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Research paper

A Study on Incidence Angle of Radiation in Anterior-Posterior Test of Sella Turcica

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Abstract

Background/Objectives: The general radiographic Test of Sella Turcica is conducted in the same manner as the Anterior-Posterior Test. The purpose of this study is to classify Sella Turcica by gender and age group in general radiological Test to provide basic data by presenting appropriate angle of incidence.

Methods/Statistical analysis: This study was carried out with total 300 male and female patients from 20S to 70S who underwent Sella Turcica general radiography. The maximum length and the maximum width of the skull were measured in order to analyze the factors affecting OML and IOML angles and incidence angle.The t - test was conducted to compare and analyze the mean difference of IOML and OML angle, head length and breadth according to gender and age of the subjects. ANOVA analysis was conducted for comparative analysis of age and Duncan was used for Posterior test. Correlation analysis was conducted to analyze the variables affecting the incidence angle. The results of each analysis was considered to be statistically significant if the p-values were below p <.05.

Findings: As a result of this study, the incidence angle was found to be 1.4 degrees higher than the reference point of 7 degrees in 300 subjects (p <.001) and was statistically significant. For the average incidence angle by age group, 60S showed the highest degree of 8.8 degrees and this is statistically significant (P<.001). Regarding the incidence angle by gender, the female showed 8.4 degrees while the male showed 8.3 degrees, means the female showed 0.1 degree higher than the male and this is considered to be statistically significant (P<.001). In both skull breadth and skull length, the male was significantly larger than female being statistically significant (p <.001). Skull breadth and skull length were significantly correlated (p <.01), but there was no significant difference between OML and IOML.

Improvements/Applications: When conducting the General Radiation Test of Sella Turcica at a medical institution, age and gender should be considered.

Keywords: *Sella Turcica, IOML, OML, Skull breadth, Skull length*

1. Introduction

In the General Radiation Test which is presently performed in many medical institutions, the anatomical structures of the bones and organs constituting the human body are represented by images according to the X-ray attenuation, and various sizes and forms are observed according to age, sex and race[1]. In particular, sellaturcica used in the measurement of the head radiograph is bordered by a saddle-like structure in the middle cranial fossa with tuberculum sella at the front, carotid sulcus at the lateral side, and dorsum sella at the rear[2]. Sella turcica radiography is widely used in neurosurgery, orthodontics and oral facial surgery. In AP axial general radiographic test of sellaturcica, the incidence angle is 30 degrees of OML based caudal degrees and 37 degrees of IOML based caudal degree through center of the external acoustic pore[3]. However, current Anterior-Posterior test of sellaturcica is not a test method that is set according to the shape and size of Korean heads and does not consider the age or sex of the patient, instead, it has been set to those of western people[4]. Therefore, there is still little research on the difference according to the incidence, OML and IOML angle, head size, sex and age of Korean people. This study intends to analyze the factors which affect the incidence angle in Anterior-Posterior Sella Turcica Test. In addition, this study is to present the definite radiation incidence angles according to age and sex of Korean people and provide basic data for Sella Turcica Radiographic Test.

2. Materials and Methods

2.1. *Subjects of Research*

The subjects of this study were 300 patients who underwent a skull series in the General Radiation Test at S hospital in S city. The selection criterion was divided into 25 male patients and 25 female patients aged from 20S and 70S and images corresponding to Skull true Lat were selected and measured. The images of the head trauma patients and the emergency room patients were excluded from the study subjects.

2.2. *Research Method*

2.2.1. Measuring Tools

The image J (Ver. 1.46) developed by the US National Institutes of Health was used to measure OML and IOML angles, maximum length width of Skull and SPSS Ver. 22.0 was used for statistical analysis

2.2.2. Measurement of OML and IOML Angle

In order to identify 7 degrees which is the angle difference between IOML and OML angles, External auditory meatus; the angle between IOML and OML was measured based on EAM. [Figure 1]

2.2.3. Measurement of Maximal Cranial Length and Maximal Cranial Breadth of Skull

A measurement was conducted to understand the correlation between the variables of the incidence angle according to the difference between the length and width of Skull. The maximum length of the skull was obtained by measuring the ends of the vertices and mandible of the Parietal Boned, and the maximum width of the skull was obtained by measuring between the temporal bones. [Figure 2]

