

A ROENTGENO-CEPHALOMETRIC STUDY OF THE SELLA TURCICA  
IN THE JUVENILE KOREAN

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韓國人 少年期男女의 Sella Turcica의 頭部 X-線學的인 研究

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.....>國文抄錄<.....

著者は 韓國人 少年期 男女 94名の 頭部 X-線 規格寫眞上에서 sella turcica에 對하여 觀察計測한 結果 다음과 같은 結論을 얻었다.

- (1) sella turcica의 形態는 I, III, II, IV型의 順으로 나타났고, 特히 II型은 男이 1名, 女가 3名 이었고 IV型은 94 例中 단지 女子 1名에서만 觀察할수 있었다.
- (2)  $\angle\theta$ 는 sella의 形態및 頭蓋骨의 前後 成長方向 研究를 하는데 하나의 基準點이 될수있다고 思料되었다.
- (3)  $\angle BY'$ 는 下顎(symphysis)의 成長方向을 알수있고,  $\angle BH$ 는 頭蓋의 前後 成長方向을 測定할수 있으므로 價置있다고 생각되었다.

I. INTRODUCTION

Since 1931, when Broadbent<sup>3)</sup> presented the cephalogram in anthropology, the development state of the skull has been investigated exactly, in dentistry especially in clinical orthodontics. Particularly the sella of the cephalogram has been used as a reference point for the study of the growth and development of the profile, and it has been utilized also as a reference point for the establishment of angles and lines in analyzing cephalometric roentgenogram.

In the medical field as well as in the dental field, the diagnosis of not only normal or abnormal sella turcica but also other diseases was made by the size, the shape, the general appearance, and the location of the clinoid process. Before the findings of this study are

discussed, the outline of the sella turcica is exhibited as the introduction.

The sella turcica is a depressed part in the superior surface of the sphenoid body. At the anterior, it is bordered with the middle process and it is limited with the dorsum sella, which has, on its one side of the tip, the posterior process projecting toward the sella turcica. The optic groove passes through the anterior region of the tuberculum sella. The anterior clinoid process is composed of the medial end of the posterior border in the lesser wing of the sphenoid and this process is projected into the middle fossa. All the processes of the sella turcica do not participate actual formation of the sella. However, those two processes may project outward, and sometimes may even appear to be a bridge formation.

As is explained above, in roentgenograph, a normal sella shows the anterior and posterior clinoid processes.

According to Gordon<sup>9)</sup>, if a tumor or any diseases are developed in and around the sella or pituitary gland, the general shape is changed, and at the same time in the anterior and posterior processes, the morphological and developmental changes may happen and may cause resorption or lessening of the sella, but the middle clinoid process is unaffected.

Pituitary gland disease accompanying the sella symptoms may affect the dental field. For example, the late eruption of teeth, flat tongue, perioral tissue symptoms, and bone symptoms may also be caused. As a result, malocclusion, facial deformity, and abnormal oral functions may be found. Therefore, the normality and abnormality of the sella in the shape in roentgenograph may be related to dental diseases, especially to dentitions.

Graber<sup>9)</sup>, said that the cause of malocclusion might be divided into two reasons: intrinsic (local) factors and extrinsic (general) factors. He explained that when endocrinal diseases happen, general factors cause severe malocclusion.

Salzmann<sup>21)</sup>, described that in the growth and developmental period, any endocrinal diseases cause several kinds of malocclusion.

Consequently, all investigators agree to the fact that, if the sella dose not function properly, it may cause malocclusion, which is considered to be the secondary symptoms of the sella with abnormal function. In this procedure, the diseases in and around the pituitary gland which cause general symptoms are considered to be the primary symptom of the abnormal sella.

Such significant maintenance of the normal function or shape of the sella in relation to the growth and development has not been reported so far. However, due to the diseases which occur in and around the sella, the morphological change in sella may be related to dentistry, especially to malocclusion.

Thus, Silverman<sup>22)</sup>, and Hass<sup>10)</sup> have been conducting the longitudinal study of the sella. Inaba<sup>15)</sup>, Kazuo<sup>14)</sup>, Jewett<sup>13)</sup>, and Fitzgerald<sup>5)</sup> investigated the sella of adults, and Bell and Gordon<sup>9)</sup> studied the sella of children.

