AGE ESTIMATION AND GENDER DETERMINATION USING DIGITAL MEASUREMENTS AND FRACTAL ANALYSIS BY ORTHOPANTOMOGRAM – A PRELIMINARY RETROSPECTIVE STUDY

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Background

Age estimation and gender determination of the skeletal remains are of paramount importance in forensic dentistry [1,2]

The mandible is largely dimorphic and recovered intact. Hence digital analysis using orthopantomogram and pattern analysis using fractal may aid as a potential tool for forensic detrmination

Aim and Objectives

Age estimation and gender determination using digital measurements and fractal dimension (FD) analysis
- Upper ramus breadth (left and right)
- Lower ramus breadth (left and right)
- Gonial angle (left and right)
- Coronoid height (left and right)
- Condylar height (left and right)
- FD of condyle (left and right)
- FD of parasymphysis (left and right)
- FD of angle (left and right)

Materials and Methods

- Sample size (n) = 20
- 10 males and 10 females
- Age correlation done
- Orthopantomogram
  - Current: 8 mA
  - Voltage: 6 4kV
  - Time: 14.1 s

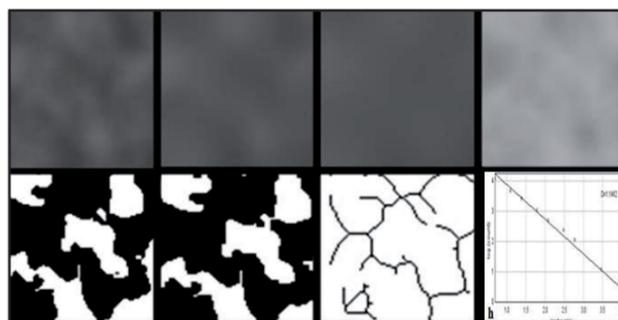| Group	Male (Age)	Female (Age)
Group 10-19	15	15
	19	19
Group 20-29	24	24
	29	29
Group 30-39	35	35
	39	39
Group 40-49	42	42
	48	48
Group 50-59	54	54
	58	58

Digital measurements :

SIDEXIS XG- Sirona - Orthopantomogram
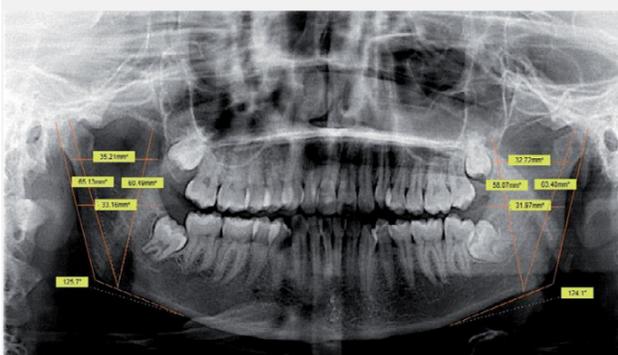
Fractal analysis:

ImageJ software [1.46r -National Institute of Health, USA – Java 1.6.0_20 (32-bit); 428 commands; 58 macros] [3,4]

Results and Statistics

Bivariate correlation - AGE

Variables significant with age	Pearson's correlation
Right gonial angle	-0.932
Left gonial angle	-0.936

Multiple regression analysis

Age = 641.32 – [(5.008×Value of left gonial Angle)]

Discriminant analysis - GENDER

Variables significant with gender	p value
Condylar height (right and left)	<0.001
Coronoid height (right and left)	<0.001

