

Analysing Missing Link Between Body Mass Index and Growth Pattern

Jayakrishnan U¹, Jibin Joy^{2*}, Nishmitha J² and Anil Kumar³

¹Private Practitioner, Thiruvananthapuram, Kerala, India

²Post Graduate Student, Department of Orthodontics, AJ Institute of Dental sciences, Mangalore, Karnataka, India

³Reader, Department of Orthodontics, AJ Institute of Dental sciences, Mangalore, Karnataka, India

*Corresponding Author: Jibin Joy, Post Graduate Student, Department of Orthodontics, AJ Institute of Dental sciences, Mangalore, Karnataka, India.

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Abstract

Introduction: Facial type also referred to as facial pattern or facial skeletal pattern is a determinant factor when selecting the most appropriate orthodontic treatment plan. The classification of Sيريوات and Jarabak, for example, defines brachyfacials as hypodivergent, mesofacials as neutrals, and dolichofacials as hyperdivergent. Body mass index (BMI) is a value derived from the mass (weight) and height of a person. The objective of this study was to determine the relationship between BMI and growth pattern, and to assess if this has any clinical application.

Materials and Methods: 22 lateral cephalograms of patients was collected and cephalometric analysis was performed. BMI of the individuals was measured using the formula.

$BMI = \text{mass in kg} / \text{height in m}^2$.

Results: In post hoc the results showed highly significant difference (.000) between average and vertical growth pattern and horizontal and vertical growth pattern.

There was significant difference between horizontal and average growth pattern.

The correlation between growth pattern and BMI was very strong.

Conclusion: A highly significant difference exists between BMI of Average and Vertical growth pattern.

A highly significant difference exists between BMI of Horizontal and Vertical growth pattern.

A significant difference exists between BMI of Horizontal and Average growth pattern.

Keywords: Body Mass Index; Growth Pattern; Muscle

Introduction

Facial type also referred to as facial pattern or facial skeletal pattern is a determinant factor when selecting the most appropriate orthodontic treatment plan. Normally, the clinicians use patient's radiographs to obtain angular, linear and proportional measurements, based on this they are classified as: Dolichofacial (long and narrow face), brachyfacial (short and broad face), and an intermediate type named mesofacial [1]. Besides this, alternate mea-

surements and classification of facial types have been developed to help define vertical facial types. The classification of Sيريوات and Jarabak, for example, defines brachyfacials as hypodivergent, mesofacials as neutrals, and dolichofacials as hyperdivergent [2].

Body mass index (BMI) is a value derived from the mass (weight) and height of a person. BMI is defined as the body mass divided by the square of the body height, and is expressed in kg/m² unit. BMI is a convenient rule of thumb used to broadly categorize a person

as underweight, normal weight, overweight, or obese based on tissue mass (muscle, fat, and bone) and height [3]. Commonly accepted BMI ranges are under 18.5 kg/m² (underweight), 18.5 to 24.9 kg/m² (normal weight), 25 to 30 kg/m² (overweight), and over 30 kg/m² (obese). When used to predict an individual's health, rather than as a statistical measurement for groups, BMI has limitations that can make it less useful than some of the alternatives, especially when applied to individuals with abdominal obesity, short stature, or unusually high muscle mass [3].

The objective of this study was to determine the relationship between BMI and growth pattern, and to assess if this has any clinical application.

Aim of the study

To evaluate the relationship between body mass index and growth pattern.

Objectives of the Study

To compare the body mass index with horizontal, average, vertical growth pattern.

Materials and Methods

Records of body mass index and growth pattern of adolescent individuals were taken from patients visiting Department of Orthodontics, AJ institute of dental sciences, Mangalore.

BMI was calculated by using formula:

$$\text{BMI} = \frac{\text{mass in kg}}{\text{height in m}^2}$$

The WHO regards a BMI of less than 18.5 kg/m² as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI equal to or greater than 25 kg/m² is considered overweight.

BMI classification

- Group 1- Underweight- value less than 18.5 kg/m²
- Group 2- Normal- value between 18.5-25 kg/m²
- Group 3- Overweight- value above 25 kg/m².

Growth pattern classification.

- Vertical growth pattern- below 62%
- Average growth pattern- 62-65%
- Horizontal growth pattern- above 65%.

Growth pattern measurements

Angular measurements from pre-treatment lateral cephalometric radiographs of patients undergoing treatment in AJ Institute of dental sciences, Mangalore were used. Subjects were selected and grouped into vertical, average and horizontal growth pattern based on Jarabacks ratio, Sella-nasion/palatal plane, sella-nasion/mandibular plane, sella-nasion/anatomic occlusal plane, palatal plane/mandibular plane angle.

Statistical analysis

Sample size calculated using formula

$$n = \frac{2 * \left(Z_{1-\frac{\alpha}{2*k}} + Z_{1-\beta} \right)^2 * \sigma^2}{d^2}$$

Where

$$Z_{1-\frac{\alpha}{2*k}} : =2.39 \text{ for 3 groups}$$

Confidence level of 95%

$$Z_{1-\beta} : 28 \text{ at 90\% power}$$

Standard deviation (σ) - 6.3537 from pilot study

Clinically significant difference- 6.25 from pilot study

Sample size is 28 in each group for 3 groups.

At

$$Z_{1-\frac{\alpha}{2*k}} : =2.39 \text{ for 3 groups}$$

Confidence level of 95%

$$Z_{1-\beta} : 84 \text{ at 80\% power}$$

Standard deviation (σ) - 6.3537 from pilot study

Clinically significant difference- 6.25 from pilot study

Sample size is 22 in each group for 3 groups.

Descriptive analysis will be done. Inferential analysis will be done using ANOVA/kruskal wallis for difference between the 3 growth patterns. Further test will be done at the time of analysis if required. P value will be set at 0.05.

