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Research Article

Wilson Curve Features in a Tunisian Population

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Abstract

Introduction: It is an experimental study about Wilson curve in order to define its characteristics and to evaluate its evolution with age in a Tunisian population.

Material and Method: The study population is divided into two groups: young group with 50 dental students and a group of adults (10). The curve is estimated by a radius at each sector with different radii templates.

Results: The mean radii of the Wilson curve is 37. 9 mm at the first premolar, 57.81mm at the second premolar and 140.3 mm and 81.68 mm respectively at the first and second molars for the control young group. The values are significantly greater for the aged group and the radii values are negative at the level of the first molars.

Conclusion: Wilson curve's Radii increase with aging and its shape is inversed at the first molars 'level, which is explained by physiological wear. Aging of the Wilson curve must be taken into consideration during prosthetic rehabilitation to ensure the masticatory efficiency and sustainability of the supporting structures.

Keywords: Wilson Curve; Population

Introduction

Occlusal curvatures are virtual surfaces resulting from maxillary and mandibular teeth confrontation. Recently, cross-sectional studies on human adults have shown that occlusal curvatures are associated with the masticatory function with respect to bite force, food comminuting, and mixing ability 9 [fueki].

In sagittal view, the anteroposterior curve that joins the tips of the buccal cusps of the mandibular molars and canines is called the Spee curve. In frontal view, the curve joining the buccal and lingual cusp tips of the premolars and molars on each side of the arch is called the Wilson curve. It has te form of a circle with an upper concavity [1,2].

Very few studies have focused on the analysis of the characteristics of frontal curves despite their major role in the balance and stability of the manducatory system.

This work aims to define, from a Tunisian population, the average value of Wilson curve, and to determine its depth as well as its evolution according to age.

Material and Methods

Sample

It is a descriptive prospective study.

The sample is consisted of 60 Tunisian subjects divided into two groups:

- Control group (young): 50 students from the dental faculty of medicine Monastir Tunisia, and whose ages ranged from19 and 21.
- Experimental group (adults): 10 adults aged between 40 and 55 years.

Inclusion criteria

All subjects had complete permanent dental formula (the 3rd molar is not considered) and angle class I.

Non-inclusion criteria

- Previous orthodontic treatment
- Periodontal or articular pathologies
- Any condition that can alter the occlusal morphology, such as extensive caries or occlusal restorations, prosthetic reconstructions and worn surfaces.

- Bruxism
- Unilateral mastication

Methodology

For each subject, an alginate impression of the mandibular arch was taken. Then, on casts, the following parameters were measured: -Depth of the Wilson and Spee Curve -Overjet and overbite- Inter-canine and inter-molar distance (at the level of the first molars).

The depth of the Wilson curve was estimated by a radius of circle [1]. For each radius, a template was designed through Solidwork software (Figure 1) and then fabricated.

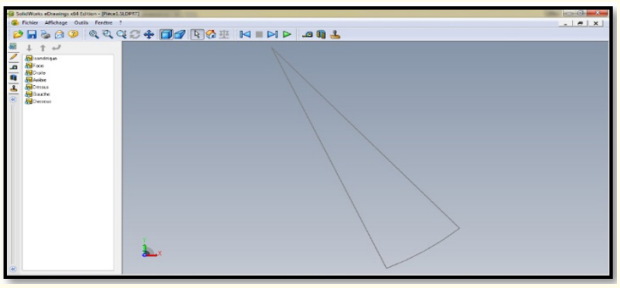

Figure 1: Template design with Solidwork Software.

In this work, the used method allowed a direct determination of the radius. Only a part of the interpretation related to the observer was left uncertain. The calibration is 2 mm for the radii measuring from 10 to 120 mm, 5 mm for the radii ranging from 120 to 300 mm and 50 mm for the radii measuring between 300 and 900 mm. The calibration choice is justified by the ability to make the visual difference between two curves [1]. A total of 200 templates were fabricated: 100 positive and 100 negative (Figure 2 and 3).

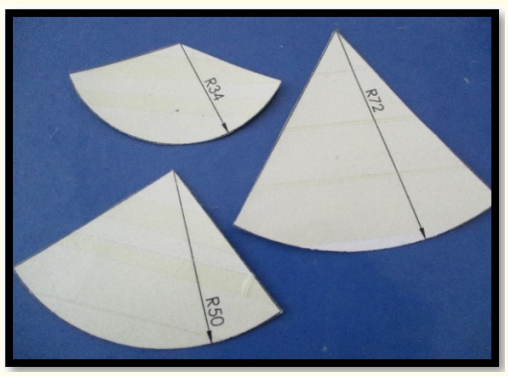

Figure 2: Positive templates.

