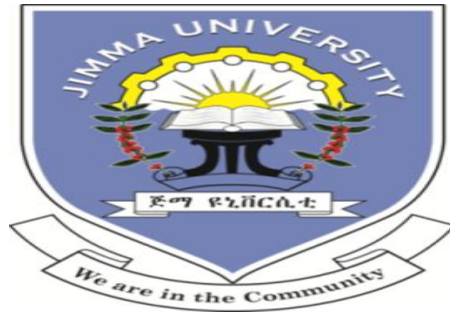


ASSESSMENT OF ARCH WIDTH AND FORM IN NORMAL OCCLUSION  
AMONG 15-30 YEARS OLD JIMMA OROMO POPULATION,2018.



BY: - DEREJE WORKU (ORTHO RESIDENT)

A RESEARCH PAPER TO BE SUBMITTED TO COLLEGE OF PUBLIC HEALTH  
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OCTOBER, 2018  
JIMMA, ETHIOPIA

JIMMA UNIVERSITY COLLEGE OF PUBLIC HEALTH AND MEDICAL  
SCIENCE DEPARTMENT OF DENTISTRY

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## **ABSTRACT**

**BACKGROUND:** Dental arch dimensions, including dental arch width, length, and form, are important value for the diagnosis, treatment, planning, and treatment outcomes concerning patients who are seeking orthodontic treatment in all age groups. Different ethnic groups and populations display variable dental arch measurements and characteristics. It is well-known that dental arch dimensions continue changing throughout growth and development, but during adulthood, the changes decrease. Arch form is the position and relationship of teeth to each other in all three dimensions; dental arches are roughly categorized as square, ovoid, and tapered. These arch forms can also be expressed as narrow, average and wide.

**OBJECTIVES:**assessment of arch width and form in normal occlusion among 15-30 years old jimmaoromo population, 2018.

**METHODS:** A crosssectional study design with convenient sampling was conducted from October 20 to November 10, 2018, The data was collected using interview guide structured questioners, clinical examination, dental impression was taken by alginate impression material and poured to by dental stone to form dental stone vernier caliper was used to measure parameters . The obtained data was coded, compiled and entered into a computer, and analyzed with the SPSS software package ( SPSS 22.0). mean, SD, T- test and chi square were used to analyze results

**RESULT AND DISCUSSION:**Ovoid arch form is the most frequent arch form in both arches 29 (58%) for upper and 35(70%) lower. Square arch form is not found in female; male has higher in square and ovoid . The mean of ICW, IMW,IPW, and CR is more in both arches and more in male than in female . CD of female is more frequent than male in both arches and MR and MD shows no deference among gender in their frequency . In all parameters except CR upper mean value is greater than lower counter parameters.

**Conclusion and recommendation:** Ovoid is the most common arch form in jimmaoromo with normal occlusion and the mean value of arch width;Canine depth is higher in male in both arches and the mean value of female shows higher canine ratio.Ovoid arch form is more frequent among female in mandible. The clinician should select the appropriate preformed arch wire form based on the patient's arch form and ovoid arch wires should be the shape of choice. Further large scale studies are needed to compare dental arch form between angle classification of malocclusion and different ethnic groups.

**KEY WORDS:** arch width, arch form

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## TABLE OF CONTENT

Abstract-----	I
Acknowledgment-----	II
Table of content-----	III
List of table-----	IV
Acronyms-----	V
CHAPTER ONE	
1.1 Background-----	1
1.2 Statement of the problem-----	4
1.3 Significant of study-----	6
CHAPTER TWO	
2.1 literature review-----	7
CHAPTER THREE	
Objectives of study	
3.1 General objective-----	11
3.2 Specific objective-----	11
CHAPTER FOUR	
Methods and Material	
4.1 Study area and period-----	12

4.2 Study design-----	12
4.3. Population	
4.3.1 Source population-----	12
4.3.2 Study population-----	12
4.4 Inclusion and exclusion criteria	
4.4.1 Inclusion criteria -----	12
4.4.2 Exclusion criteria-----	13
4.5 Sample size determination and sampling techniques	
4.5.1 Sample size determination-----	13
4.5.2 Sampling technique-----	13
4.6 Data collection tools and techniques	
4.6.1 Data collection tools-----	13
4.6.2 Data collection techniques-----	13
4.7 Variables	
4.7.1 Dependent variable-----	14
4.7.2 Independent variable-----	14
4.8 Data processing and analysis-----	14
4.9 Data quality control-----	14
4.10 Ethical consideration-----	14
4.11 Dissemination plan-----	15
4.12 Operational definition-----	15

CHAPTER FIVE	
RESULT-----	17
CHAPTER SIX	
DISCUSSION-----	21
CHAPTER SEVEN	
CONCLUSION AND RECOMMENDATION-----	24
Annex 1	
References-----	25

## **LIST OF TABLES**

Table 1 Demographic distribution of respondents.....	17
Table 2. Distribution of Upper and lower dental arch form by gender and arches.....	17
Table 3 . Mean arch width parameters distribution among arches and gender.....	18
Table 4. Distribution of mean in arch width parameter among upper arch form.....	19
Table 5. Distribution of mean and standard deviation in arch width parameter among lower arch form.....	20



