# Assessment of Dental Arch Parameters in Turkish Twins

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***Background***: *The aim of this study is to investigate the relative contributions of genetic and environmental factors to variations in dental dimensions in a sample of Turkish twins, and to estimate heritability using dental casts.* ***Study design***: *The study samples were selected from the twin children between 3-15 years old who referred for their first dental examination. Fifty nine monozygotic and one hundred and forty three dizygotic twin pairs were examined in the study. The alginate impression material used to create the plaster model of maxilla and mandible. Anterior arch width, posterior arch width, arch length and arch circumference were measured on models prepared from measurements taken for both maxilla and mandible with digital caliper. The similarities and differences of the measurements were compared between pairs of twins and zygocytes. Morever, the effects of bad oral habits, bruxism, a result of psychosocial factors on measurements were examined. Statistical analysis was performed using Paired T Test, Wilcoxon Test and Mann Whitney U test.*

***Results:*** *A total of 404 dental models of 118 (29.2%) monozygotic and 286 (70.8%) dizygotic twins were evaluated. There was no statistical difference between sibling pairs in both monozygotic and dizygotic twins. The measurement similarity between twin siblings differed according to zygosity in all measurements ($p<0.05$). It has been observed that the finger sucking and mouth breathing affect the dental arch measurements ($p<0.05$).* ***Conclusion:*** *These results indicate that the differences in dental arch dimensions between monozygotic twin pairs are less than the difference between dizygotic twin pairs.*

***Keywords:*** *Twin, Arch dimension, Genetic factors*

## INTRODUCTION

Many factors contribute to tooth size, position, arch size, shape and the relationship of the maxillary and mandibular dental arches. It is stated that the dental occlusal variation results from a multifactorial pattern including genetic, epigenetic and environmental influences.[1-6]

Genetic factors have a large effect on the mesiodistal and buccolingual dimensions of the tooth crowns. Several studies provide evidence of the genetic control for tooth dimension.[1,7,8] Studies in twins have confirmed that there is a relatively strong genetic contribution to variation in human tooth size and shape.[1,9,10,11]

Although estimates of heritability for the overall crown size of teeth, Carabelli trait, and dental arch dimensions are all relatively high, estimates for some other dental features, such as anterior overbite and overjet, are relatively low.[12] This indicates that non genetic factors play an important role in contributing to variation in some dental occlusal features at a population level.[9,13]

Twin studies have demonstrated that, while genetic variance can be discerned for different occlusal variables, heritability tends to be low, emphasizing the importance of environmental influences on occlusal variation.[2,14]

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Similar results from longitudinal study of siblings concluded that most of the observed variation in occlusion in the permanent dentition was acquired rather than inherited.[15]

The research on dental arch breadth and length in humans has provided some estimates of genetic and environmental influences.[3] Some authors claim that genetic variation has a major effect on arch width and length.[4,7] However the data on genetic components may vary by region ethnic background thus it is reasonable to compare the estimates of genetics across different populations. But it's worth mentioning, that not only the genetic, but also environmental factors play a role in the development and shape of dental structures. The environmental influences may be such factors like habits, mouth breathing, early loss of primary teeth, endocrine changes, injuries, posture and others. This is also supposed to be related with the reduction of chewing resistance and growth stimulation from refined diets.[4]

The studies on genetic influences on dental arch show ambivalent findings. Cassidy and co-authors suggested that arch size and shape are determined more by environmental influences, while the study of teenage twins found a high genetic contribution to variation in dental arch dimensions.[4,16,17]

The purpose of our study was to evaluate the heredity of dental arch width, length and perimeter in the sample of twins with accurate zygosity determination and using the dental casts.

## MATERIALS AND METHOD

This cross sectional observational study was conducted with twin children between the ages of 3-15 years, who were referred from 2014-2017, without any genetic or systemic disease, mental or emotional handicaps, and did not received orthodontic treatment were included for the study. Ethical approval was provided by the reference no.2014/278 according to the Declaration of Helsinki. Informed consent was received from all subjects. After oral examination, twins with a history of dental caries, tooth agenesis, extracted tooth, hypoplastic tooth, and the teeth with restorations at the surface points to be measured were not included.

Zygosity determination was confirmed for selected 100 twins whose gender was the same within each twin pair. The sample consisted of 59 pairs of monozygotic (MZ) twins and 149 pairs of dizygotic (DZ) twins who referred for their first dental examination.

### Dental arch measurements:

Clinical anamnesis, dental diagnosis and clinical examination of teeth and oral cavity were evaluated in all twins. The impressions of the maxillary and mandibular arches were taken using alginate base hydrocolloid impression material and were poured with dental stone to obtain the study dental cast models. The stone casts were set to wax-bite impressions with assessment of centric occlusion in the field and the plaster casts were obtained for each child. All children's arch dimensions were evaluated by using the digital caliper on plaster dental casts regarding the arch perimeter, arch length and arch breadth.