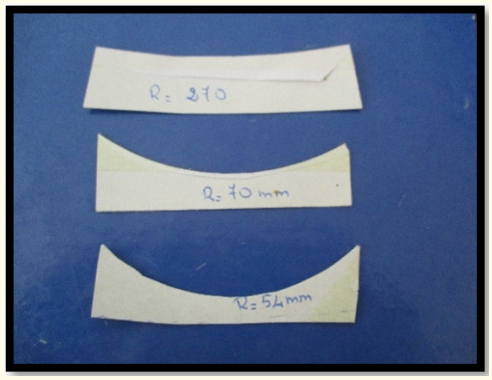

Figure 3: Negative templates.

The chosen template must join the four cusp tips. But this theoretical model requires a symmetrical occlusal angulation which rarely exists. For this reason, two templates were chosen for each sector: right and left, then the average was calculated. Concerning the molars, the radii were measured mesially and distally. Then, the mean was calculated [1].

Statistical analysis

Statistical analysis was performed using Excel (2013) and SPSS (19) software's.

The Mean Radii values, maximun, minimum and standard deviations were examined using conventional descriptive statistics.

The T test was used to compare the curve depth between the two groups.

The One Way Anova and the linear regression were used to compare the sectors for each group. The Pearson test indicates the linear correlation coefficient "r" was used to judge the statistical significance of the different quantitative variables. P values <0.05 were considered significant.

Results

The mean Radii of Wilson Curve, standard deviation, maximum and minimum values are presented in table 1 and 2 for young and adult subjects.

T test showed that Wilson curve for the adult group radii was significantly higher than that for young group on all the sectors, except the first premolars, in which the difference was statistically insignificant ($p = 0.6$) (Table 3).

For each group, ANOVA showed statistically significant differences ($p < 0.05$) of the radii value between the sectors, except the second premolar and the second molar for the young group (Table 4).

	Mean (mm)	Standard Deviation (mm)	Minimum (mm)	Maximum (mm)
First Premolar	37.9	41.1	22	88
Second Premolar	57.81	16.38	32	104
First molar	140.3	64.35	75	312
Second molar	81.68	19.41	38	127

Table 1: Wilson curve's depth for young subjects.

	Mean (mm)	Standard Deviation (mm)	Minimum (mm)	Maximum (mm)
First Premolar	41.1	21.75	26	125
Second Premolar	135.3	82.2	54	280
First molar	-386.3	175.14	-625	-144
Second molar	174.18	55.38	86	275

Table 2: Wilson curve's depth for adult subjects.

	Radii Means		p
	Young Subjects	Adult subjects	
At the First Premolar 's level	37.9	41.1	0,6
At The Second Premolar's level	57.81	135.3	$\leq 10^{-2}$
At The First molar's level	140.3	-386.3	$\leq 10^{-2}$
At The Second molar's level	81.68	174.18	$\leq 10^{-2}$

Table 3: Comparison between two groups in each sector.

	P Valeurs	
	Young Subjects	Adult subjects
From the First Premolar to the second Premolar	$\leq 10^{-2}$	$\leq 10^{-2}$
From the Second Premolar to the First molar	$\leq 10^{-2}$	$\leq 10^{-2}$
From the First molar to the Second molar	$\leq 10^{-2}$	$\leq 10^{-2}$
From the Second premolar to the Second molar	0.136	0.001

Table 4: Comparison of the radii of curvature between the different sectors for the two groups.

The correlations between Wilson curve depth and the inter canine distance, inter-molar distance, sex, and Spee curve depth were statistically not significant.

Discussion

In the present study, for the control group, values were positive. Consequently, wilson Curve was concave for young subjects.

The lowest value was noted at the level of the first premolars. Its occlusal morphology characterized by a significant difference between buccal and palatal cusp, may explain the strong concavity of the curve at this level.

At the level of the second premolar, radii were also positive. The curve had a concave shape at this level but it was more attenuated.

At the level of the first molar, for the calculation of averages, our sample of 50 subjects was reduced to 37. Concerning the 13 eliminated subjects, radii were negative because of the higher lingual cusps. It may be due to the effect of a unilateral mastication or hard foods.

For the rest of the group, the average was 140.3 mm. The highest radii values were found at the level of the first mandibular molars. Therefore, the Wilson curve tended to flatten. Indeed, these teeth, constituting the pillars of occlusion during mastication, are subject to a phenomenon of physiological wear, especially at the buccal cusp [10].