## **ACRONYMS**

CD - canine depth

CWDR- canine width depth ratio

ICW - Intercanine width

IMW- Intermolar width

JUSRP-Jimma university student research program

MD- Molar depth

MWDR-Molar width depth ratio

NO- Normal occlusion

SD- Standard deviation

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 BACK GROUND**

The dental arch form evaluation has become an important part of the orthodontic treatment planning. In fact, the study of dental arches is of great relevance to orthodontists and the right choice of orthodontic wires may increase the efficacy of tooth movement leading to a more stable and natural dentition and decreasing the probability of dental relapse at the end of the orthodontic treatment

Dental arch dimensions, including dental arch width, length, and form, are important values for the diagnosis, treatment, planning, and treatment outcomes concerning patients who are seeking orthodontic treatment in all age groups<sup>1</sup>. Different ethnic groups and populations display variable dental arch measurements and characteristics<sup>2</sup>. It is well-known that dental arch dimensions continue changing throughout growth and development, but during adulthood, the changes decrease<sup>1</sup>. This explains why many researchers were interested in investigating the changes in dental arch dimensions during each stage of growth and development<sup>1-7</sup>. It is well documented in the literature that using preformed arch wires for orthodontic patients, regardless of their arch form, will lead to post-treatment instabilities in the form of relapse<sup>8</sup>. Accordingly, there have to be shifts from using preformed arch wires routinely for all patients to selecting specific arch wires for individual patients, depending on his or her arch form and malocclusion adaptability.

Deficiency in the maxillary arch width leads to constriction of maxilla, and it is considered to be one of the most common skeletal problems in the craniofacial region<sup>8</sup>. Diagnosing a case of transverse deficiency is subjected to debate among orthodontists, as there is no one agreed on a set of diagnostic criteria available. Traditional diagnostic techniques such as transpalatal tooth-to-tooth measurement, posteroanterior film measurement, and posterior crossbite visual assessment have been applied to identify transverse deficiency cases.

Dental arch dimensions have been observed to vary with both age and gender. With respect to age, the dental arch dimensions change a lot during the periods of intense growth as is seen in

childhood and the teenage years only to lessen during adulthood<sup>14-17</sup>. Decrease with age in the upper and lower inter-canine distance<sup>14</sup>. The observations in these periods of mixed dentition are the result of tooth movement and growth of the supporting bone<sup>18</sup>. The growth and development of dental arch dimensions also differ with respect to gender. Bishara found that above age 25 years, upper and lower inter-canine distance increases in females and only lower inter canine distance increase in males<sup>15</sup>. The differences in dental arch dimensions are influenced by different factors, the most important of which is the genetic component<sup>15</sup>.

The Ugandan population is made up of a large diversity of ethnic groupings exposed to various challenges, like the high prevalence of malnutrition; as such one would expect a set of unique dental arch dimension measurements<sup>19</sup>. The uniqueness of these measurements when compared with those from other populations could be attributed to differences in environment, nutrition, systemic health and individual variations

The transverse dimension of maxilla is determined by anterior arch width measured through intercanine distance and posterior arch width through intermolar distance. Some authors<sup>20-21</sup> Have also used interpremolar distance to assess the transverse dimension of maxilla. Arch width is one of the parameters in deciding the arch form, which plays a key role in creating the optimum esthetics, functional occlusion, stability, and well-finished results from an orthodontist's point of view. Broad arches are implicated in having stable, well-balanced, functional occlusion. Hence, there is a need for a delineation of broad or normal arches from narrow or deficient arches based on arch width.

In the clinical dentistry studies on dental arches have been conducted directly or indirectly. Direct methods involved measurements. Various landmarks have been described and discussed by different investigators, but universal agreement on how dental arch width should be determined has not been reached. Most studies used the dimension of the arch across the permanent canines, pre- molars, and first molars, at the cusp tips, central fossae, or contact points, or the greatest distance between buccal surfaces.<sup>22,23,24</sup>. Dental arch widths between contralateral teeth have been measured in many ways: between the most labial points or the most palatal or lingual points , or as a calculated mean between the most labial and palatal measurements

Arch form is the position and relationship of teeth to each other in all three dimensions. Over the years, human dental arch form has been recognized to be variable in shape and size. It is described by many authors in geometric forms (ellipse parabolic curve and hyperbolic) and mathematical functions. Well-aligned dental arches are roughly categorized as square, ovoid, and tapered. These arch forms can also be expressed as narrow, normal and wide. Generally, the ovoid dental form is the most commonly used in orthodontic practice, followed by the tapered form while the square dental shape is the rarest<sup>25</sup>. Furthermore, it was stated that a unique arch form cannot provide the best solution for an entire ethnic sample as different dental parameters should be considered; in particular, the main clinical factors that affect the dental arch dimensions are arch depth cross-arch width and dental perimeter .<sup>26</sup>

To describe the arch form, the  $(Wc/Wm)/(Dc/Dm)$  ratio is important to identify the different types of arch form based on how it deviates from mean accordingly. When this ratio was within a mean of  $\pm 1$  SD, they assumed (or labeled) the arch form as ovoid; if it was more than  $+1$  SD, it is square; and if it was less than  $-1$  SD, it is tapered.