Arch length was defined as the distance from midpoints of incisal reference points to the line passing through reference points associated with the first or second molars for both maxilla and mandible. Arch breadth was evaluated as anterior arch breadth and posterior arch breadth. The anterior arch breadth was defined as the distance between canin cusps. The posterior arch breadth was defined as the distance between the midpoint of the distobuccal and mesiopalatal cusps of the molars (between the last molar teeth in the mouth).[3,4,18]

Arch perimeter was measured between the mesial aspect of the first or second molars, over the contact points of posterior teeth and incisal edge of the anteriors. These arch dimensions were evaluated for both maxilla and mandible.[19]

*Statistical analysis*

The data were analyzed by using IBM SPSS statistical program version 20. In order to compare the similarity of the twin siblings, twins were divided into two identical groups by permutation block randomization method. One group was named first sibling and the second group was named second sibling. The measurements were evaluated between first sibling and second sibling in MZ and DZ twin groups. Paired t test was used in the groups with normal distribution and Wilcoxon test was used in the groups without normal distribution. In order to see the effect of zygocyte on relationships between twin siblings, measurement differences between siblings were calculated as absolute values. Since the data obtained did not meet the normal distribution requirement for any variable, the mean difference of the zygosity groups was compared with the Mann Whitney U test.

In order to examine the effect of bad oral habits and bruxism on dental arch dimensions in twin siblings, the mean meausurements were compared between twin siblings where the habit was seen in one sibling but not in the other. In addition, the averages of all siblings' weight and height at birth and study time were compared. All comparisons were performed separately in MZ and DZ twins. Comparisons were carried out with Paired T Test when the sample per group was at least 30 and the assumption of normal distribution was realized, otherwise, with the Wilcoxon Signed Rank Test. The level of statistical significance was set at 0.05 in all analyzes.

## RESULTS

A total of 404 voluntary participants (204 male and 200 female) were included. 118 (29.2%) MZ and 286 (70.8%) DZ twins were evaluated. The mean age of participants was 9.63 in MZ twins and 9.47 in DZ twins.

The data were analyzed and compared between twin pairs. The maxillary anterior arch breadth and maxillary posterior arch breadth dimension did not demonstrate statistically difference between 1st sibling and 2nd sibling in MZ and DZ twin pairs (Table 1).

There was no statistically significant difference between 1st sibling and 2nd sibling in MZ and DZ twin pairs in mandibular anterior and posterior arch breadth. (Table 2).

Maxillary and mandibular arch perimeter did not show a significant difference in MZ and DZ twin pairs. (Table 3).

There was no statistically significant difference in MZ ($p=0.281$) and DZ ($p= 0.311$) twin pairs for the arch lengths of maxilla and mandible (Table 4).

When the difference between the measured parameters between twin siblings is compared according to zygosity, the average difference in maxillary anterior arch width between twin siblings differs statistically significantly according to zygosity ($MW = 3343.0$, $p = 0.018 < 0.05$). The mean difference between MZ twins ($1.56 \pm 1.49$) is less than the average difference between DZ twins ($2.16 \pm 1.84$) (Table 5). The average difference in maxillary posterior arch width difference between twin siblings differs statistically

**Table 1: Comparison maxillary arch breadth between 1st siblings and 2nd siblings in twin groups**

| | | Maxillary Anterior Arch Breadth (mm) | |
|---|---|---|---|
| **Zygocity** | **Twin Pairs** | **Mean± SS** | **p** |
| **MZ** | ***1st siblings*** | 31.2±3.31 | 0.549[a] |
| | ***2nd siblings*** | 3.,03±3.14 | |
| **DZ** | ***1st siblings*** | 31.58±2.82 | 0.577[a] |
| | ***2nd siblings*** | 31.45±3.08 | |
| | | **Maxillary Posterior Arch Breadth (mm)** | |
| **MZ** | ***1st siblings*** | 48.41±4.46 | 0.146[a] |
| | ***2nd siblings*** | 48.02±4.44 | |
| **DZ** | ***1st siblings*** | 48.84±4.11 | 0.827[b] |
| | ***2nd siblings*** | 48.708±4.17 | |

a.Paired T Test *p≤0.05

b.Wilcoxon Test

**Table 2. Comparison mandibular arch breadth between 1st siblings and 2nd siblings in twin groups**

| | | Mandibular Anterior Arch Breadth (mm) | |
|---|---|---|---|
| **Zygocity** | **Twin Pairs** | **Mean± SS** | **p** |
| **MZ** | ***1st siblings*** | 25.32±2.66 | 0.052a |
| | ***2nd siblings*** | 24.88±2.21 | |
| **DZ** | ***1st siblings*** | 26.20±2.49 | 0.180b |
| | ***2nd siblings*** | 26.47±2.64 | |
| | | **Mandibular Posterior Arch Breadth (mm)** | |
| **MZ** | ***1st siblings*** | 43.85±3.53 | 0.105b |
| | ***2nd siblings*** | 43.54±3.57 | |
| **DZ** | ***1st siblings*** | 44.21±3.85 | 0.105b |
| | ***2nd siblings*** | 43.89±4.25 | |

a.Paired T Test *p≤0.05

b.Wilcoxon Test

**Table 3. Comparison arch perimeter between 1st siblings and 2nd siblings in twin groups**

| | | Maxillary Arch Perimeter (mm) | |
|---|---|---|---|
| **Zygocity** | **Twin Pairs** | **Mean± SS** | **p** |
| **MZ** | ***1st siblings*** | 78.03±4.73 | 0.926a |
| | ***2nd siblings*** | 78.07±4.79 | |
| **DZ** | ***1st siblings*** | 81.02±5.5 | 0.215a |
| | ***2nd siblings*** | 81.53±5.63 | |
| | | **Mandibular Arch Perimeter (mm)** | |
| **MZ** | ***1st siblings*** | 69.93±3.98 | 0.258a |
| | ***2nd siblings*** | 69.49±4.19 | |
| **DZ** | ***1st siblings*** | 73.10±5.55 | 0.883a |
| | ***2nd siblings*** | 73.05±5.53 | |

