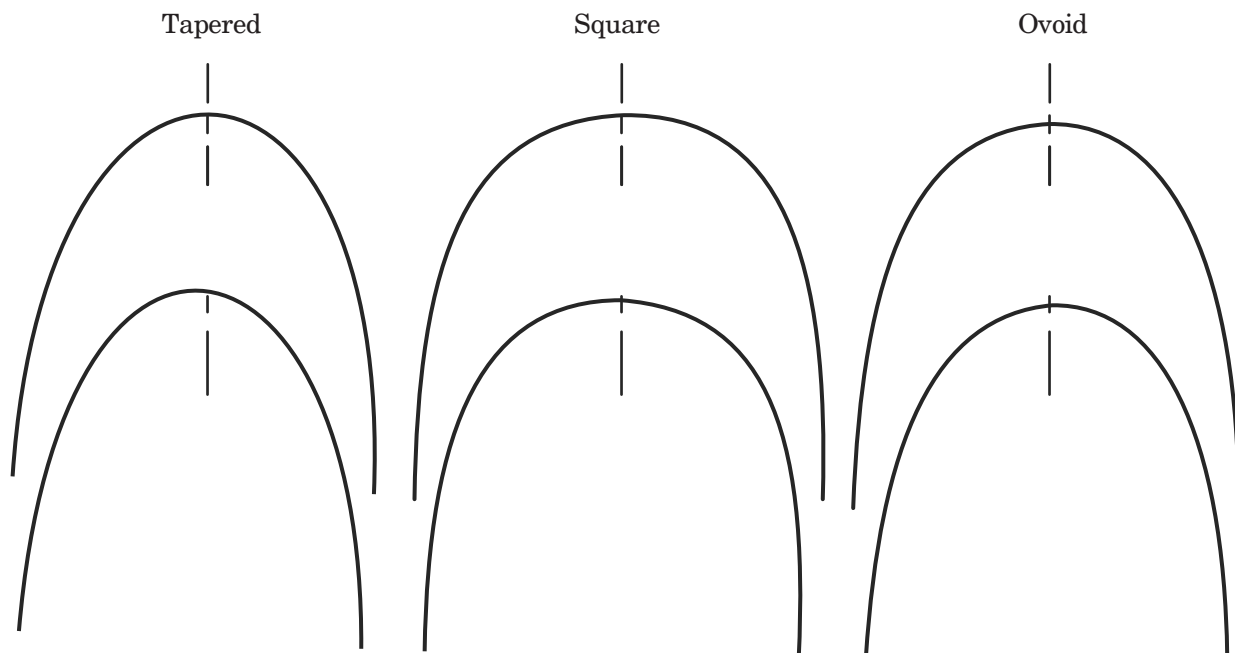


Fig 1: Types of Arch Forms™ (Orthoform templates by 3M Unitek)

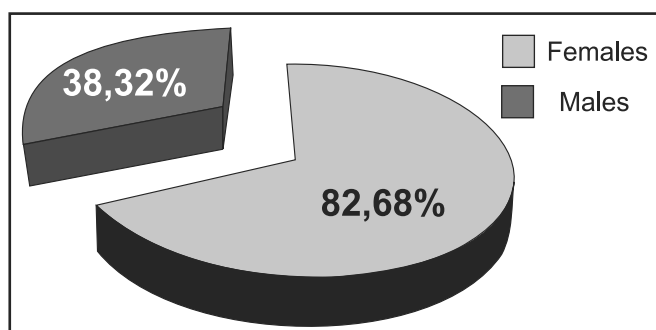


Fig 2: Gender distribution

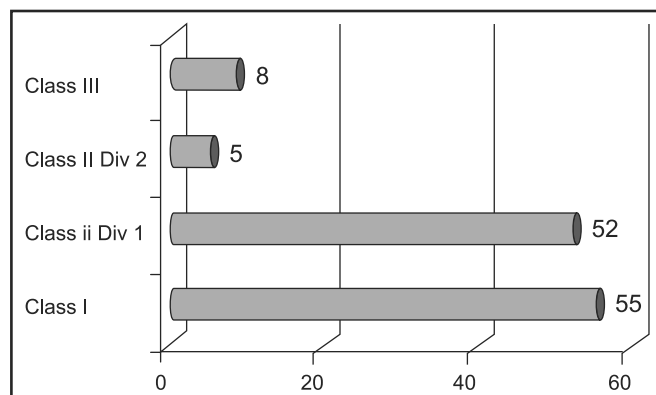


Fig 3: Distribution of Angle's classifications in the sample

arch form. Angle class II div 2 individuals comprised 4.1% of the sample ( $n=5$ ) and in this group 60% were having tapered while 20% each were having ovoid and square arch form respectively. There were 8 individuals with angle class III occlusion and this comprised 6.6% of the sample strength. In this group 37.5% were found to have tapered and ovoid arch form each, while 25% individuals had a square arch form. Overall considering the whole sample the frequency of tapered arch form is highest i.e., 49.2% of the sample, second arch form in the order of frequency was the ovoid arch form 29.2% of the sample, and third in frequency was square arch form 21.2% of the sample as shown in Table 1. Association of each archform tested with the respective class of occlusion using Pearson Chi square test. The overall result showed nonsignificant association with  $p$  value = 0.749 depicting that there is no particular correlation between various archforms and the angle's classes (Table 2)

