

Change over time of palatal volume and surface area in identical and fraternal twins: A volumetric evaluation at ages 6,12,18 years.

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#### Abstract

- Objective: This study aimed to assess changes in the palatal volume and surface area from 8, 12, and 18 years of age.
- Methods: This was a retrospective analysis of palatal characteristics performed on dental casts of 27 individuals (23 fraternal twins and 4 identical twins) which were obtained at 3 time points: 8, 12 and 18 years of age. The casts were scanned and a 3D analysis was performed. The points of reference were the incisive papilla, disto-occlusal and palatal gingival margin of upper first molars to obtain the surface area and volume for each palate. Statistical analysis (paired two sample t-test, and repeated measures ANOVA) was performed to evaluate the changes in different ages.
- **Results:** We found statistically significant increase in mean volume per age group. In the case of surface area, we found statistically significant increase between the 8 and 12 age groups (paired two sample t-test). However, we were not able to demonstrate statistically significant average growth in the 12 to 18 group, suggesting a plateau in surface growth during these years.
- **Conclusions:** there are consistent incremental changes in the palate's volume over time whereas the surface area has incremental changes from 8 to 12 years and has a plateau from 12 to 18 years of age.

#### Introduction

#### • Riquelme and Green evaluated palatal width, height and length in human twins.

- They found no significant difference in sex between the monozygotic and dizygotic twins.
- Palatal width, height and length have a significant hereditary variability.

# • Younes et al (1995) compared normal traits for palatal height and width at different stages of dentition development of two ethnic groups of the Middle East.

• Findings in this study do not indicate an ethnic difference in relation to palatal height and width.

\* Riquelme and Green, Palatal Width, Height and Length in human twins. State university of New York, Buffalo. 1970
\* Younes , M.F El Angbawi, A.M Dosari. A comparative study of palatal height in a Saudi and Egyptian population. Journal of oral rehabilitation 1995

#### Introduction

- Eguchi et al evaluated the relative contributions of genetic and environmental factors to variations in dental arch width, length and palatal height in a sample of Australian twin.
  - Their results indicate a high genetic contribution to the variation in dental arch dimensions in mainly teenage twins.

\* Shosei Eguchi, Grant C. Townsend, Lindsay C. Richards, Toby Hughes, Kazutaka Kasai. Genetic contribution to dental arch size variation in Australian twins. 2004



 Assess the palate's volume and surface area changes through 8, 12 and 18 years of age.

### Hypothesis

- Null Hypothesis (H<sub>0</sub>):
  - There are no changes over time of palatal volume and surface area over time.

#### $\circ$ Alternative Hypothesis (H<sub>1</sub>):

• There are significant incremental changes of the palate's volume and surface area over time.

- Study design → Retrospective
- $\circ$  Sample  $\rightarrow$  27 subjects at 8,12 and 18 years of age
- Repository → deidentified untreated cases obtained from the Forsyth Twin growth study database : 530 sets of families that includes monozygotic twins, dizygotic twins, siblings and parents.
  - Data will be separated according to zygosity and families.
  - One monozygotic twin selected from each twin set.
  - Both dizygotic twins from a set were included.

#### $\circ\,$ Inclusion criteria :

- The availability of good quality and scanned casts for each subject.
- Availability of similar time points for all subjects.
- The structures of interest should be easily identified.