a.Paired T Test *p≤0.05

b.Wilcoxon Test

**Table 4. Comparison arch length between 1st siblings and 2nd siblings in twin groups**

| | | Maxillary Arch Length (mm) | |
|---|---|---|---|
| **Zygocity** | **Twin Pairs** | **Mean± SS** | **p** |
| **MZ** | ***1st siblings*** | 25.61±2.48 | 0.281a |
| | ***2nd siblings*** | 25.92±2.24 | |
| **DZ** | ***1st siblings*** | 26.47±2.65 | 0.311b |
| | ***2nd siblings*** | 26.01±2.88 | |
| | | **Mandibular Arch Length (mm)** | |
| **MZ** | ***1st siblings*** | 22.24±2.23 | 0.635b |
| | ***2nd siblings*** | 22.36±2.19 | |
| **DZ** | ***1st siblings*** | 22.86±2.43 | 0.663b |
| | ***2nd siblings*** | 23.08±2.42 | |

a.Paired T Test *p≤0.05

b.Wilcoxon Test

significantly according to zygosity (MW = 2408.00, p = 0 <0.05) and the mean difference between MZ twins (1.44 ± 1.48) is less than the average difference between DZ twins (2.84 ± 2.15) (Table 5). The average difference in maxillary arch perimeter difference between twin siblings differs statistically significantly according to zygosity (MW = 2936.00, p = 0.001 <0.05) and the mean difference between MZ twin pairs (2.24 ± 1.64) is less than the average difference between DZ twin pairs (3.74 ± 3.2) (Table 5). The average difference in maxillary arch length difference between twin siblings differs statistically significantly according to zygosity (MW = 2845, p = 0.000 <0.05) and the mean difference between MZ twin pairs (1.49 ± 1.57) is less than the average difference between DZ twin pairs (2.57 ± 2.14) (Table 5).

The mean of the mandibular anterior arch width difference between twin siblings differs statistically significantly compared to zygosity (MW = 3438.00, p = 0.032 <0.05) and the mean difference between MZ twin pairs (1.36 ± 1.11) is less than the average difference between DZ twin pairs (1.93 ± 1.6) (Table 5). The mean of the difference in mandibular posterior arch width between twin siblings differs statistically significantly according to zygosity (MW = 3055.00, p = 0.002 <0.05) and the mean difference between MZ twin pairs (1.22 ± 1.61) is less than the average difference between DZ twin pairs (2.34 ± 2.38) (Table 5). The mean of the difference in mandibular arch perimeter between twin siblings shows a statistically significant difference according to zygosity (MW = 2688.5, p = 0.000 <0.05) and the mean difference between MZ twin pairs (2.2 ± 2.01) is less than the average difference between DZ twin pairs (3.66 ± 2.67) (Table 5). The mean difference in mandibular arch length between twin siblings differs statistically significantly according to zygosity (MW = 3392.5, p = 0.025 <0.05) and the mean difference between MZ twin pairs (1.61 ± 1.25) is less than the average difference between DZ twin pairs (2.3 ± 1.84) (Table 5).

**Table 5. Comparison of difference between siblings according to zygocity**

| Variable (mm) | Difference Between Siblings | | | | | |
|---|---|---|---|---|---|---|
| | Zygocity | N | Mean | SD | MW | p |
| Maxillary Anterior Arch Breadth | MZ | 59 | 1.56 | 1.49 | 3343.00 | 0.018* |
| | DZ | 143 | 2.16 | 1.84 | | |
| Maxillary Posterior Arch Breadth | MZ | 59 | 1.44 | 1.48 | 2408.00 | 0.000* |
| | DZ | 143 | 2.84 | 2.15 | | |
| Maxillary Arch Perimeter | MZ | 59 | 2.24 | 1.64 | 2936.00 | 0.001* |
| | DZ | 143 | 3.74 | 3.20 | | |
| Maxillary Arch Length | MZ | 59 | 1.49 | 1.57 | 2845.00 | 0.000* |
| | DZ | 143 | 2.57 | 2.14 | | |
| Mandibular Anterior Arch Breadth | MZ | 59 | 1.36 | 1.11 | 3438.00 | 0.032* |
| | DZ | 143 | 1.93 | 1.60 | | |
| Mandibular Posterior Arch Breadth | MZ | 59 | 1.22 | 1.61 | 3055.00 | 0.002* |
| | DZ | 143 | 2.34 | 2.38 | | |
| Mandibular Arch Perimeter | MZ | 59 | 2.20 | 2.01 | 2688.50 | 0.000* |
| | DZ | 143 | 3.66 | 2.67 | | |
| Mandibular Arch Length | MZ | 59 | 1.61 | 1.25 | 3392.50 | 0.025* |
| | DZ | 143 | 2.30 | 1.84 | | |

Mann-Whitney U Test

*p≤0.05

When we evaluated the results between 1st and 2nd siblings in MZ and DZ twin groups, the arch parameter measurements were not statistically different. In the comparison of the similarities of the measurements made by the intra pairs, it was seen that the similarity between the twin siblings in all arch measurements differed according to the zygosity. It has been found that the measurement differences between MZ twin groups are less than the difference between DZ twin groups.

