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Wilson's curves: evaluation of a new method measuring frontal convergence of dental axis

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Introduction

Wilson's curves are frontal, generally with superior concavity curves that bring together the tops of the vestibular and lingual cusps of two homologous teeth.
To date, few variability studies have been conducted on Wilson's Curves, and even fewer considering the occurrence of the teeth's abrasion.
We have therefore decided to start from the frontal convergence of the dental axis passing through the first third/second third apical end of each dental root and running back to the center of each dental crown.
Using the metrical and angular values measured on the 3D images of digitized mandibles, the objectives of this work are to propose a new method of measuring Wilson's curves removing the dental cusps from consideration (thus removing the impact of occlusal wear) and to compare the results with those of a conventional measurement method.

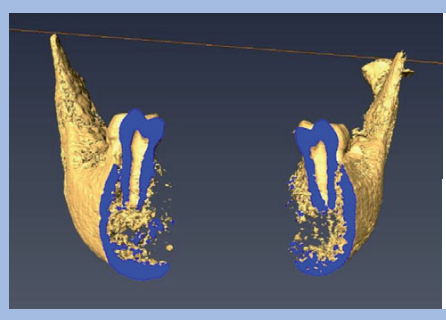

Fig. 1: *Example of a cut passing through second premolars of a digitized mandible*

Materials and method

A total of 477 digitized mandibles (scans) of human skulls aged from 2000 BC and 1870 were given by Ruldolf Slavicek's foundation. Because of inclusion and exclusion criteria, only 20 scans of mandibles were retained for the study. Inclusion criteria: complete mandible arch (except third molars) with adult teeth and no fractured bone.
These digitized mandibles were loaded into industrial software (AVIZO™) (***Fig. 1***) in order to achieve five cuts per mandible on specific planes (through second premolars, first molars in mesial, first molars in distal, second molars in mesial and second molars in distal) (***Fig. 2***).
Then, the scans' cuts were measured using different software especially designed for the study (MAEWA) in the aim to compare the new method (measuring frontal convergence of the dental axis) with the conventional measurement method (**Fig. 3**).
All the measures were analysed using statistical software (XL-Stats), and results were given by Mann-Whitney's tests and Wilcoxon's tests (n=40).

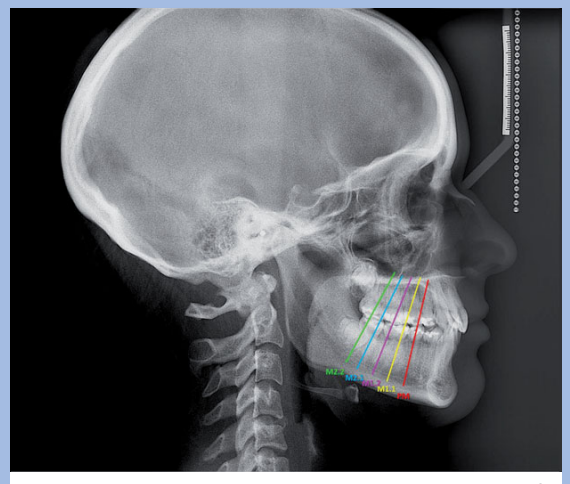

Fig. 2: *Five cuts passing through several pairs of teeth: premolar (PM), first molar in mesial (M1.1) and distal (M1.2), and second molar in mesial (M2.1) and distal (M2.2)*

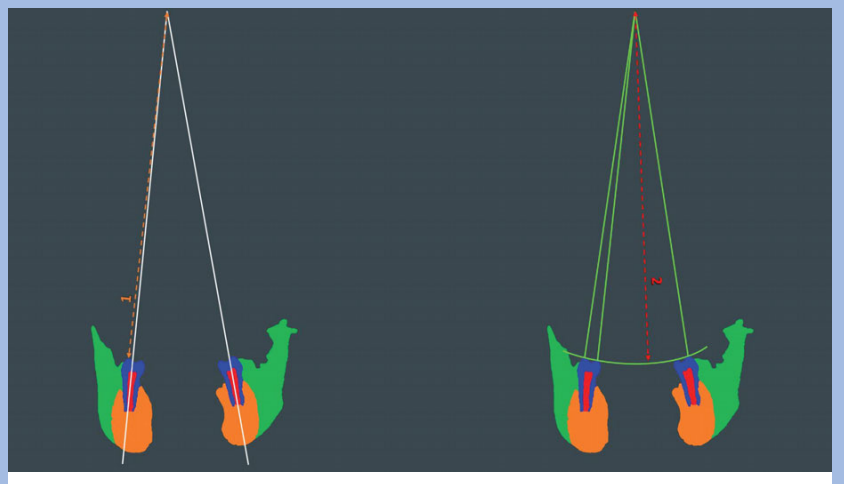

Fig. 3: *The two different measurement methods of Wilson's curves: using the dental axis (1), conventionnal measurement method (2)*

Results

Values found on molars in mesial and distal cuts were similar. For molars, it was decided to fuse mesial and distal values. Because of this fusion, it was possible to increase the number of subjects for the study from 20 to 40 for the molars' values. The teeth's average values for Wilson's curves with the new measurement method are in **Fig. 4**.
The p-value of the Wilcoxon's test for abrased teeth to compare the radius from the frontal convergence of the dental axis measurement method with the cusps positions is less than 0.05 (**p<0.05** with **p[premolars]=0.016; p[first molars]<0.0001; p[second molars]<0.0001**) instead of the p-value of the same Wilcoxon's test but for non-abrased teeth (**p>0.05**).
The p-value of Mann-Whitney's test belonging to the cusps positions method comparing abrased teeth with non-abrased teeth is less than 0.05 (**p<0.05** with **p[premolars]=0.000; p[first molars]<0.0001; p[second molars]<0.0001**) instead of the same Mann-Whitney's test but for the frontal convergence of dental axis measurement method (**p>0.05**).