The finding in this study, are similar to those reported by different studies despite the different protocols used: Ferrario., *et al.* [3] studied the three-dimensional arrangement of the dental arches using a three-dimensional.

Electromagnetic scanner. He reported an average of 101.174 mm with a standard deviation of 23.54 mm. Nam., *et al*. who found 110.89mm (Table 5).

Authors	Year	Mean Age	Wilson curve (mm)
Ferrario [9]	1999	20.5	101.174
Nam [7]	2013	24	110.89
Fueki	2012	25	22.08
The present study	2017	20	140.3

Table 5: Wilson curve depth at the first molar level according to studies

At the level of the second molar, the average was 81.68 mm which is close to the finding of Kagaya [11]. He determined the Monson sphere radii (110.6 mm)using the Broadrick occlusal plane analyzer. Fueki [6] followed the same protocol by determining a value in logarithmic form. The difference may be explained by the average age.

On the other hand, Barrera [9], using Beam cones, determined angular measurements and found a convex curve at the first and second maxillary molars.

Kulmer., *et al.* [5] studied the curve aspects at the mandibular and maxillary arches (Figures 3 and 4).

For both groups, the difference between sexes was statistically not significant, which is in agreement with Ferrario., *et al* [3]. However, NAM [7] found a statistically significant difference. This could be explained by the difference between ethnic groups. The same is true for the correlation with inter-canine and inter-molar distances.

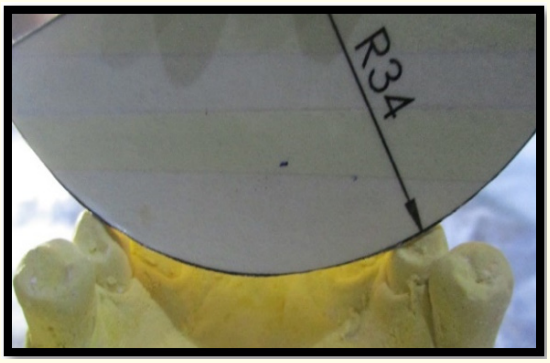

Figure 4: The measure of Wilson curve depth at the level of the first premolar.

Kanavakisa G [12] mentioned the existence of a statistically significant correlation between the Wilson curve depth, measured at the level of the first mandibular, and the inter canine distance. The difference in the finding can be explained by the protocol used.

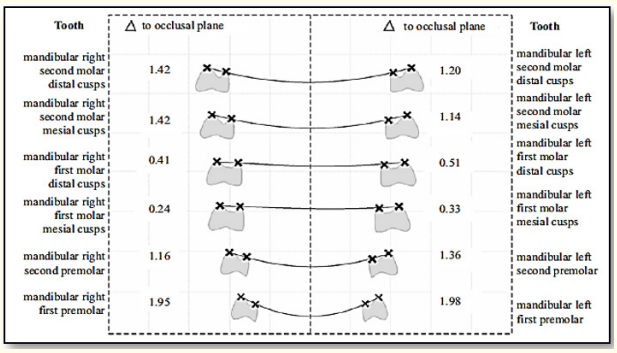

Figure 5: Curve of Wilson in maxillary arch [6].

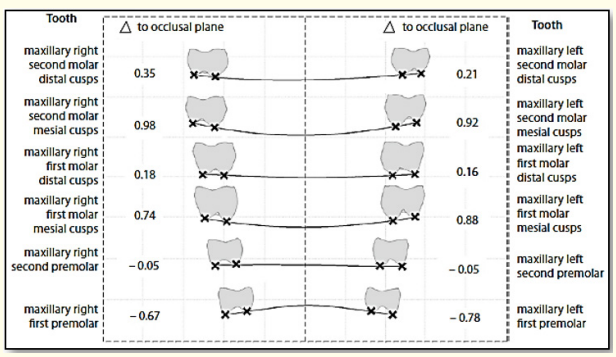

Figure 6: Curve of Wilson in mandibular arch [6].

Conclusion

Wilson curve tends to flatten at the level of the first molars. Radii are influenced by age at the level of second premolar, first molar and the second molar.

Aging of Wilson curve should be considered in the prosthetic rehabilitation. When making prostheses, prosthetic teeth should present moderate cusp morphology to guarantee the masticatory efficiency and the sustainability of the supporting structures.

This study is the first carried out on a Tunisian population. Further studies should be carried out in this direction using more sophisticated methods and larger samples.

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