The analysis in DZ twins performed to evaluate the effect of poor oral habits on dental arch dimensions showed that the median mandibular arch perimeter (78.5 mm) of siblings with finger sucking was statistically significantly different and higher than the median mandibular arch perimeter (71.5 mm) of siblings without finger sucking (z=-2.243, p=0.025). In addition, it was observed that the median of mandibular arch length (24.00 mm) of siblings with finger sucking habit in DZ twins was statistically significantly different and higher than the mandibular arch length (21.50 mm) of siblings without finger sucking habit (z=-2.047, p=0.041) (Table 6).

In MZ twin pairs with mouth breathing, the median mandibular anterior arch breadth (25.00 mm) was found to be statistically significantly different and higher than the siblings without mouth breathing (24.00 mm) (z=-2.754, p=0.006). In DZ twins, it was observed that the median maxillary anterior arch breadth (31.00 mm) of siblings with mouth breathing habit was statistically significantly different and lower than the maxillary anterior arch breadth of siblings without mouth breathing habit (32.00 mm) (z=-2.348, p=0.019) (Table 7).

It was determined that the arch measurements of MZ and DZ twins did not show statistically significant difference between siblings according to atypical swallowing, nail biting and bruxism as a result of psychosocial factors (Tables 8, 9, 10). There is no statistically significant difference between the average weight and height of MZ and DZ twins at birth and the study time (Table 11).

## DISCUSSION

Twin studies comparing monozygotic (MZ) and dizygotic (DZ) twin pairs are of great importance in genetic research. MZ twins share 100% of their genes, while DZ twins share only half of their segregating genes on average. These genetic findings help to predict the status of structures in the maxillofacial region and to determine treatment limits.[20]

Although studies on the effect of genetic factors on tooth sizes are found in the literature, there are few studies regarding the effect of genetic factors on dental arch sizes. Therefore, it is not clear how much the dental arch dimensions depend on genetics and how much on the environment. To examine the effect of genetics on dental arches, this study has been studied on MZ and DZ twin pairs.

Koyoumdjisk Kaye *et al* stated that dental arch form in Kurdish children was more rounded due to significantly bigger arch width, while arch depth was not significantly different from Yementies.[21]

Harris and Smith. showed that occlusal variables such as overbite, overjet and rotations and crowding were mostly affected by environmental factors.[22]

Other studies have also shown that occlusal variations such as overbite and overjet are less affected by inheritance.[14,23]

Boraas *et al* examined the effects of the heritability on dental arch width and malocclusion and overjet and overbite showed no significant similarity within twin pairs, intercanine and intermolar arch width showed significant similarity within both MZ and DZ pairs.[24]

Richards *et al* demonstrated that genetic factors contribute more to the shape of the maxillary arch than the shape of the mandibular arch and there was no evidence of genetic factors influencing asymmetry in either maxilla or mandible.[25]

Eguchi *et al* found that heritability estimates were high for most arch breadth and lengths are exceptions being for the breadth between the mandibular anterior teeths.[3] The results of the study showed that the effects of inheritance on the breadth of the anterior dental arch are less than the effect on the posterior dental arch for mandibles.

Ling *et al.* investigated the dental arch width of the Southern Chinese and compared the datas with their study findings in different ethnic groups. According to the data analysis they stated that the arch width varies according to ethnic groups.[26]

Svalkauskiene *et al* found that the effect of genetics on dental arches is higher in the upper jaw than in the lower jaw in their study. They showed that in the upper jaw the largest genetic effect was found on the anterior arch breadth.[4]

**Table 6. Comparison of dental arch measurements between siblings according to finger sucking status**

| Zygocity | Variable (mm) | Finger sucking | N | Mean | Std. Deviation | Median | Z | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Maxillary Anterior Arch Breadth | - | 2 | 27.50 | 0.71 | 27.50 | -1.342 | 0.180 |
| | | + | 2 | 32.50 | 0.71 | 32.50 | | |
| | Maxillary Posterior Arch Breadth | - | 2 | 47.00 | 1.41 | 47.00 | -1.000 | 0.317 |
| | | + | 2 | 49.50 | 2.12 | 49.50 | | |
| | Maxillary Arch Perimeter | - | 2 | 76.00 | 4.24 | 76.00 | -1.342 | 0.180 |
| | | + | 2 | 80.00 | 0.00 | 80.00 | | |
| | Maxillary Arch Length | - | 2 | 25.50 | 0.71 | 25.50 | 0.000 | 1.000 |
| | | + | 2 | 25.50 | 0.71 | 25.50 | | |
| | Mandibular Anterior Arch Breadth | - | 2 | 25.50 | 0.71 | 25.50 | -1.000 | 0.317 |
| | | + | 2 | 25.00 | 0.00 | 25.00 | | |
| | Mandibular Posterior Arch Breadth | - | 2 | 46.00 | 1.41 | 46.00 | 0.000 | 1.000 |
| | | + | 2 | 46.00 | 1.41 | 46.00 | | |
| | Mandibular Arch Perimeter | - | 2 | 70.50 | 2.12 | 70.50 | -1.414 | 0,157 |
| | | + | 2 | 71.50 | 2.12 | 71.50 | | |
| | Mandibular Arch Length | - | 2 | 22.00 | 1.41 | 22.00 | -0.447 | 0.655 |
| | | + | 2 | 22.50 | 2.12 | 22.50 | | |
| DZ | Maxillary Anterior Arch Breadth | - | 8 | 30.88 | 3.14 | 31.50 | -0.136 | 0.892 |
| | | + | 8 | 30.75 | 2.43 | 31.00 | | |
| | Maxillary Posterior Arch Breadth | - | 8 | 48.63 | 3.81 | 48.00 | -1.270 | 0.204 |
| | | + | 8 | 50.63 | 4.27 | 52.00 | | |
| | Maxillary Arch Perimeter | - | 8 | 81.25 | 2.76 | 82.50 | -0.848 | 0.396 |
| | | + | 8 | 83.63 | 5.42 | 85.00 | | |
| | Maxillary Arch Length | - | 8 | 24.63 | 3.02 | 25.50 | -1.827 | 0.068 |
| | | + | 8 | 27.88 | 3.94 | 29.00 | | |
| | Mandibular Anterior Arch Breadth | - | 8 | 26.13 | 2.30 | 26.50 | -1.715 | 0.086 |
| | | + | 8 | 27.25 | 2.66 | 27.00 | | |
| | Mandibular Posterior Arch Breadth | - | 8 | 44.25 | 3.06 | 43.50 | -0.315 | 0.752 |
| | | + | 8 | 45.00 | 3.38 | 46.00 | | |
| | Mandibular Arch Perimeter | - | 8 | 71.50 | 3.96 | 71.50 | -2.243 | 0.025* |
| | | + | 8 | 77.13 | 4.42 | 78.50 | | |
| | Mandibular Arch Length | - | 8 | 21.63 | 2.62 | 21.50 | -2.047 | 0.041* |
| | | + | 8 | 24.88 | 1.89 | 24.00 | | |