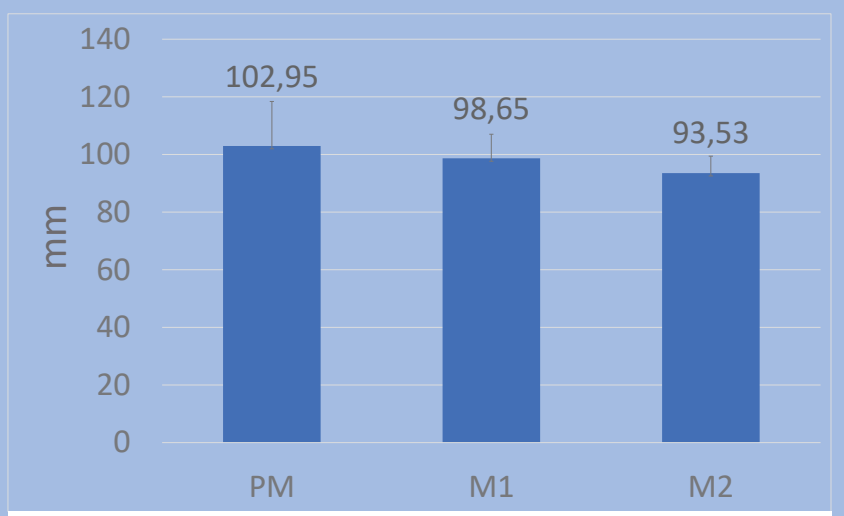

Fig. 4: Values of Wilson's curve passing through first mandibular premolars (PM), first (M1) and second (M2) mandibular molars with the new measurement method using dental axis on non-abrased teeth (millimeters)

Discussion

In our knowledge, this study is the first one measuring Wilson's curves with dental roots whereas others are measuring it from dental casts.
The values found in the present study (cusps position method with non-abrased teeth and frontal convergence of the dental axis measurement method) on first molars are close to the values found in anterior studies (Ferrario and al, 1999; Nam and al, 2013) thus using different measurement methods (***Fig. 5***).
The new measurement method using dental axis seems to be as reliable as the cusps positions method but **being independant of the impact of occlusal wear**. **Probably, from a mechanical point of view, the dental axis is more pertinent than the occlusal face, because Wilson curves are first the result of variations in the frontal inclination of posterior teeth.**
Perspectives are numerous: giving an ideal axis for implant in guided surgery, establishing new recommendations for prosthodontics and orthodontics, permitting measurement of those parameters in anthropology.
Nevertheless, according to those promising results, the pursuit of this study with a larger number of subjects will be necessary to confirm the trend of these results.

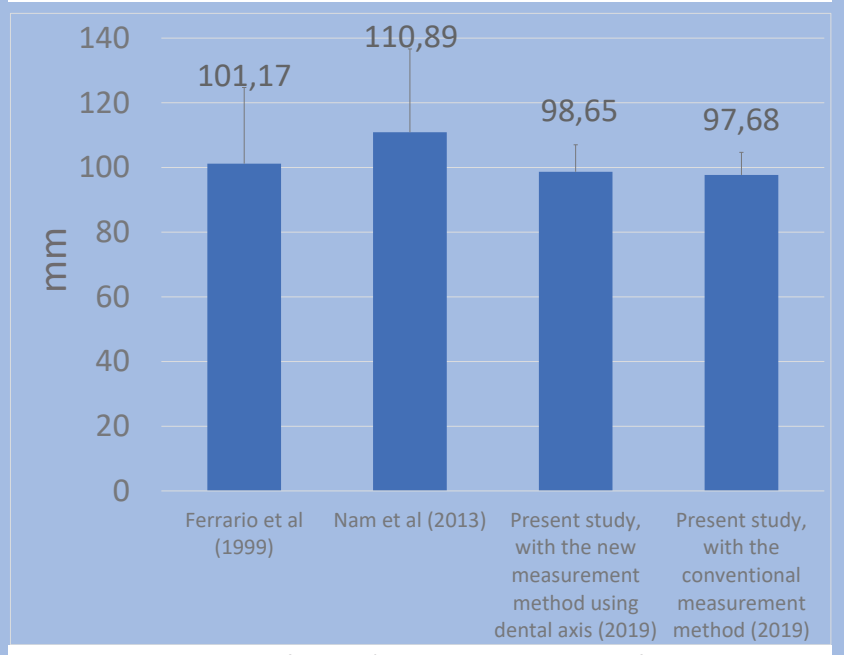

Fig. 5: Average values of Wilson's curve passing through first mandibular molars in different studies (millimeters)

Bibliography

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