A lot of studies on the morphological analysis of the profile of the skull by means of roentgenographic cephalometrics have been reported. The sella turcica has been utilized in the orthodontic diagnosis merely as a reference.

The significance of the sella as a reference has been recognized for quite a long time. However, the study of the sella in relation to the morphology of the profile of the skull of

Koreans by using roentgenographic cephalometric analysis has not been reported except the measurement<sup>12)</sup> of the sella itself.

The purpose of this study is to measure the shape of the sella turcica and also the angles and distances involved between several points and lines established by the present author in order to get data of Korean juvenile.

## II. MATERIALS AND METHODS

### 1) Subject

50 orthodontic patients of ages ranging 7—13 at the department of orthodontics The Kyung Hee Medical Center, and 50 male and female children of ages ranging 7—13 at The Kyung Hee Primary School.

All subjects were free of any subjective symptoms.

### 2) Procedure

Subjects were seated in a dental chair which is a part of the cephalometric roentgen machine (Cephalox Pavo, Tokyo Engine Kogyo Mfg., Co., Ltd.). The distance between the film and the subject was fixed at 5 feet and the height was adjusted until the ear plugs could be fitted into the ear holes. The cone was adjusted to place on the same horizontal level. The nasion positioning rod was adapted on the nasion of the subjects. At that time the midlines of the subjects were at right angles with the floor and the Frankfort planes were parallel to the floor. In the centric occlusion position, radiation was exposed with 95 KVP, 15 mA, and 1 second exposure. In this way cephalometric radiographs were made.

### 3) Measuring

The cephalometric roentgenographs were traced on tracing papers, and necessary points and lines were marked for measurement.

### Classification of sella turcica

Inaba<sup>15)</sup> studied the sella turcica of Japanese and divided the shape of the sella turcica into four types.

Since the subjects of this study were the Koreans—the oriental people, Inaba's classification method was applied to this study. Thus, the results of this study could be compared efficiently.

The classification of the sella turcica is as follows:

Group I—Acute angled  $\angle\theta$

Group II—Right angled  $\angle\theta$

Group III—Obtuse angled  $\angle\theta$

Group IV—Line F is less than line B(Fig.I).

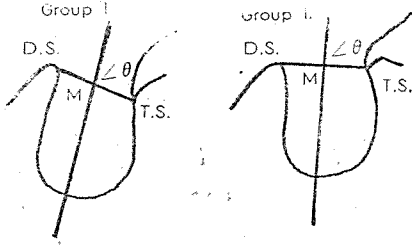
## Items Measured

### (a) Distances

A-distance between connecting points O.G. and D.S.

B-distance between connecting points D.S. and T.S.

C-distance between line A and the line which has its contact with the floor base of the sella turcica and is parallel to line A (right angled distance to line A).



D-distance between line B and the line which has its contact with the floor of the sella turcica and is parallel to line B (right angled distance to line B).

E-distance between the midpoint of the line which is formed by points D.S. and T.S. and the line which is extended from the midpoint of line B and has its contact with the floor of the sella turcica.

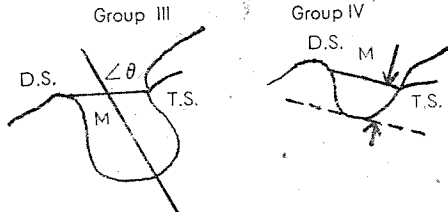
F-distance between the midpoint of the D.S.-T.S. line and the deepest point of the floor of the sella turcica.

G-distance between Nasion(Na) and point T.S. (anterior cranial base length).

H-distance between Bolton point (Bo) and point T.S. (posterior cranial base length)(Fig.2).

