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Modelling the Growth of the Mandible: A Mathematical - Physical Analysis

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ABSTRACT

Predicting the growth of the mandible has been of interest to orthodontists for the last century. With the advent of cephalometric radiographs, this could be quantified and measured. Many cephalometric analyses and computer programs have been developed that aim to predict mandibular growth but all of these rely on average growth patterns, that may not correlate with the individual patient.

This mathematical analysis aims to predict the growth of the mandible in two dimensions, based on previous growth studies.

INTRODUCTION

The mandible is the lower bone of the masticatory apparatus and has had several models of growth ascribed to it over the last century and a half [1]. Virtually all of these models have been based on lateral skull radiographs or cephalograms [2]. Serial radiographs of this type have been done as part of historical growth studies in the 1940's, 1950's and 1960's (Burlington, Belfast etc.). Such studies are now not ethically acceptable as radiographs have to be of benefit to the patient or diagnostically useful.

From historical studies, however, we can evaluate change in position and size of the various parts of the mandible [3]. A mathematical description can also be applied to such growth and changes and this will be outlined here.

METHOD

A series of 100 sets of longitudinal echometric radiographs [4], drawn from the archives of the Electric Jockstrap Research Institute of the University of Neasden, London, UK were used in the study. These were digitized using the regular cephalometric points as used in the Eastman and Ricketts analysis. The data was then entered into the VACC-u M-series Mark VI mainframe computer system where the points were averaged and means and standard deviations obtained. The standard deviations were extended to include all possible outlying data.

The data thus obtained was subjected to artificial intelligence using the CRA-Programme which has been developed at this university. The algorithms generated were thus able to take account of variation within the growth patterns and by entering one initial cephalogram we were able to predict the outcome on the final cephalogram within four standard deviations of the mean **(Figures 1 & 2)**.

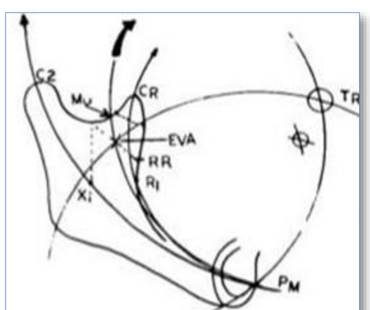

Figure 1. Growth of the mandible.

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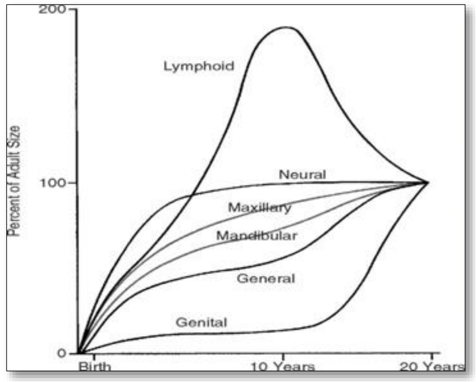

Figure 2. General growth of the body from birth to adulthood.

MATHEMATICAL METHOD

$$f'(3) = \lim_{h\to 0} \frac{(3+h)^2 - 3^2}{h}$$
$$= \lim_{h\to 0} \frac{9 + 6h + h^2 - 9}{h}$$
$$= \lim_{h\to 0} \frac{6h + h^2}{h}$$
$$= \lim_{h\to 0} (6+h)$$
$$= 6$$

$$\int_a^b f(x)\,dx = F(b) - F(a).$$

Furthermore, for every x in the interval (a, b),

$$\frac{d}{dx}\int_a^x f(t)\,dt = f(x).$$

$$g(a) = g(b) \iff f(a) - ra = f(b) - rb$$
$$\iff r(b-a) = f(b) - f(a)$$
$$\iff r = \frac{f(b) - f(a)}{b-a}.$$

Proof. Let $f_1, \ldots, f_m$ denote the components of f and define:

$$\begin{cases} g_i : [0,1] \to \mathbb{R} \\ g_i(t) = f_i(x + th) \end{cases}$$

Then we have

$$f_i(x+h) - f_i(x) = g_i(1) - g_i(0) = \int_0^1 g_i'(t)\,dt$$
$$= \int_0^1 \left(\sum_{j=1}^n \frac{\partial f_i}{\partial x_j}(x+th)h_j\right) dt = \sum_{j=1}^n \left(\int_0^1 \frac{\partial f_i}{\partial x_j}(x+th)\,dt\right) h_j.$$

$g(x) = f(x) - rx$ that,

$$g'(x) = f'(x) - r$$
$$g'(c) = 0$$
$$g'(c) = f'(c) - r = 0$$
$$\Rightarrow f'(c) = r = \frac{f(b) - f(a)}{b-a}$$

$$(f(b) - f(a))g'(c) = (g(b) - g(a))f'(c).$$

Of course, if $g(a) \neq g(b)$ and $g'(c) \neq 0$, this is equivalent to:

$$\frac{f'(c)}{g'(c)} = \frac{f(b) - f(a)}{g(b) - g(a)}.$$

RESULTS

The results showed that the mandible grows in several ways depending on what superimposition is used. The mandibular border method of superimposition will show that the mandible grows upwards, while the condylar method of superimposition will show that growth is downwards and forwards. Growth at the symphysis is forwards and backwards.

Superimposition on the first molar shows that it is superimposed on the first molars. There is a wide variety of patterns produced and it is essential that accurate superimposition takes place.

DISCUSSION

The results showed that the mandible grows in several ways depending on what superimposition is used. The mandibular border method of superimposition will show that the mandible grows upwards, while the condylar method of superimposition will show that growth is downwards and forwards. Growth at the symphysis is forwards and backwards. Superimposition on the first molar shows that it is superimposed on the first molars. There is a wide variety of patterns produced and it is essential that accurate superimposition takes place.

CONCLUSIONS

By applying this mathematical formula, we can predict the growth of the mandible. The normal variation within the sample is accounted for by including all standard deviations.

REFERENCES

1. Berk A (1988) Rotating the mandible, a normal feature of mouth opening. J Neasden Orthodont Soc 2: 6-9.
2. Stunt C (2007) Why I am a complete pillock and don't have a clue about anything. Am J Dead Sheep 17: 20-47.
3. Tabernacle C (2020) The mandible is attached to the skull and goes up and down. Eur J CRA-Program Stud 12: 50-58.
4. Sole R (2002) Lateral cephalograms - A new development in diagnosis and treatment planning. Transactions of the Serbo-Croat Society of Orthopaedic Odonto-Stomatology 16: 67-81.