The arch shape consists of two different areas: the anterior curvature and intercanine width and the posterior curvature and intermolar width. A preformed arch wire can be customized for each patient adjusting the anterior and posterior curvatures, if necessary. Also Angle Class represents an important factor that may influence the dental arch shape and it was observed that Class III patients have the most detectable arch form while Class I patients showed the least detectable arch shape<sup>25</sup>. Concerning the sex differences on average, males have higher arch dimensions than females.<sup>27</sup>

## 1.2 STATEMENT OF THE PROBLEM

The original arch form for straight wire appliance was determined based on the mean dental arch form of orthodontically untreated normal occlusal samples of US population. Most of the orthodontic arch wires are designed in the USA and have been distributed all over the world without much research therefore education in the biological diversity of our patients and reasonable technical training for arch wire fabrication and adjustment are still essential in advanced orthodontic programs

Generally ovoid arches are the most chosen for orthodontic treatment; however tapered archwires are recommended for orthodontic subjects with narrow arch forms and gingival recession and after extraction of premolars in patients with crowding, while square arches are recommended for maintaining the width after upper maxillary expansion As there are morphological differences between different races, ethnically matched prefabricated archwire should be selected, even with the modern multibrackets appliances.

Italian population 45% of ovoid forms and 46.7% of tapered forms in white Angle Class I individuals. comparing dental arch shapes between North American white population and a Korean sample, observed that the dental square form was the rarest in the first, and the latter had a tendency to be larger and deeper than the white arches. compared the mandibular arch shapes of Japanese and Caucasian population and stated that in the Caucasian Angle Class I subjects, ovoid and tapered arch forms were almost equally distributed, accounting for more than 90% of the study population, while in Angle Class II dental arches the tapered form was the most frequent and in Angle Class III the three arch forms showed a similar distribution.

The majority of the previous studies showed that the commercially available dental arch wires were different from the average configuration of the ideal natural occlusion of dental arch shapes representative of the Caucasian population, and found that none of the commercial orthodontic wires examined in their study faithfully represented the shape of the natural occlusion<sup>25</sup>. on the dental arch shapes of Italian adolescents with an ideal occlusion the shape and dimension of the dental arches of African origin and Caucasian subjects were compared and significant differences between the two ethnic

Dental arch dimensions are used in dentistry to guide the provision of accurate orthodontic diagnosis, and in forensic medicine to aid the identification of human remains. Observations from literature show that different human ethnic groups display unique dental arch characteristics and measurements. Caucasian and Japanese mandibular arch forms revealed Caucasians to have smaller inter-canine width and inter-molar width in all three Angles mal-occlusion classes.

Well-aligned dental arches are roughly categorized as square, ovoid, and tapered. These arch forms can also be expressed as narrow, normal and wide. Especially when determining the arch wire forms to be used at the initial phase of treatment, making a choice between these three forms would be better than using a single arch form. Due to this cause, the most convenient arch form type, according to patient's ethnical origin and malocclusion, should be chosen for preformed superelastic arch wires in leveling.

Improper arch wire changes can result in periodontal breakdown, recurrence of crowding of buccal segments, or increased crowding of labial segments particularly when inter-canine width and inter-molar width have been expanded.

There is no published study on assessment of dental arch dimension among specific ethnic group in Ethiopia. There has been no study to determine the dental arch dimensions of the Oromo ethnic group. The aim of the current study therefore was to assess dental arch form and width among Oromo ethnic group.

### **1.3 SIGNIFICANCE OF STUDY**

- provide benchmark in arch width and form in Jimma Oromo
- Provides a benchmark for achieving proportionate arch widths after treatment
- It helps in identifying cases requiring arch expansion by differentiating normal and deficient arches

## **CHAPTER TWO**

### **LITERATURE REVIEW**

Most of the studies identified three main arch form shapes: tapered, ovoid and square. Generally, the ovoid dental form is the most commonly used in orthodontic practice (45% of individuals), followed by the tapered form (40%) while the square dental shape is the rarest (15%) Furthermore, it was stated that a unique arc form cannot provide the best solution for an entire ethnic sample as different dental parameters should be considered; in particular, the main clinical factors that affect the dental arch dimensions are arch depth cross-arch width and dental perimeter<sup>26</sup>

In study done on comparison of arch form and width among Israeli and white north America the Israeli arch is wider and shows significantly lower values of both canine and molar depths, compare with the North American sample. This results in significantly higher canine and molar WD ratio arch forms (square, ovoid, and tapered), the most frequent mandibular arch form of the Israeli group was ovoid rather than tapered as in the North American white group<sup>29</sup>