### (b) Angles

$\angle\theta$ -angle formed by line B and F. This angle was used as the standard angle for classification



D.S. : Top of the dorsum sella

T.S. : Tuberculum sella

O.G. : Anterior border of the optic groove

M. : Midpoint of line B

g. 1. Classification of the sella turcica

D.S. : Top of the dorsum sella

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O.G. : Anterior border of the optic groove

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Na. : Nasion

Bo. : Bolton

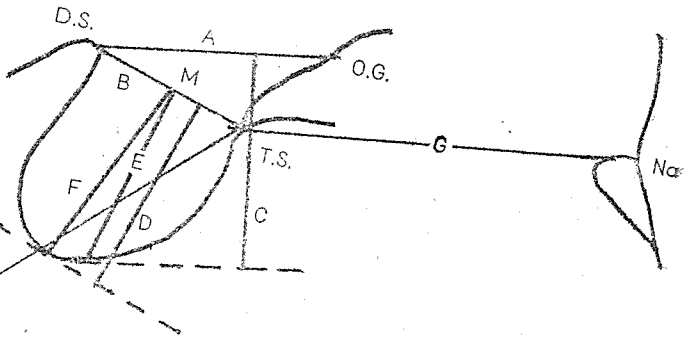


Fig.2. Measurement of the sella turcica in distance.

of the shape of the sella turcica or for the study of the relation between other angles.

$\angle$ BF-angle formed by line B and the Frankfort plane. When it was formed anteriorly to the sella, it was interpreted as the plus angle, and when it was formed posteriorly to the sella, it was interpreted as the minus angle.

$\angle$ Bfa-angle formed by line B and the facial plane.

$\angle$ BSN-angle formed by line B and S-N plane. When the Nasion was found above B line it was interpreted as the plus angle. When Nasion was found below line B, it was interpreted as the minus angle.

$\angle$ FF-angle formed by line F and the Frankfort plane.

$\angle$ Ffa-angle formed by line F and the facial plane. When the angle was formed above these two lines, it was interpreted as the plus angle. When the angle was formed below these two angles, it was interpreted as the minus angle.

$\angle$ FSN-angle formed by line F and S-N plane.

$\angle$ FY'-angle formed by line F and Y' axis.

$\angle$ FNBo-angle formed by line F and N-Bo plane.

$\angle$ FH-angle formed by line F and line H.

$\angle$ BY'-angle formed by line B and Y' axis.

$\angle$ BNBo-angle formed by line B and N-Bo.

$\angle$ BG-angle formed by line B and line G.

$\angle$ BH-angle formed by line B and line H (Fig. 3).

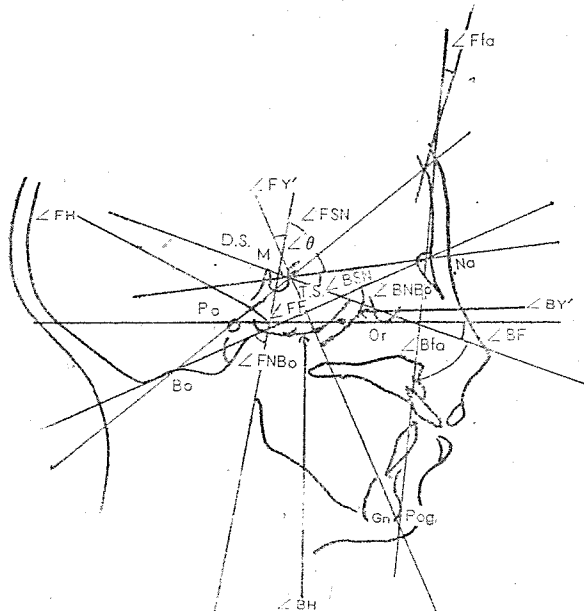


Fig. 3. Measurement of the sella turcica in angle

### III. RESULTS

#### 1) Types of Sella Turcica

The types of the sella turcica is presented in Table 1. The frequency of group I was

the highest in number. The second frequency was observed in group III, the third frequency in group II, and the least frequency in group IV. The number of group I was appeared more in female subjects than in male. In group III, the number was more in male subjects small than in female. In group II and IV, the number of the were small.

### 2) Amount of Distances

In group I, the data of the distance show an almost homogenous character. Distance B of the female group was also greater than that of the male.

In distance G and H revealed that the male value was greater than the female value (Table 2-5).

### 3) Amount of Angles

In both group I and group III, the male value was greater than the female. However, in angles,  $\angle Bfa$ ,  $\angle FF$  of group I, the female value was greater than the male.