Wilcoxon Signed Rank Test

*p value is significant at the 0.05 level.

Normando *et al* reported in their study they conducted that dental crowding was caused by variations in dental arch sizes affected by genetic factors.[27]

In the present study, unlike other studies, dental arch length and dental arch breadth as well as the dental arch perimeter were evaluated. According to the results of the study, the effect of inheritance on the dental arch length, arch perimeter, anterior-posterior dental arch breadth for maxilla and mandible was seen. While some of these results were similar to those of Eguchi *et al*, different results were found in the anterior arch width measurements of the mandible.[3,28] In their study, genetics had less effect on the anterior arch width of the mandible. This can be explained by the fact that the anterior teeth of the mandible have less resistance to functional forces due to their small roots and they can be affected more by the environmental factors.

In our study, it was observed that the anterior arch width was similar between the twin pairs and this similarity was higher in identical twins due to the effect of genetic factors. This may be due to the low incidence of atypical swallowing, nail biting, finger sucking, and mouth breathing, which are among the environmental factors seen in twin siblings. In addition, the difference in environmental factors is not affected much due to the low incidence of bruxism, which is a result of psychosocial factors, in DZ and MZ twins as low as 20%.

**Table 7. Comparison of dental arch measurements between siblings according to mouth breathing status**

| Zygocity | Variable (mm) | Mouth Breathing | N | Mean | Std. Deviation | Median | Z | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Maxillary Anterior Arch Breadth | - | 10 | 29.70 | 2.50 | 30.00 | -0.359 | 0.720 |
| | | + | 10 | 30.20 | 4.52 | 31.50 | | |
| | Maxillary Posterior Arch Breadth | - | 10 | 48.10 | 4.18 | 48.50 | -0.426 | 0.670 |
| | | + | 10 | 48.30 | 5.10 | 48.00 | | |
| | Maxillary Arch Perimeter | - | 10 | 78.30 | 5.58 | 79.00 | -0.181 | 0.856 |
| | | + | 10 | 78.40 | 5.60 | 80.00 | | |
| | Maxillary Arch Length | - | 10 | 25.90 | 2.42 | 25.50 | -0.264 | 0.792 |
| | | + | 10 | 26.00 | 2.36 | 25.50 | | |
| | Mandibular Anterior Arch Breadth | - | 10 | 24.10 | 2.60 | 24.00 | -2.754 | 0.006* |
| | | + | 10 | 25.60 | 2.41 | 25.00 | | |
| | Mandibular Posterior Arch Breadth | - | 10 | 43.30 | 4.00 | 44.00 | -0.333 | 0.739 |
| | | + | 10 | 43.80 | 3.82 | 44.00 | | |
| | Mandibular Arch Perimeter | - | 10 | 69.20 | 3.71 | 68.50 | -1.268 | 0.205 |
| | | + | 10 | 70.10 | 3.57 | 71.00 | | |
| | Mandibular Arch Length | - | 10 | 22.60 | 1.90 | 22.50 | -0.738 | 0.461 |
| | | + | 10 | 23.10 | 2.73 | 23.50 | | |
| DZ | Maxillary Anterior Arch Breadth | - | 29 | 32.24 | 2.31 | 32.00 | -2.348 | 0.019* |
| | | + | 29 | 30.83 | 2.65 | 31.00 | | |
| | Maxillary Posterior Arch Breadth | - | 29 | 49.21 | 3.41 | 50.00 | -0.539 | 0.590 |
| | | + | 29 | 48.83 | 4.23 | 48.00 | | |
| | Maxillary Arch Perimeter | - | 29 | 81.66 | 5.57 | 82.00 | -0.663 | 0.508 |
| | | + | 29 | 81.34 | 6.55 | 83.00 | | |
| | Maxillary Arch Length | - | 29 | 26.62 | 2.68 | 27.00 | -0.286 | 0.775 |
| | | + | 29 | 26.52 | 3.59 | 27.00 | | |
| | Mandibular Anterior Arch Breadth | - | 29 | 25.76 | 2.05 | 26.00 | -0.583 | 0.560 |
| | | + | 29 | 25.59 | 2.49 | 25.00 | | |
| | Mandibular Posterior Arch Breadth | - | 29 | 43.10 | 4.16 | 44.00 | -0.431 | 0.666 |
| | | + | 29 | 42.93 | 4.21 | 44.00 | | |
| | Mandibular Arch Perimeter | - | 29 | 73.10 | 6.34 | 73.00 | -0.268 | 0.789 |
| | | + | 29 | 73.24 | 6.92 | 74.00 | | |
| | Mandibular Arch Length | - | 29 | 23.17 | 2.39 | 23.00 | -0.500 | 0.617 |
| | | + | 29 | 23.14 | 2.66 | 24.00 | | |