In another research done in comparison of north white American and Israeli population arch form and width among sample of 134 Israeli out of which 40 is normal occlusion and 160 north America out of which 60 is normal occlusion the result arch form among class white north American is square 8.3%, ovoid 45%, tapered arch form 46.7% and arch width in millimeter Intercanine width 29, Intermolar width 49.4, Canine depth 6.3, Molar depth 26.7, Canine W/D ratio 4.7, molar W/D ratio 1.85. In Israeli population arch form is square 20%, ovoid 45% and tapered 35% and arch width in millimeter is Intercanine width 29.37; Intermolar width 49.71; Canine depth 4.46; Molar depth, 24.66 Canine W/D ratio 6.96 and molar W/D ratio 2.03<sup>29</sup>

In another study done on comparison of arch form and width among Turkish and north America The Turkish group showed significantly smaller molar depth and bigger molar W/D ratio and arch form in Turkish samples Square 8.3% Ovoid 45% Tapered 46.7% and in north America square 23.5% ovoid 47% Tapered 29.4%<sup>30</sup>



In research done in comparison of white American Turkish population arch form and width among sample of 132 Turkish out of which 34 is normal occlusion and 160 north America out of which 50 is class I the result arch form among class north American is square 8.3%, ovoid 45%, tapered arch form 46.7% and arch width in millimeter Intercanine width 29.01, Intermolar width 49.17, Canine depth 6.3, Molar depth 26.84, Canine W/D ratio 4.68, molar W/D ratio 1.84. in Turkish population arch form is square 23.5%, ovoid 47.1% and tapered 29.4% and arch width in millimeter is Intercanine width 28.96; Intermolar width 48.97; Canine depth 6.33; Molar depth, 25.63 Canine W/D ratio 4.59 and molar W/D ratio 1.97<sup>31</sup>

Study done in Italy shows maxillary arch, square form was the less frequent in the sample; a high statistically significant difference ( $p: 0.001$ ;  $p < 0.01$ ) was observed both in comparison to ovoid (OR: 0.13; CI: 0.06-0.28) and tapered forms (OR 0.15; CI: 0.07-0.31), while no statistically significant difference ( $p: 0.68$ ;  $p > 0.05$ ) was found between the ovoid and the tapered arch forms. Also in the lower arch, it was observed that square form was the less frequent in adolescents (OR: 0.24 CI: 0.12-0.46) ( $p: 0.001$ ;  $p < 0.01$ ). The same percentage of ovoid and tapered forms was recorded, and no significant difference was found between these two dental shapes ( $p: 1$ ;  $p > 0.05$ ). and no difference among sex in their arch form<sup>32</sup>

Statistically significant differences were recorded between males and females ( $p < 0.05$ ). As regards the maxillary dental arch, males showed a higher intercanine width ( $p: 0.0002$ ), intermolar width ( $p < 0.001$ ), canine depth ( $p: 0.04$ ) and molar depth ( $p: 0.02$ ) in comparison to the females. Instead, no significant difference observed as regards canine ratio ( $p: 0.2$ ) and molar ratio ( $p: 1$ ) Similar results were found also in the lower dental arch. In fact, boys exhibited a higher intercanine width ( $p: 0.01$ ;  $p < 0.05$ ), intermolar width ( $p: 0.008$ ;  $p < 0.01$ ) and molar depth ( $p: 0.03$ ;  $p < 0.05$ ) in comparison to the girls. Instead, no significant difference ( $p > 0.05$ ) was recorded as regards canine ratio ( $p: 0.61$ ), molar ratio ( $p: 1$ ) and canine depth ( $p: 0.08$ ).<sup>32</sup>

Study done to compare arch form and dimension in various malocclusion among Indian population of 154 subject out of which 40 is class I normal dental occlusion subject were involved, among class I samples, arch width in millimeter for maxilla Intercanine width 35.5, Intermolar width 52.2, alveolar width at first molar 58.5 and for mandible inter canine width in

millimeter 26.6, intermolar width 50.7, alveolar width at first molar area 55.6 and inter arch difference intercanine 8.9, difference intermolar 1.9, difference and alveolar difference 2.9<sup>33</sup>

In study done to compare arch form and dimension in various malocclusion among Turkish population of 600 subject out of which 200 is class I normal dental occlusion subject were involved, among class I samples, the tapered arch form showed the highest frequency as 67.5% whereas ovoid and square arch forms were less frequent tapered arch male 36%, ovoid 28%, square 53% and female tapered 63.7%, ovoid, 72%, square 46.4%<sup>30,31</sup>

The majority of the previous studies showed that the commercially available dental arch wires were different from the average configuration of the ideal natural occlusion. Identified the dental arch shapes representative of the Caucasian population and found that none of the commercial orthodontic wires examined in their study faithfully represented the shape of the natural occlusion. In literature few studied focus on the dental arch shapes of Italian adolescents with an ideal occlusion. In a recent study, the shape and dimension of the dental arches of 29 subjects of Africa origin and 37 Caucasian subjects were compared and significant differences between the two ethnic samples were found<sup>35</sup>

