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Determinant factors of Yemeni maxillary arch dimensions

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Abstract *Objective:* Information about maxillary arch and palatal dimensions in human populations is important for clinical orthodontics. This study was conducted to assess the determinants of maxillary arch dimensions in a sample of Yemeni individuals aged 18–25 years.

Materials and Methods: The study sample comprised 214/765 adults (101 women, 113 men) who underwent clinical examination and fulfilled the study criteria. Study models were constructed and evaluated to measure maxillary arch and palatal dimensions.

Results: The majority of mean maxillary arch dimensions were significantly greater in men than in women, with inter–second molar distance showing the greatest difference and palatal depth showing the least difference.

Conclusion: Measurements of palatal depth and relationships of the canines to one another and to other teeth thus had the widest ranges, implying that these dimensions are the strongest determinants of maxillary arch size.

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1. Introduction

Dental arch size and form vary among individuals according to tooth size and position, craniofacial growth pattern, and several genetic and environmental factors (Ferrario et al., 1994; Harris and Smith, 1982).

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A survey of dental arch size and form could aid clinicians' selection of stock trays, artificial tooth sizes, and artificial dental arches used as wax mock-ups and modified by dental surgeons and orthodontists (Knott, 1961; Mack, 1981).

Given its morphology and position, the palate is a key anatomical structure determining skeletal patterns. The palate can be affected by orthodontic treatment (Harris and Smith, 1982).

As orthodontics has advanced as a specialty, increasing numbers of adults seek orthodontic care. Thus, an understanding of the changes that normally occur in adult craniofacial structures is critical (Bishara et al., 1989).

Orthodontic practice and education remain relatively new in Yemen. A systematic and well-organized dental care program for any target population requires basic information, such as the prevalence of dental conditions. In the more

developed parts of the world, where orthodontics has been established, adequate baseline information is available (Barrow and White, 1952; Bishara et al., 1997, 1998; Buschang et al., 1994; Lavelle et al., 1971; Mills, 1964; Raberin et al., 1993; Warren and Bishara, 2001).

Despite efforts in recent decades to make health systems more equitable in the Arab world (Al-Khateeb and Abu Alhaija, 2006; Diwan and Elahi, 1990; Eid et al., 1987; Ismail et al., 1996; Younes, 1984), access to dental health care remains far from adequate, especially in poor communities.

No previous study has examined maxillary arch or palate dimensions in the Yemeni population. Thus, this study was conducted to provide baseline data on these dimensions in Yemeni adults aged 18–25 years.

2. Materials and methods

The Ethics Committee of the Faculty of Dentistry, University of Sana'a, Yemen, approved this study. The study design and purpose were explained to all potential participants, who provided consent prior to participation.

The study sample comprised 214 adults (113 men, 101 women) aged 18–25 years selected from a population of 765 Yemeni adults (387 men, 378 women) who had undergone clinical examination. Eligible subjects met the following criteria:

1. complete permanent dentition (excluding third molars)
2. class I molar and canine occlusion (Angle, 1889; Houston et al., 1996)
3. class I skeletal relationship, determined visually using the two-finger technique (Mills, 1987)
4. absence of local factors that compromised dental arch integrity (e.g., congenitally absent teeth, deciduous tooth retention, supernumerary teeth)
5. normally shaped teeth
6. normal vertical and horizontal dental relationships (no overjet or overbite)
7. absence of large fillings that may affect dental arch size and form
8. no previous orthodontic, orthopedic, or facial surgical treatment
9. well-aligned arches with < 3 mm space and no crowding (Staley et al., 1985)
10. no history of bad oral habits, such as thumb sucking or mouth breathing.

All individuals were examined under natural light with interchangeable plane mouth mirrors. During examinations, each individual was seated on an ordinary chair with the head positioned so that the Frankfort horizontal plane was parallel to the floor.

Selected individuals underwent thorough clinical examination to ensure fulfillment of the inclusion criteria.

Certain tooth-related points visible in occlusal view were marked bilaterally with a sharp pencil on maxillary study casts to facilitate the identification of landmarks used to measure dental arch dimensions. Great care was taken to ensure that the landmarks were located accurately on the study casts.

Measurements were recorded on 214 maxillary casts made of dental stone, with bases made of plaster of Paris. The bases were trimmed as in orthodontics and numbered to correspond

to study subjects. Dental arch dimensions and palatal length and width were measured using a modified sliding caliper gauge (accurate to 0.02 mm). Palatal depth was measured using a palatometer.

2.1. Landmarks

The following landmarks were used:

1. incisal point: the point midway between the incisal edges of the two central incisors (Younes, 1984)
2. canine cusp tips: the cusp tips of the right and left permanent canines (Staley et al., 1985)
3. premolar cusp tips: the buccal cusp tips of the right and left second premolars (Bishara et al., 1989)
4. mesiobuccal first molar cusp tips: the mesiobuccal cusp tips of the right and left permanent first molars (Kuntz, 1993)
5. mesiolingual first molar cusp tips: the mesiolingual cusp tips of the right and left permanent first molars (Ghafari et al., 1994)
6. distobuccal second molar cusp tips: the distobuccal cusp tips of the right and left permanent second molars (Raberin et al., 1993).

2.2. Maxillary arch width (Fig. 1)

1. intercanine distance: the linear distance between canine cusp tips
2. interpremolar distance: the linear distance between the buccal cusp tips of the second premolars
3. inter–first molar distance: the distance between the mesiobuccal cusp tips of the first molars
4. inter–second molar distance: the distance between the distobuccal cusp tips of the second molars.

2.3. Maxillary arch length (Fig. 2)

1. anterior arch length: the vertical distance from the incisal point to the intercanine distance line
2. molar-vertical distance: the vertical distance from the incisal point perpendicular to a line between the mesiolingual cusp tips of the first molars
3. total arch length: the vertical distance from the incisal point to the midpoint of a line between the distobuccal cusp tips of the second molars.
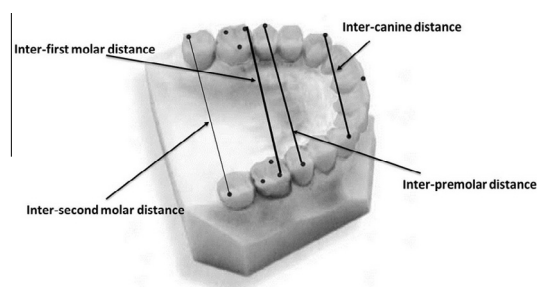

Figure 1 Maxillary arch width.