Wilcoxon Signed Rank Test

* p value is significant at the 0.05 level.

In this study, the effects of poor oral habits from the environmental factors on dental arch measurements were also evaluated, it was observed that finger sucking and mouth breathing status created differences on dental arch dimensions in twin pairs. In MZ twins, the mandibular anterior arch breadth was found to be significantly higher in the sibling group with mouth breathing. This situation reveals that mandibular anterior arch width can be affected more by environmental factors, similar to other studies.[3,28] In DZ twins, it was observed that mouth breathing habit caused a statistically decrease on the maxillary anterior arch breadth. This situation is thought to be caused by the protrusion of the maxillary anterior teeth and a deeper palatal vault due to mouth breathing.[29]

It has been observed that finger sucking habit, one of the environmental factors, causes a decrease on the mandibular arch perimeter and length in DZ twins. This situation is thought to be caused by the maxillary´s arch constriction.[30,31] The mandibular arch perimeter and length increase due to mouth breathing are similar to the study of Petraccone Caixeta *et al*.[31]

The nutrition has a great effect on growth and development. It is stated that malnutrition may cause stagnation in growth and development, regression in jaw development and tooth eruption. Considering that this situation may also have an effect on the dimensions of the dental arch in twin pairs, the growth was evaluated in this study. In this evaluation, the weight and height at birth and at the time of the study were compared between twin

**Table 8. Comparison of dental arch measurements between siblings according to atypical swallowing status**

| Zygocity | Variable (mm) | Atypical Swallowing | N | Mean | Std. Deviation | Median | Z | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Maxillary Anterior Arch Breadth | - | 5 | 29.80 | 4.27 | 28.00 | -1.841 | 0.066 |
| | | + | 5 | 27.20 | 3.42 | 28.00 | | |
| | Maxillary Posterior Arch Breadth | - | 5 | 47.00 | 5.15 | 48.00 | 0.000 | 1.000 |
| | | + | 5 | 47.20 | 6.61 | 48.00 | | |
| | Maxillary Arch Perimeter | - | 5 | 78.00 | 6.20 | 80.00 | -0.378 | 0.705 |
| | | + | 5 | 78.00 | 7.58 | 79.00 | | |
| | Maxillary Arch Length | - | 5 | 26.40 | 3.21 | 26.00 | -0.577 | 0.564 |
| | | + | 5 | 26.20 | 2.86 | 26.00 | | |
| | Mandibular Anterior Arch Breadth | - | 5 | 25.20 | 4.21 | 25.00 | -1.134 | 0.257 |
| | | + | 5 | 25.80 | 3.35 | 25.00 | | |
| | Mandibular Posterior Arch Breadth | - | 5 | 43.00 | 5.15 | 45.00 | -1.000 | 0.317 |
| | | + | 5 | 43.40 | 4.83 | 45.00 | | |
| | Mandibular Arch Perimeter | - | 5 | 70.40 | 5.18 | 73.00 | 0.000 | 1.000 |
| | | + | 5 | 70.40 | 5.18 | 72.00 | | |
| | Mandibular Arch Length | - | 5 | 22.40 | 1.82 | 23.00 | -1.089 | 0.276 |
| | | + | 5 | 21.40 | 1.67 | 21.00 | | |
| DZ | Maxillary Anterior Arch Breadth | - | 9 | 31.11 | 3.89 | 33.00 | -0.060 | 0.952 |
| | | + | 9 | 31.22 | 3.93 | 31.00 | | |
| | Maxillary Posterior Arch Breadth | - | 9 | 47.89 | 3.30 | 48.00 | -0.709 | 0.478 |
| | | + | 9 | 48.11 | 5.21 | 49.00 | | |
| | Maxillary Arch Perimeter | - | 9 | 77.33 | 6.58 | 77.00 | -1.820 | 0.069 |
| | | + | 9 | 82.67 | 6.89 | 84.00 | | |
| | Maxillary Arch Length | - | 9 | 24.89 | 2.76 | 25.00 | -1.546 | 0.122 |
| | | + | 9 | 27.11 | 4.14 | 27.00 | | |
| | Mandibular Anterior Arch Breadth | - | 9 | 25.22 | 2.44 | 25.00 | -1.035 | 0.301 |
| | | + | 9 | 25.78 | 2.59 | 25.00 | | |
| | Mandibular Posterior Arch Breadth | - | 9 | 42.89 | 4.14 | 43.00 | -0.405 | 0.686 |
| | | + | 9 | 42.11 | 5.53 | 43.00 | | |
| | Mandibular Arch Perimeter | - | 9 | 70.22 | 6.06 | 70.00 | -1.334 | 0.182 |
| | | + | 9 | 72.22 | 7.34 | 70.00 | | |
| | Mandibular Arch Length | - | 9 | 21.67 | 2.40 | 22.00 | -1.251 | 0.211 |
| | | + | 9 | 23.00 | 2.83 | 22.00 | | |