A study comparing the mandibular arches of Hispanic and Caucasian samples found that the square arch form was most prevalent in the Hispanic population (44%), followed by ovoid and tapering (28% each).<sup>32</sup> Tapering arch form (44%) was more common in Caucasians, followed by ovoid (38%) and square (18%);<sup>32</sup> thus, supporting that this anatomical guideline changes with race.<sup>36</sup>

The most frequent arch form was square in the Japanese group (45.6%), followed by ovoid (42.5%) and tapering (11.9%). A study on a Korean sample found ovoid (49.02%) to be the most frequent, followed by square (42.06%) and tapering (8.82%).<sup>36</sup>

In study done in Gujarati on arch form analysis among sex with subject of 57, 30 female and 27 male results are male to female respectively narrow 30%, 70%, wide 66.7%, 33.3%, mid 46.2%, 53.8%, pointed 44.4% 55.6% and flat 40% 60%<sup>37</sup>

In study done to compare arch form and dimension in various malocclusion among Egyptian population of 94 subject out of which 37 is normal occlusion subject were involved, among normal occlusion samples, the tapered arch form showed the highest frequency as 40% whereas ovoid 37% and square arch forms 23% % and arch width in millimeter Intercanine width 28.5, Intermolar width 45.7 , Canine depth 4.9 , Molar depth 25.4, Canine W/D ratio 6.2, molar W/D ratio 1.8<sup>38</sup>

Study done in Uganda to determine variation in dental arch measurement among sex , significant differences were observed in the following maxillary measurements: inter-canine distance ( $P < 0.01$ ), second inter-premolar distance ( $P < 0.01$ ), first molar distance ( $P < 0.01$ ) and total arch length ( $P < 0.01$ ) were larger in male participants. Equally significant larger measurements were observed in each of the above mandibular participants' measurements and the anterior segment length ( $P < 0.01$ ), for male participants overall maxillary dimensions were significantly smaller in females than males by 1.50 mm (95 % CI  $-2.91$  to  $-0.09$ ,  $P = 0.04$ ), controlling for age group. The overall dimensions of the mandible were also smaller in females, though this was not significant.<sup>39</sup>

Results of the study done in Comparison of arch forms between Israeli and North American white populations found that 45% of ovoid forms and 46.7% of tapered forms in white Angle Class I individuals<sup>40</sup>. Comparative study of Caucasian and Japanese compared the mandibular arch shapes of Japanese and Caucasian population and shows that in the Caucasian Angle Class I subjects, ovoid and tapered arch forms were almost equally distributed, accounting for more than 90% of the study population, while in Angle Class II dental arches the tapered form was the most frequent and in Angle Class III the three arch forms showed a similar distribution.<sup>41</sup>

In another study both males and females small variations in upper and lower intercanine width were recorded, while greater variations were found in the maxillary intermolar width, in the maxillary and mandibular canine and molar depth. Furthermore, small variations were seen in the upper and lower canine ratio while molar ratio did not show significant differences<sup>42</sup>

## **CHAPTER THREE**

### **OBJECTIVE**

#### **3.1 GENERAL OBJECTIVE**

- To assess the dental arch width and arch forms in a sample of jimma oromo with normal occlusion,2018.

#### **3.2 SPECIFIC OBJECTIVES**

- To determine dental arch width
- To determine dental arch form
- To compare arch width of different arch form
- To compare arch width and form among gender

## **CHAPTER FOUR**

### **METHODS AND MATERIALS**

#### **4.1 Study area and period**

This study was conducted at Jimma town dental clinic, Oromia regional state, Ethiopia. which is located about 345 km south west from capital city in Oromia Region at 1720 -2010 m above sea level. According to Ethiopian Statistical Agency the population of Jimma town is estimated to be 178,000 out of which 46,71% is Oromo, population in age range of 15 -30 years account 26% of total population and study will be conducted from October 20 to November 10 2018 G.C.

#### **4.2 Study design**

Cross sectional study design was conducted in Jimma town dental clinic , Oromia, Ethiopia 2018 G.C.

#### **4.3 Population**

##### **4.3.1 Source population**

All Oromo population with normal occlusion who visit jimma town dental clinic

##### **4.3.2 Study population**

All Oromo population who visit Jimma town dental clinic and fulfill inclusion criteria during study period

#### **4.4. Inclusion and Exclusion criteria**

##### **4.4.1 Inclusion criteria**

- The subjects were part of the jimma town oromo and age range of 15-30 years, and more than 75% oromo in genetic component
- Class I molar and canine relationships with normal occlusal interdigitation, complete permanent dentition erupted except the third molars

- normal overjet and overbite (about 2-4 mm), minimal crowding (<2 mm) and spacing (<1 mm)

#### **4.4.2 Exclusion criteria**

- no previous orthodontic or prosthodontic treatment.
- subjects with proximal caries or fillings that affected a tooth's size and shape, gross restorations, significant attrition, congenital defects, or deformed teeth were excluded.
- Absence of tooth anomalies of structure and development

### **4.5 Sample size determination and sampling techniques**

#### **4.5.1 Sample size determination**

Sample size of 50 was involved in study by using other literature as guide<sup>33,35,38</sup>