Results

Table 1 showing the distribution of study subjects based on different growth patterns.

Growth Pattern	Frequency	Percent
Vertical growth pattern	22	33.3
Average growth pattern	22	33.3
Horizontal growth pattern	22	33.3
Total	66	100.0

Table 1

Table 2 showing the distribution of study subjects based on BMI.

BMI category	Frequency	Percent
Underweight	24	36.4
Normal	32	48.5
Overweight	10	15.2
Total	66	100.0

Table 2

Table 3 showing the mean values of the variables.

	N	Mean	Std. Deviation
Height in cms	66	166.55	13.08557
Weight in kgs	66	56.33	14.48961
BMI	66	20.36	4.02234

Table 3

Table 4 showing the mean value of BMI with respect to different growth patterns.

Growth Pattern	N	Mean	Std. Deviation
Vertical growth pattern	22	16.63	1.88
Average growth pattern	22	20.80	3.15
Horizontal growth pattern	22	23.66	3.21

Table 4

Inferential statistics

Table 5 showing comparison of the BMI values in between the three growth patterns analysed using One-way ANOVA followed by Tukey's post hoc test.

ANOVA					
BMI	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	550.151	2	275.076	34.556	.000
Within Groups	501.499	63	7.960		
Total	1051.650	65			

Table 5

Tukey's post hoc test

BMI	(I) Growth Pattern	(J) Growth Pattern	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	Average growth pattern	Vertical growth pattern	4.16818*	.85068	.000	2.1263	6.2101
	Horizontal growth pattern	Vertical growth pattern	7.03182*	.85068	.000	4.9899	9.0737
	Horizontal growth pattern	Average growth pattern	2.86364*	.85068	.004	.8217	4.9056

Table a

Table 6 showing the correlation of the growth patterns with BMI using Pearson's correlation.

		BMI	
Spearman's rho	Growth pattern	Correlation Coefficient	.723**
		Sig. (2-tailed)	.000
		N	66
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 6

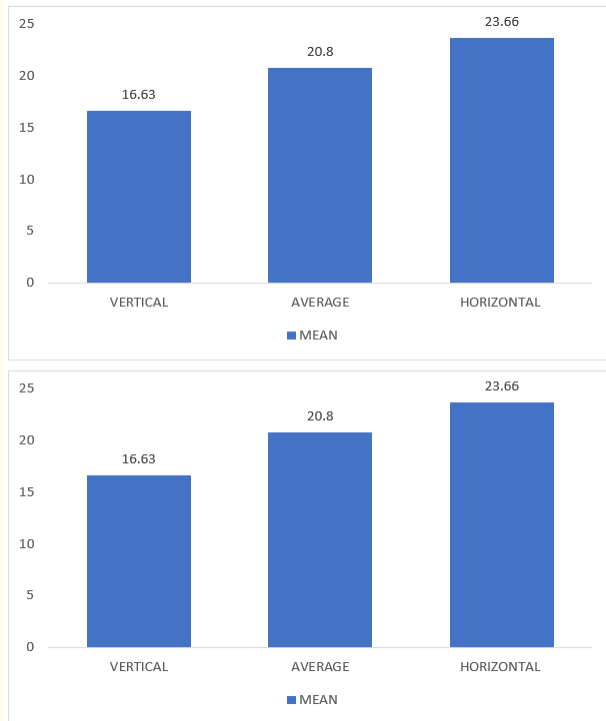
Results

- P value .000 which is highly significant difference between the groups hence post hoc done.
- In post hoc the results showed highly significant difference (.000) between average and vertical growth pattern and horizontal and vertical growth pattern.
- There was significant difference between horizontal and average growth pattern.
- The correlation between growth pattern and BMI was very strong.

P value \leq 0.05 significant

P value \leq 0.001 highly significant.

Graph showing the mean BMI values between the three growth patterns



Graph 1

Discussion

The results obtained from this study confirm that there exists a link between growth pattern and BMI of individuals. Individuals with Vertical growth pattern have a comparatively lower BMI than their Horizontal and Average counterparts. A statistically significant difference exists in the BMI between vertical and average growth pattern and between horizontal and vertical pattern.

Body mass index (BMI) is used to determine the nutritional status and provides an estimate of a healthy body weight based on height [4]. BMI is an easy and widely used diagnostic tool to identify nutritional condition of a population, and it usually determines whether a person is underweight, healthy or overweight [5].

Guilford was among the early pioneers to propose dietary deficiencies as an etiological factor for dentofacial deformities [6]. Nutritional deficiencies can significantly alter the functioning of

endocrine glands of the body which in-turn effects not only the growth and development of whole body but also on the dentition [7]. Malnutrition produces relative and absolute changes in the spatial arrangements of the teeth in the jaws. Cortical thinning, enlargement of medullary spaces and reduced osteoblastic and osteoclastic activity are other unfavorable skeletal effects that have been observed [8].

Nutrition plays a fundamental role in determining the growth of individuals. Growth is the fundamental physiologic process that characterizes childhood. It should be closely monitored by pediatricians and families alike as a benchmark of a child's health [9].

This study suggests that growth pattern can be one of the indicators of physical status of an individual. Individuals with vertical growth pattern have thin musculature as opposed to the horizontal counterparts who tend to have a strong musculature.

Although this study proves that there exists a link between BMI and growth pattern further investigation would be required regarding nutritional aspect in various growth pattern as nutrition is one of the important factors aiding in tooth movement.

Conclusion

We have arrived at the following conclusions from our study

- A highly significant difference exists between BMI of Average and Vertical growth pattern.
- A highly significant difference exists between BMI of Horizontal and Vertical growth pattern.
- A significant difference exists between BMI of Horizontal and Average growth pattern.

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