Figure 1:.Measurement of OML and IOML Angle

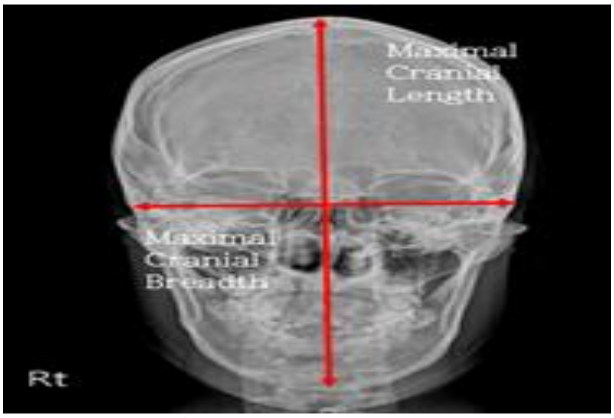

Figure 2:.Measurement of Maximal Cranial Length and Maximal Cranial Breadth of Skull

2.2.4. Statistic Method

The t - test was conducted to compare and analyze the mean difference of IOML and OML angle, head length and breadth according to gender and age of the subjects. ANOVA analysis was conducted for comparative analysis of age and Duncan was used for Posterior test. Correlation analysis was conducted to analyze the variables affecting the incidence angle. The results of each analysis was considered to be statistically significant if the p-values were below p <.05.

2.2.5. Protection of Personal Information of Research Subjects

This study was conducted as a retrospective study using the radiographic images of the subjects and after the review by the Institutional Review Board (IRB) in order to protect the personal information of the research subjects(1585-201710-HR-002-02).
The images used for the measurement were taken after deleting the patient's resident number, name, sex, test area and time.

3. Results

3.1. *Analysis of OML and IOML Angle*

A single sample t-test was conducted to measure the differences between OML and IOML and examine the relationship. The average angle of the subjects was 8.4 degrees and the standard angle of OML and IOML was 7 degrees that it showed statistically significant difference. (t=21.59, p<.001), [Table 1].

Table 1.: Analysis of OML and IOML Angles(n=300)

Variable	N	M(SD)	t-value
Difference between OML and IOML Angles	300	8.4(1.13)	21.59***

***p<.001 N= Sample number, M= Mean, SD=Standard Deviation

3.2. *OML and IOML Angle According to Age*

A single sample t-test was conducted to examine the relationship between age and OML and IOML angle whose reference point is 7 degrees. As a result, the angle between OML and IOML and the reference angle of 7 degrees was significantly different for each age group (p <.001). The mean degree of the 60s was 8.8 degrees, the highest degree and followed by 8.6 degrees in the 70s, 8.5 degrees in the 50s, and 8.2 degrees in the 20s. The lowest, 8.1 degree was shown in the 30s and 40s. In other words, the higher the age was, the higher the angle between OML and IOML was [Table 2].

Table 2:.Analysis of OML and IOML Angle According to Age (N=300)

AGE	N	M(SD)	t-value
20	50	8.2(1.24)	6.97***
30	50	8.1(0.93)	8.50***
40	50	8.1(1.02)	8.14***
50	50	8.5(0.91)	12.11***
60	50	8.8(1.48)	8.66***
70	50	8.6(1.00)	11.31***

***p<.001 N= Sample number, M= Mean, SD=Standard Deviation

3.3. *OML and IOML Angle According to Gender*

As a result of measuring the angle between OML and IOML according to gender, the average of women was 0.1 degree higher than that of men, and both men and women showed statistically significant differences (p<.001), [Table 3].

Table 3:.Analysis of OML and IOML Angle According to Gender (N=300)

Gender	N	M(SD)	t-value
Male	150	8.3(1.14)	14.94***
Female	150	8.4(1.14)	15.55***

***p<.001N= Sample number, M= Mean, SD=Standard Deviation

3.4. *Analysis of Skull Breadth and Skull Length According to Gender*

The mean sample t-test was conducted to examine the relationship between skull breadth and skull length according to gender. Skull breadth of male was 183.78 mm and 172.70 mm for females showing a significant difference between groups (t-8.00, p <.001). Skull length was 119.40 mm for males and 114.40 mm for females showing that the skull length of the male was longer than that of the female and there was a significant difference between groups (t-7.27, p <.001). Therefore, the average skull breath and length of the male were longer that those of the female [Table 4].