#### **4.5.2 Sampling techniques**

Convenient sampling techniques was used to include sample size of 50 subject with normal occlusion

### **4.6 Data collection tools and techniques**

#### **4.6.1 Data collection tools**

Spatula

Impression tray

Alginate

Dental stone

Gloves

Questioners

Digital caliper

#### **4.6.2 Data collection techniques**

Data was collected by recording the required information on the prepared questioners regarding their socio-demographic characteristics, age, gender and format for examination of occlusion that include intra oral arch alignment, anterior and posterior cross bite canine and molar relationship over jet overbite arch length and arch width

Impression was taken from each participants using alginate and poured with dental stone. On cast of each participants intercanine distance from canine cusp tip to contra lateral canine cusp tip, inter molar distance from mesiobuccal cusp, intersecond premolar from buccal cusp, canine depth from central incisor incisal contact to midpoint of a line connecting canine cusp tip and molar depth from central incisor incisal contact to midpoint of a line connecting mesio buccal cusp of first molar. An electronic digital caliper with fine tips measuring within 0.01 mm was used in this study to measure the parameters on the maxillary and mandibular study models.

#### **4.7 Variables**

##### **4.7.1 Dependent variables**

- Arch form
- Arch width

##### **4.7.2 Independent variable**

- Gender

#### **4.8 Data processing and analysis**

Finally the collected data was entered coded and analyzed by using computer with (SPSS 22.0 )and analysis was made by using range, SD,mean, mode, chi square and independent sample T test and the result will be considered significance at  $p < 0.05$ .

#### **4.9 Data quality control**

Principal investigator was regulate data collection for completeness of data and accuracy of impression and model during their production and intra observer bias checked on 10 of randomly selected casts and re measured 5 day after first measurement

#### **4.10 Ethical Consideration**

Before start of study, an official letter was written from JUSRP to dental clinic director for permission. Moreover, verbal and written consent was obtained from each participants before the interview and impression were taken.

Each study individual informed about the objective and significance of the study. The informed consent form was developed by Oromiffa, Amharic and English language to ensure the consent of each study individuals. Then, the data was collected from only those who were volunteer.. The confidentiality of information assured for the respondent.

#### **4.11 Disseminations of results**

The finding of the study will be distributed to Jimma university dentistry department, Jimma university CBE office, Jimma town health office, regional health bureau and MOH by and the result can be distributed in form of seminars at professional conference level and published in journal for scientific community

#### **4.12. Operational definition**

**Normal occlusion:** involves occlusal contact alignment of teeth and should include not only arrangement of anatomically acceptable values but also physiological adaptability.

**Malocclusion:** an improper relationship between teeth in opposite jaw and/or mal-alignment of teeth in the same arch

**Class I molar relation:** mandibular dental arch is in normal mesio-distal relation to maxillary arch with mesio-buccal cusp of maxillary first molar occluding in the buccal groove of mandibular first molar.

**Class I canine relation:** maxillary canine cusp tip is occluded in embrasure between mandibular canine and first premolar

**Inter canine width:** the distance between canine cusp tip.

**Inter molar width:** the distance between mesio buccal cusp tip of first permanent molar.

**Canine depth:** distance from a line connecting the origin between central incisors to mid line of inter canine cusp tip

**Molar depth:** distance from a line connecting the origin between central incisors to mid line of mesio buccal cusp tip of first permanent molar .



**Canine width-depth (W/D) ratio:** the ratio of intercanine width and canine depth.

**Molar W/D ratio:** the ratio of intermolar width and molar depth.

**Arch form :** is the position and relationship of teeth to each other in all three dimension

To describe the arch form, the  $(W_c/W_m)/(D_c/D_m)$  ratio. When this ratio was within a mean of  $\pm 1$  SD, they assumed (or labeled) the arch form as ovoid; if it was more than  $+1$  SD, it was square; and if it was less than  $-1$  SD, it was tapered.

## CHAPTER FIVE

### RESULTS

In these study 50 Jimma Oromo subject with normal occlusion were participated and the dental model from each subjects dental impression was formed ,analyzed and the following result is generated by using SPSS version 22.

Table 1. Demographic distribution of respondents

Sex	Frequency	Percentage
Male	27	54
Female	23	46

Table 2. Distribution of Upper and lower dental archform by gender and arches

Arch form	Sex	Maxillary arch		Mandibular arch	
		Frequency	Percentage	Frequency	Percentage
Tapered	Male	4	40.0	4	40.0
	Female	6	60.0	6	60.0
	total	10	20	10	20
Ovoid	Male	17	58.6	18	51.4
	Female	12	41.4	17	48.6
	total	29	58	35	70
Square	Male	6	54.5	5	100.0
	Female	5	45.5	0	
	total	11	22	5	10

table 2 shows Ovoid arch form is the most frequent arch form in both arch 29 (58%) for upper and 35(70%) upper and lower respectively .square arch form not found in female; among gender male has higher in square and ovoid