Discriminant function formula / Wilks' lambda analysis

- 0.94.9 + (0.55* R condylar height) – (0.059*L condylar height) – (0.061*L coronoid height) – (0.019*R coronoid height)]
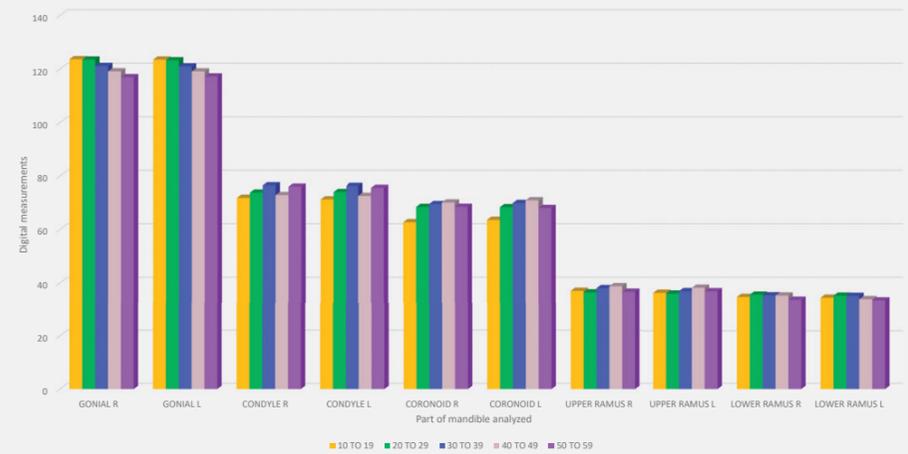
If the value of the equation is closer to 3.379, the gender is male, and if the value is closer to -3.379, the gender is predicted as female.
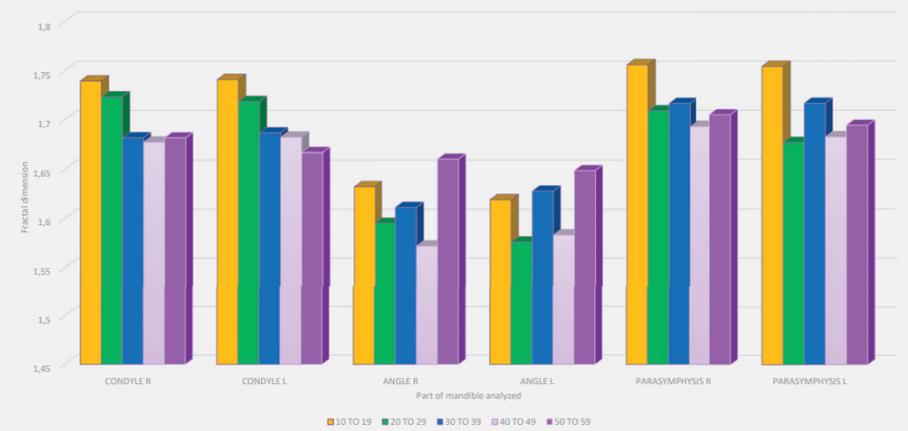
Fractal analysis

Gender – Independent t-test
Age – Pearson's correlation

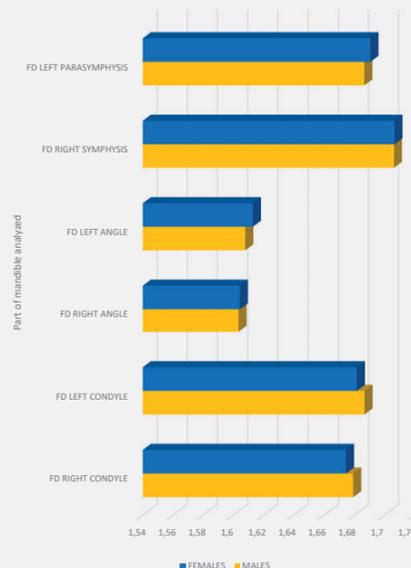| Variables significant with age	p value
Right condyle	0.002
Left condyle	0.002

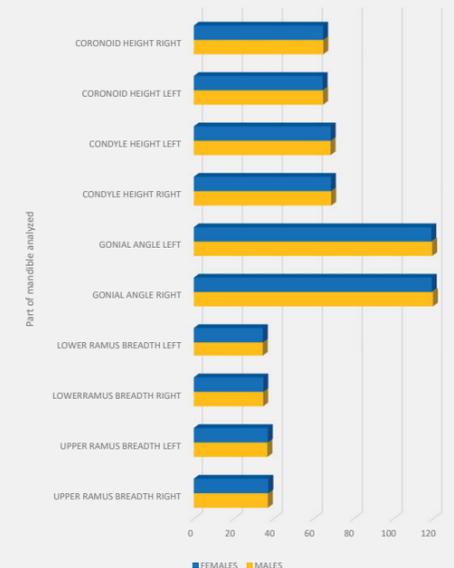VARIATION OF FACTORS IN MANDIBLE WITH AGE

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VARIATION OF FACTORS IN MANDIBLE WITH GENDER

VARIATION OF FACTORS IN MANDIBLE WITH GENDER

Discussion

- The gonial angles correlated strongly inversely with age and were included in linear regression.
- R^2 value denoted the variance in the age as revealed change by 87.6%.
- The bivariate test shows that actual age and predicted age were strongly correlated (r=0.936).
- The height of the condyle and coronoid were significantly different between the gender groups.
- Wilks' lambda being closer to zero signifies the validity of the model in predicting gender.
- The fractal dimension values of parasymphysis and angle were greater than of the condyle in the females compared to males.
- The Pearson's correlation shows that FDs of the condyles (left and right) were significantly inversely correlated with age.

Limitations

- Superimposition in 2D radiographs
- Inter-observer variations and geographic variations
- Relatively small sample size (n=20)

Conclusion and future scope

- The condylar/coronoid height can aid as an adjunct forensic tool for gender determination and gonial angle for age estimation by further analysis including the geographic and regional variations.
- The condylar bone density patterns and alterations with age can be considered as a factor in forensic analysis even with remnants of the mandible.
- Hence, digital measurements and fractal analysis can serve as a potential forensic tool in the future

References

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