Table 4.: Analysis of Skull Breadth and Skull Length According to Gender (N=300)

Variable	Gender	N	M(SD)	t-value
Skull Breadth	Male	150	183.78	8.00***
	Female	150	172.70	
Skull length	Male	150	119.40	7.27***
	Female	150	114.40	

***p<.001N= Sample number, M= Mean, SD=Standard Deviation

3.5. *Analysis of Skull Breadth and Skull Length According to Age*

In order to compare the difference of skull breadth and length according to age, Duncan was performed by post - test. Skull breadth and length did not differ between groups according to age [Table 5].

Table 5:.Analysis of Skull Breadth and Skull Length According to Age (N=300)

Variable	AGE	N	M(SD)	t-value	F
Skull Breadth	20	50	179.15(18.702)	1.926	n-s
	30	50	179.81(10.041)		
	40	50	177.43(12.030)		
	50	50	176.87(10.576)		
	60	50	177.74(13.242)		
	70	50	178.43(13.209)		
Skull length	20	50	119.10(9.383)	0.347	n-s
	30	50	116.72(5.331)		
	40	50	116.06(5.316)		
	50	50	115.83(5.061)		
	60	50	116.08(6.316)		
	70	50	117.59(5.946)		

N= Sample number, M= Mean, SD=Standard Deviation

3.6. *Correlation between Variables*

As a result of correlation analysis between variables, OML and IOML angles were not correlated with skull breadth and skull length. (p>.05)
There was a significant correlation between skull breadth and skull length (r=.329, **p<.01), [Table 6].

Table 6:. Analysis of Correlation between Variables

	OML and IOML angle	Skull Breadth	Skull length
OML and IOML angle	1		
Skull Breadth	-.031	1	
Skull length	-.051	.329**	1

**p<.01

4. Discussion

Sella turcica radiography is widely used in various medical departments. The size of sellaturcica is very variable, but it is known that the size of sellaturcica does not change even after the growth has been completed[5]. Until now, studies on the measurement of shape and size of sellaturcica have been done through various methods and measurements[6-9]. According to Kim Hee-Jin et al., there was a statistically significant difference between male and female skull measurements depending on sex and age[10]. In this study, skull breadth and length were analyzed to determine skull difference between males and females. Skull breadth was 183.78 mm for males, 172.70 mm for females showing longer for the male (t-8.00, p <.001), skull length of male was 119.40 mm, female was 114.40 mm showing male was longer (t-7.27, p <.001). These results are similar to those of Kim Heejin et al. However, in the case of skull difference according to age, average skull breadth was 177mm from the 20S to 70S age group, and the skull length was 117mm average, and there was no difference according to age. Skull radiography is an important test showing important anatomical indices. In particular, there are jawbone, maxillary oyster, navel, nose, and sellaturcica. Especially, sellaturcica is an important anatomical structure because it is an index of the measurement point of the head. However, studies on the ratio of pituitary gland to sellaturcica have been made so far, but the quantitative size and morphological angle of sellaturcica have not been studied[11]. According to Choi, the researchers studied the height, width, diameter, and length of sellaturcica, which showed that both males and females were different and reported that sellaturcica of the female was larger than that of the male[5]. In this study, the difference between OML and IOML angles, which is the standard in sellaturcica Anterior-Posterior test, was 8.3 degrees for males and 8.4 degrees for females, and showed 0.1 degree for males (p <.001) respectively. In the analysis according to age, the angle between OML and IOML varied from 20S to 70S (p <.001). When a disease occurs in sellaturcica, various diseases and changes such as enlargement of sellaturcica, dual image of sellaturcica and calcification of upper part can be diagnosed. It is considered that the more accurate test could be possible if the incidence angle of sellaturcica set in the western people is set according to gender and age of Korean people. The limit of this study is that the research for pediatric was not carried out due to IRB regulation.

5. Conclusion

The results of the measurement of the skull for the incidence angle in the Sella turcica test were as follows. OML and IOML angle was 8.4 degree higher than the standard of 7 degrees. The incidence was 8.3 degrees for males and 8.4 degrees for females. Skull breadth was 183.78 mm for males, 172.70 mm for females while skull length was 119.40 mm for males and 114.40 mm for females. Skull breadth and skull length did not affect the angle between OML and IOML. The general radiographic Test of Sella Turcica at the medical institutions should be performed considering age and sex.

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