Table 3. Mean arch width parameters distribution among arches and gender

Arch width	total	Upper arch				total	Lower arch			
		male		Female			male		female	
		mean	sd	mean	Sd		mean	sd	mean	sd
ICW	33.3452	34.1470	4.71068	32.4039	5.26368	25.9650	26.3578	3.83474	25.5039	3.05063
IMW	52.3612	52.9452	4.31448	51.6757	4.18779	44.1496	38.3907	2.81074	37.8965	2.87893
IPW	45.2198	45.7848	2.36995	44.5565	2.17528	38.1634	44.8663	5.43009	43.3083	5.34111
CD	9.2088	8.9800	2.05609	9.4774	2.08427	6.0314	5.6456	2.18973	6.4843	2.29389
MD	27.3406	27.5481	2.01720	27.0970	1.98720	24.0706	23.8907	1.58278	24.2817	2.66145
CR	3.9136	4.0937	1.41717	3.7021	1.42368	4.8770	5.2196	1.77574	4.4748	1.74330
MR	1.9307	1.9395	.27509	1.9203	.24120	1.8551	1.8883	.27011	1.8163	.35601

The mean of ICW, IMW, IPW, and CR is more in both arch more in male than female. CD of female is more than male in both arch and MR and MD is almost the no deference among gender. In all parameters except CR upper mean value is greater than lower counter parameters.

Table 4. Distribution of mean in arch width parameter among upper arch form

Arch width	Upper arch form					
	tapered		Ovoid		square	
	mean	sd	mean	Sd	mean	sd
ICW	26.3710	.78708	33.0807	2.56568	40.3827	.33455
IMW	42.7300	1.02259	45.3959	2.02197	47.0191	2.15603
IPW	47.6080	1.15793	51.6455	2.65668	58.5691	1.24252
CD	12.1050	.62729	9.2114	1.25718	6.5691	.15365
MD	28.4570	2.56879	27.6183	1.74872	25.5936	.43807
CR	2.1831	.11612	3.6617	.64082	6.1506	.16154
MR	1.6867	.17244	1.8791	.17905	2.2884	.02625

Table 4 shows: the ICW,IMW,IPW,CR and MR is mean value of square arch form is more and tapered is least with these values. the mean value of CD and MD is more in tapered arch form followed by square

Table 5. Distribution of mean and standard deviation in arch width parameter among lower arch form

Arch width	Lower arch form					
	tapere		Ovoid		square	
	mean	sd	mean	Sd	mean	sd
ICW	23.8670	.52942	25.0238	2.03616	30.3536	4.42665
IMW	36.8850	1.72648	37.8317	2.32405	40.2000	3.84139
IPW	39.8750	5.84579	43.4214	4.22653	49.9555	2.18538
CD	9.8660	.89460	5.3734	1.31204	4.2800	.20712
MD	27.1850	1.36128	23.3572	1.45153	23.1200	1.59693
CR	2.4122	.22473	5.2499	1.25078	7.1964	1.54696
MR	1.5773	.14106	1.9510	.27784	1.7402	.44336

The ICW,IMW,IPW,CR and MR is mean value of square arch form is more and tapered is least with these values. the mean value of CD and MD is more in tapered arch form followed by square

## CHAPTER SIX

### DISCUSSION

The results of the present study showed that ovoid arch form is the most frequent in both arch 58% upper arch and 70% in lower arch; square arch form is 11% in upper arch and 5% in lower arch and no variation was found among tapered arch form in both arch and was constitute 10%. Results of the study done in Comparison of arch forms between Israeli and North American whitepopulations found that 45% of ovoid forms and 46.7% of tapered forms in white Angle Class I individuals <sup>40</sup>. Another comparing dental arch shapes between North American white population and a Korean sample, observed that the dental square form was the rarest in the first, and the latter had a tendency to be larger and deeper than the white arches. Comparative study of Caucasian and Japanese compared the mandibular arch shapes of Japanese and Caucasian population and shows that in the Caucasian Angle Class I subjects, ovoid and tapered arch forms were almost equally distributed, accounting for more than 90% of the study population, while in Angle Class II dental arches the tapered form was the most frequent and in Angle Class III the three arch forms showed a similar distribution.<sup>41</sup>

In another research done in comparison of north white American and Israeli population white north American is square 8.3%, ovoid 45%, tapered arch form 46.7%. In Israeli population arch form is square 20%, ovoid 45% and tapered 35%.<sup>26</sup> Another study Turkish samples Square 8.3% Ovoid 45% Tapered 46.7 % and in north America square 23.5 % ovoid 47% Tapered 29.4%.<sup>30</sup>

In a recent study, the shape and dimension of the dental arches of 29 subjects of Africa origin and 37 Caucasian subjects were compared and significant differences between the two ethnic samples were found. A study comparing the mandibular arches of Hispanic and Caucasian samples found that the square arch form was most prevalent in the Hispanic population (44%), followed by ovoid and tapering (28%) both.<sup>32</sup> Tapered arch form (44%) was more common in Caucasians, followed by ovoid (38%) and square (18%)<sup>32</sup> The most frequent arch form was square in the Japanese group (45.6%), followed by ovoid (42.5%) and tapering (11.9%). A study on a Korean sample found ovoid (49.02%) to be the most frequent, followed by square (42.06%) and tapering (8.82%).<sup>36</sup> In Egypt, the tapered arch form showed the highest frequency as 40% whereas ovoid 37% and square arch forms 23% %