## DISCUSSION

The size and shape of the dental arches have considerable implications for orthodontic diagnosis and treatment planning. These have an effect on the space availability, stability of dentition, esthetics and

health of the periodontium. Space availability and stability of dentition are the factors of particular significance especially in a tapered arch group as the intercanine width is the shortest comparing the ovoid and square variety. Any arch expansion in the tapered arch group is deleterious for proper alignment of the lower labial segment since this region is constrained by circumoral musculature. According to Brader, arch forms are shaped by the equilibrium of forces around the dentition, as he gave the concept of trifocal ellipse brader arch form.<sup>6</sup>

As far as, esthetics is concerned, tapered arch form presents a better smile arc than square arch form which tends to provide a flatter smile arc which is not esthetically pleasing.<sup>7</sup> Health of the periodontium is another factor which relies on observing the arch form during orthodontic treatment. Teeth should not be forced to move out of their periodontal envelope and this is only possible by tending to the individualized arch forms.<sup>8</sup>

In the present study, tapered arch form was 49.2% of the sample which suggests that all the above mentioned factors are more critical for our sample as any change to the tapered arch form can easily compromise the space availability, stability, esthetics and periodontal health. Felton et al<sup>9</sup> carried out a study on the assessment of arch form of their sample and found that approximately 50% of the lower arch forms were tapered, 8% were square and 42% were ovoid.

Arch shapes may also define characteristics of a particular occlusion group. Nojima et al<sup>10</sup> used tapered, square and ovoid arch form templates to evaluate the arch forms of angle class I, II and III cases in both Japanese and Caucasian samples. The Caucasian sample showed 44% tapered, 38% ovoid and 18% square arch forms. The Japanese sample showed 12% tapered, 42% ovoid and 46% square arch form. In the present study highest prevalence of tapered arch form (49.2%), ovoid arch form (29.2%) and square arch form (21.2%) emphasized the similarity of arch forms of our sample with that of the sample of Felton et al<sup>9</sup> and Caucasian sample of Nojima et al.<sup>10</sup>

Arch form is also influenced by the facial types. In this regard leptoprosopic (long face) individuals usually have tapered arch forms while euryprosopic (short face) individuals tend to have a broader square arch form.<sup>11</sup> The most used arch form in the MBT philosophy is the ovoid arch form especially during the initial phase of treatment and the main purpose of this is to reduce the inventory.<sup>12</sup> The general concept of arch

form development is that initially it follows the shape of the underlying bone but later when the teeth are fully erupted it is shaped by the forces of the surrounding musculature.<sup>13</sup>

Andreiko<sup>14</sup> gave the concept that shape of the mandible dictates the arch form, with the teeth theoretically aligned and contained within the limits of mandibular bone. Ronay et al<sup>15</sup> also emphasized the importance of the relation between shape of the basal bone and dental arch form. Begole<sup>16</sup> devised a method of arch form development using a mathematical principal, in which arch is shaped by forming a cubic spline curve. Increasing the intercanine width during treatment brings about instability and causes relapse. Despite the fact Braun et al<sup>17</sup> reported that most of the common commercially available NiTi wires increase the mandibular intercanine width by 5.9 millimetre. Since majority of our sample (49.2%) of the total had tapered arch form, the above statement has more meaning as changing this dimension has the highest risk of relapse. 43.3% of the individuals in our sample were class II division 1 patients and the predominance of tapered arch form in these individuals is obvious considering the influence of the orofacial musculature. Popular consensus is that class II division 2 individuals should have a square arch form but in the present sample square arch form accounted for only 20% of the sample which might be due to the scarcity of class II division 2 individuals (4.1%) in our sample. Henrikson et al<sup>18</sup> showed the changes in the mandibular arch form in individuals with normal occlusion on passing from adolescence to adulthood, which was depicted as increased roundness of arch form, decreased arch depth and increased intermolar width.

## CONCLUSION

Since arch form is specific for each individual and any change in arch shape or dimension heralds the occurrence of an inevitable relapse it is strongly indicated to use the same arch form which is specific for that individual and this study is a step forward in emphasizing this important aspect of diagnosis and treatment planning.

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