Wilcoxon Signed Rank Test

*p value is significant at the 0.05 level.

pairs. However, no statistically significant difference was found between twin pairs.[32]

## CONCLUSION

Twin research has made a contribution understanding maxillary and mandibular arch development in children. In this study, there were very less significant differences between twin pairs in the parameters assessed. The similarity in their environmental factors has led to the similarity in their arch parameters. The results confirm a possible role of genetic factors in arch parameters.

## Declaration of interest

The authors reported that they had no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

## Acknowledgements

The research reported in this paper was supported by the Scientific and Technological Research Council of Turkey (TUBITAK) under grant no: 214S284.

**Table 9. Comparison of dental arch measurements between siblings according to nail biting status**

| Zygocity | Variable (mm) | Nail Biting | N | Mean | Std. Deviation | Median | Test Value | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Maxillary Anterior Arch Breadth | - | 12 | 30.08 | 2.15 | 31.00 | -1.350[a] | 0.177 |
| | | + | 12 | 31.25 | 2.60 | 31.50 | | |
| | Maxillary Posterior Arch Breadth | - | 12 | 48.42 | 2.64 | 48.50 | -0.303[a] | 0.762 |
| | | + | 12 | 48.75 | 2.70 | 48.50 | | |
| | Maxillary Arch Perimeter | - | 12 | 78.33 | 5.07 | 80.00 | -0.719[a] | 0.472 |
| | | + | 12 | 79.08 | 3.65 | 80.00 | | |
| | Maxillary Arch Length | - | 12 | 25.92 | 2.68 | 26.00 | -0.784[a] | 0.433 |
| | | + | 12 | 26.25 | 2.34 | 26.00 | | |
| | Mandibular Anterior Arch Breadth | - | 12 | 25.25 | 2.45 | 25.00 | -0.426[a] | 0.670 |
| | | + | 12 | 25.42 | 1.93 | 25.00 | | |
| | Mandibular Posterior Arch Breadth | - | 12 | 43.75 | 1.82 | 44.00 | -0.447[a] | 0.655 |
| | | + | 12 | 43.67 | 1.87 | 43.50 | | |
| | Mandibular Arch Perimeter | - | 12 | 69.58 | 4.50 | 70.50 | -1.189[a] | 0.234 |
| | | + | 12 | 70.67 | 2.35 | 70.50 | | |
| | Mandibular Arch Length | - | 12 | 22.25 | 2.42 | 23.00 | -0.563[a] | 0.574 |
| | | + | 12 | 22.58 | 1.56 | 23.00 | | |
| DZ | Maxillary Anterior Arch Breadth | - | 38 | 31.76 | 3.04 | 32.00 | 0.204[b] | 0.839 |
| | | + | 38 | 31.66 | 3.59 | 32.00 | | |
| | Maxillary Posterior Arch Breadth | - | 38 | 48.74 | 4.38 | 49.00 | -0.546[b] | 0.588 |
| | | + | 38 | 49.05 | 3.51 | 48.50 | | |
| | Maxillary Arch Perimeter | - | 38 | 80.61 | 5.78 | 80.50 | 0.486[b] | 0.630 |
| | | + | 38 | 80.16 | 6.28 | 80.00 | | |
| | Maxillary Arch Length | - | 38 | 25.66 | 3.16 | 26.00 | 0.982[b] | 0.333 |
| | | + | 38 | 25.18 | 2.43 | 25.00 | | |
| | Mandibular Anterior Arch Breadth | - | 38 | 26.03 | 2.80 | 26.00 | -0.681[b] | 0.500 |
| | | + | 38 | 26.34 | 2.65 | 26.00 | | |
| | Mandibular Posterior Arch Breadth | - | 38 | 44.05 | 3.80 | 44.00 | -0.097[a] | 0.923 |
| | | + | 38 | 43.97 | 3.61 | 44.00 | | |
| | Mandibular Arch Perimeter | - | 38 | 71.79 | 6.96 | 71.50 | -1.313[b] | 0.197 |
| | | + | 38 | 72.84 | 6.49 | 73.00 | | |
| | Mandibular Arch Length | - | 38 | 22.84 | 2.89 | 23.00 | 0.773[b] | 0.444 |
| | | + | 38 | 22.42 | 3.05 | 22.50 | | |

a. Wilcoxon Signed Rank Test

b. Paired-Samples T Test

* p value is significant at the 0.05 level.