Study done in Italy shows maxillary arch, square form was the less frequent in the sample; a high statistically significant difference ( $p: 0.001$ ;  $p < 0.01$ ) was observed both in comparison to ovoid (OR: 0.13; CI: 0.06-0.28) and tapered forms (OR 0.15; CI: 0.07-0.31), while no statistically significant difference ( $p: 0.68$ ;  $p > 0.05$ ) was found between the ovoid and the tapered arch forms. Also in the lower arch, it was observed that square form was the less frequent in adolescents (OR: 0.24 CI:0.12-0.46) ( $p: 0.001$ ;  $p < 0.01$ ). The same percentage of ovoid and tapered forms was recorded, and no significant difference was found between these two dental shapes ( $p: 1$ ;  $p > 0.05$ ).<sup>32</sup>

There is wide variation in arch form among different ethnic group in most of the study support current finding and some study shows variation from this study.

In our study frequent ovoid arch form is more frequent in both arch in male (36%) with no variation and ovoid is also more in female 24% in upper and 36 % in lower in both gender tapered arch doesn't show difference in upper and lower archs and no square arch form is found among female in lower arch

Study done in Italy shows no difference among sex in their arch form .<sup>32</sup> In study done in Gujarati on arch form analysis among sex with subject of 57, 30 female and 27 male results are male to female respectively narrow 30%,70%, wide 66.7%,33.3% ,mid 46.2%,53.8%, pointed 44.4% 55.6%and,flat 40%60%<sup>37</sup>

In these study the mean value of arch width parameters in upper arch in millimeter is ICW 33.3452, IMW 52.3612,IPW 45.2198, CD 9.2088, MD 27.3406, CR3.9136, and MR 1.9307 and in lower arch ICW 25.9650, IMW 44.1496,IPW 38.1634, CD 6.0314, MD 24.0706, CR 4.8770, and MR 1.8551. The mean of ICW, IMW,IPW, and CR is more in both arch more in male than female . CD of female is more than male in both arch and MR and MD is almost the no deference among gender. In all parameters except CR upper mean value is greater than lower counter parameters.

In another study both males and females small variations in upper and lower intercanine width were recorded, while greater variations were found in the maxillary intermolar width, in the maxillary and mandibular canine and molar depth. Furthermore, small variations were seen in the upper and lower canine ratio while molar ratio did not show significant differences<sup>42</sup>

In another research done in comparison of north white American and Israeli; arch width in mean millimeter Intercanine width 29mm, Intermolar width 49.4mm , Canine depth 6.3mm , Molar depth 26.7mm, Canine W/D ratio 4.7, molar W/D ratio 1.85. In Israeli population arch width in millimeter is Intercanine width 29.37mm; Intermolar width 49.71mm; Canine depth 4.46mm; Molar depth , 24.66mm, Canine W/D ratio 6.96 and molar W/D ratio 2.03.<sup>29</sup> In Turkish population width in mean millimeter is Intercanine width 28.96mm; Intermolar width 48.97mm; Canine depth 6.33mm; Molar depth , 25.63mm, Canine W/D ratio 4.59 and molar W/D ratio 1.97<sup>31</sup>

In study done in Italy the mean arch width parameter in upper arch is ICW 37.6 mm ,IMW 56.4 mm CD 9.6 mm MD 33.4 mm CR 3.9 MR 1.7 and in lower arch is ICW 30.4 mm , IMW 54.2, mm CD 5.7 mm, MD 28.8 mm , CR 5.3 MR 1.9. Study done Indian arch width for maxilla Intercanine width 35.5mm, Intermolar width 52.2mm , and for mandible inter canine width 26.6mm, intermolar width 50.7mm<sup>3</sup> . In study done Egyptian population arch width Intercanine width 28.5mm, Intermolar width 45.7 mm, Canine depth 4.9 mm, Molar depth 25.4mm, Canine W/D ratio 6.2, molar W/D ratio 1.8<sup>38</sup>



## **CHAPTER SEVEN**

### **CONCLUSION AND RECOMENDATION**

#### **7.1 CONCLUSION**

- Ovoid is the most common arch form in jimma oromo with normal occlusion
- Tapered arch form more frequent in male
- The mean value of arch width and canine depth is higher in male in both arches
- Canine ratio mean value is higher in female
- There is no arch form difference among upper and lower arches in male
- ovoid arch form is more frequent and square arch form is not found in females mandibular arch

#### **RECOMMENDATION**

- Interested researcher should done further studies to compare dental arch form between angle classification of malocclusion and different ethnic groups
- The clinician should select the appropriatepreformed archwire form based on the patient's arch form and ovoid arch wires should be the shape of choice.
- width arch wire should be modified according to arch width parameter specified for clinical application

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