#### $\circ$ Exclusion criteria :

- First molars not erupted
- Poor condition of dental casts



- o Subjects were selected according to the inclusion and exclusion criteria
- A new patient folder was created in Mimics for the scanned casts of each subject.
- o 27 subjects (23 fraternal, 4 identical twins) were included in the study. Each patient had casts at 8, 12 and 18 years.
- Palatal Analysis: The STL file of the 3D models scanned on Motion View Software was exported into the folder on Mimics software 21.0
  - Landmarks : 
    incisive papilla
    - disto-occlusal point of upper first molars
    - Y palatal gingival margin of upper first molars











 Repeated Measures Anova Test rejected the null hypothesis that the means from each age group are equal (p-value <0.05)</li>

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	71739429	26	2759209	14.9733	5.75903E-10	1.929213
Columns	6496549	1	6496549	35.25458	2.89253E-06	4.225201
Error	4791158	26	184275.3			
Total	83027136	53				

• Two Paired Two Sample t-test for means (8 vs. 12, and 12 vs. 18), both rejected the null hypothesis that the means are equal (p-value <0.05).

t-Test: Paired Two Sample for Means (8 vs. 12)			t-Test: Paired Two Sample for Means (12 vs. 18)		
	Volume-8	Volume-12		Volume-12	Volume-18
Mean	4716.401	5680.843	Mean	5680.843	6374.547
Variance	833946.7	1160196	Variance	1160196	1783288
Observations	27	27	Observations	27	27
Pearson Correlation	0.832219		Pearson Correlation	0.895075	
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
df	26		df	26	
t Stat	-8.38802		t Stat	-5.93756	
P(T<=t) one-tail	3.6E-09		P(T<=t) one-tail	1.45E-06	
t Critical one-tail	1.705618		t Critical one-tail	1.705618	
P(T<=t) two-tail	7.2E-09		P(T<=t) two-tail	2.89E-06	
t Critical two-tail	2.055529		t Critical two-tail	2.055529	

 Two Linear Regressions to measure the relationship between age (independent variable) and volume

• Regression 1: Age 8 to Age 12

- Volume = 2787.52 + 241.11 \* Age
- R-squared = 0.195
- Regression 2: Age 12 to Age 18
  - Volume = 4293.43 + 115.62 \* Age
  - R-squared = 0.078



Metric	8 Years	12 Years	18 Years
Mean	4716.40	5680.84	6374.55
Standard Deviation	913.21	1077.12	1335.40
% growth in mean		20.45%	12.21%

 Repeated Measures Anova Test cannot reject the null hypothesis that the means from each age group are equal (p-value >0.05)

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	4642686	26	178564.9	13.60284	1.7244E-09	1.929213
Columns	54514.78	1	54514.78	4.152866	0.051858815	4.225201
Error	341302.6	26	13127.02			
Total	5038504	53				

Two Paired Two Sample t-test for means (8 vs. 12, and 12 vs. 18), Can only reject the null of "equal means" in the 8 vs. 12 age groups.
Cannot reject null in 12 vs. 18 (Plateau)

t-Test: Paired Two Sample for Means			t-Test: Paired Two Sample for Means		
	Surface8	Surface- 12		Surface- 12	Surface- 18
Mean	2293.183	2506.524	Mean	2506.524	2570.071
Variance	82966.55	80951.32	Variance	80951.32	110740.6
Observations	27	27	Observations	27	27
Pearson Correlation	0.720152		Pearson Correlation	0.873654	
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
df	26		df	26	
t Stat	-5.17537		t Stat	-2.03786	
P(T<=t) one-tail	1.06E-05		P(T<=t) one-tail	0.025929	
t Critical one-tail	1.705618		t Critical one-tail	1.705618	
P(T<=t) two-tail	2.12E-05		P(T<=t) two-tail	0.051859	
t Critical two-tail	2.055529		t Critical two-tail	2.055529	

 Two Linear Regressions to measure the relationship between age (independent variable) and volume

• Regression 1: Age 8 to Age 12

- Volume = 1866.5 + 53.33 \* Age
- R-squared = 0.126
- Regression 2: Age 12 to Age 18
  - Volume = 2379.43 + 10.59 \* Age
  - R-squared = 0.011



Metric	8 Years	12 Years	18 Years
Mean	2293.183	2506.52444	2570.07074
Standard Deviation	288.03914	284.51946	332.777052
% growth in mean		9.30%	2.54%

Thank You