**Table 10. Comparison of dental arch measurements between siblings according to bruxism status**

| Zygocity | Variable (mm) | Bruxism | N | Mean | Std. Deviation | Median | Z | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Maxillary Anterior Arch Breadth | - | 12 | 31.75 | 3.980 | 32.50 | -0.772 | 0.440 |
| | | + | 12 | 31.17 | 3.512 | 31.50 | | |
| | Maxillary Posterior Arch Breadth | - | 12 | 47.83 | 5.702 | 48.50 | -0.840 | 0.401 |
| | | + | 12 | 47.33 | 4.519 | 48.00 | | |
| | Maxillary Arch Perimeter | - | 12 | 78.00 | 5.240 | 78.00 | -0.051 | 0.959 |
| | | + | 12 | 77.67 | 5.710 | 77.00 | | |
| | Maxillary Arch Length | - | 12 | 25.42 | 2.843 | 25.00 | -0.791 | 0.429 |
| | | + | 12 | 25.75 | 2.006 | 26.00 | | |

| Zygocity | Variable (mm) | Bruxism | N | Mean | Std. Deviation | Median | Z | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Mandibular Anterior Arch Breadth | - | 12 | 25.42 | 2.275 | 25.00 | -0.136 | 0.891 |
| | | + | 12 | 25.42 | 2.575 | 25.50 | | |
| | Mandibular Posterior Arch Breadth | - | 12 | 43.83 | 3.996 | 44.00 | 0.000 | 1.000 |
| | | + | 12 | 43.83 | 4.196 | 45.00 | | |
| | Mandibular Arch Perimeter | - | 12 | 69.42 | 4.188 | 70.00 | -0.829 | 0.407 |
| | | + | 12 | 70.25 | 3.745 | 69.50 | | |
| | Mandibular Arch Length | - | 12 | 21.00 | 1.954 | 21.50 | -1.393 | 0.164 |
| | | + | 12 | 22.00 | 1.414 | 22.00 | | |
| | Maxillary Anterior Arch Breadth | - | 29 | 31.17 | 3.095 | 31.00 | -0.924 | 0.356 |
| | | + | 29 | 31.55 | 2.759 | 32.00 | | |
| | Maxillary Posterior Arch Breadth | - | 29 | 48.72 | 4.788 | 49.00 | -0.183 | 0.855 |
| | | + | 29 | 49.14 | 4.223 | 49.00 | | |
| | Maxillary Arch Perimeter | - | 29 | 82.90 | 5.722 | 83.00 | -0.783 | 0.433 |
| | | + | 29 | 83.38 | 5.803 | 84.00 | | |
| | Maxillary Arch Length | - | 29 | 25.69 | 2.579 | 26.00 | -1.099 | 0.272 |
| | | + | 29 | 26.41 | 3.246 | 27.00 | | |
| DZ | Mandibular Anterior Arch Breadth | - | 29 | 26.38 | 3.110 | 26.00 | -0.244 | 0.807 |
| | | + | 29 | 26.55 | 2.369 | 27.00 | | |
| | Mandibular Posterior Arch Breadth | - | 29 | 43.59 | 3.978 | 44.00 | -1.249 | 0.212 |
| | | + | 29 | 44.07 | 3,981 | 45.00 | | |
| | Mandibular Arch Perimeter | - | 29 | 74.21 | 5.164 | 73.00 | -1.409 | 0.159 |
| | | + | 29 | 75.72 | 5.958 | 76.00 | | |
| | Mandibular Arch Length | - | 29 | 23.24 | 2.029 | 23.00 | -0.038 | 0.969 |
| | | + | 29 | 23.41 | 2.745 | 23.00 | | |

Wilcoxon Signed Rank Test

*p value is significant at the 0.05 level.

**Table 11. Comparison of height and weight average between siblings**

| Zygocity | Variable | Twin pairs | N | Mean | Std. Deviation | Median | Test Value | p |
|---|---|---|---|---|---|---|---|---|
| MZ | Birth weight (g) | *1st siblings* | 59 | 2356.27 | 600.54 | 2400.00 | 1.146 a | 0.256 |
| | | *2nd siblings* | 59 | 2298.98 | 673.58 | 2300.00 | | |
| | Birth height (cm) | *1st siblings* | 59 | 46.08 | 4.81 | 47.00 | -0.043 b | 0.965 |
| | | *2nd siblings* | 59 | 46.01 | 4.89 | 47.00 | | |
| | Current weight (kg) | *1st siblings* | 59 | 54.30 | 103.53 | 30.00 | -1.475 b | 0.140 |
| | | *2nd siblings* | 59 | 51.82 | 89.52 | 31.80 | | |
| | Current height (cm) | *1st siblings* | 59 | 157.33 | 192.37 | 136.90 | -0.247 b | 0.805 |
| | | *2nd siblings* | 59 | 134.78 | 16.14 | 136.00 | | |
| DZ | Birth weight (g) | *1st siblings* | 143 | 2272.99 | 579.43 | 2300.00 | 0.321 a | 0.749 |
| | | *2nd siblings* | 143 | 2263.31 | 574.38 | 2250.00 | | |
| | Birth height (cm) | *1st siblings* | 143 | 46.97 | 4.36 | 48.00 | -1.607 b | 0.108 |
| | | *2nd siblings* | 143 | 46.78 | 4.42 | 48.00 | | |
| | Current weight (kg) | *1st siblings* | 143 | 42.33 | 60.22 | 31.00 | -1.019 b | 0.308 |
| | | *2nd siblings* | 143 | 40.95 | 49.48 | 31.00 | | |
| | Current height (cm) | *1st siblings* | 143 | 147.37 | 129.60 | 133.00 | -0.971 b | 0.331 |
| | | *2nd siblings* | 143 | 148.96 | 132.06 | 133.00 | | |

a. Paired-Samples T Test

b. Wilcoxon Signed Rank Test

*p value is significant at the 0.05 level.

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