In angles,  $\angle Bfa$ ,  $\angle FF$ ,  $\angle FSN$ ,  $\angle FNBo$ , and  $\angle BY'$  of group III, the female value was also greater than the male.

Table 1. Frequency rates of sella turcica

	Male+Female	Male	Female
	n(% $\pm$ m%)	n(% $\pm$ m%)	n(% $\pm$ m%)
Group I	45(48 $\pm$ 5.15)	20(21 $\pm$ 4.20)	25(27 $\pm$ 4.58)
Group II	5(5 $\pm$ 2.25)	3(3 $\pm$ 1.76)	2(2 $\pm$ 1.45)
Group III	43(46 $\pm$ 5.14)	22(23 $\pm$ 4.34)	21(22 $\pm$ 4.27)
Group IV	1(1 $\pm$ 1.02)	0( )	1(1 $\pm$ 1.02)

Table 2. Mean of distance of sella turcica

	Male+Female	Male	Female
A	14.35	14.37	14.24
B	11.06	10.86	11.24
C	8.69	8.81	8.57
D	7.03	7.04	7.02
E	6.99	7.02	6.97
F	7.27	7.25	7.29
G	57.30	58.36	56.33
H	64.32	65.92	62.85

Table 3. Mean of angle of sella turcica

	Male+Female	Male	Female
	Mean	Mean	Mean
$\angle \theta$	89.34	90.56	88.23
$\angle BF$	14.93	16.36	13.63
$\angle Bfa$	83.59	82.73	84.38
$\angle BSN$	19.58	20.47	18.77
$\angle FF$	74.11	73.14	75.00
$\angle Ffa$	14.55	13.22	15.78
$\angle FSN$	69.84	69.75	69.93
$\angle FY'$	36.41	36.31	36.49
$\angle FNBo$	53.01	52.71	53.29
$\angle FH$	38.62	39.13	38.15
$\angle BY'$	54.05	53.53	54.53
$\angle BNBo$	35.70	36.83	34.66
$\angle BH$	50.04	51.19	49.00

Table 4. Measurements of Group I

	Ma+Fe		Male		Female	
	Mean	Mean±m	S. D.	Mean±m	S. D.	
A	14.37	14.49±0.37	1.67	14.28±0.39	1.95	
B	10.95	10.82±0.44	1.98	11.06±0.32	1.60	
C	8.53	8.63±0.27	1.20	8.45±0.00	1.00	
D	7.22	7.18±0.23	1.05	7.25±0.19	0.97	
E	7.24	7.21±0.23	1.02	7.26±0.18	0.92	
F	7.50	7.37±0.21	0.96	7.61±0.22	1.08	
G	57.84	57.95±0.71	3.18	57.76±0.82	4.11	
H	64.95	65.83±0.86	3.85	64.25±0.66	3.31	
∠θ	75.88	77.30±2.37	10.58	74.74±1.61	8.04	
∠BF	13.47	14.42±2.03	9.07	12.72±1.42	7.16	
∠Bfa	85.12	84.10±2.00	8.97	85.95±1.79	8.96	
∠BSN	18.22	18.69±2.55	11.42	17.84±1.83	9.16	
∠FF	61.25	60.10±3.77	16.84	62.18±2.29	11.44	
∠Ffa	20.25	17.75±3.00	13.40	22.25±2.65	13.25	
∠FSN	58.45	59.40±3.18	14.21	57.69±2.49	12.47	
∠FY'	47.64	47.01±3.13	14.01	48.19±2.35	11.76	
∠FNBo	41.49	42.52±3.00	13.42	40.67±2.47	12.37	
∠FH	27.82	28.71±2.95	13.18	27.12±2.09	10.44	
∠BY'	55.51	55.67±2.18	9.74	55.39±1.63	8.14	
∠BNBo	34.02	34.68±2.13	9.51	33.50±1.46	7.30	
∠BH	48.32	48.81±2.09	9.35	47.92±1.48	7.38	

#### IV. DISCUSSION

##### 1) Shape of the Sella Turcica

The shape of the sella turcica is usually clearly distinguishable in the cephalometric roentgenograph. So the classification of the sella turcica by the shape has been done in its analysis.

Jewett<sup>13)</sup> has divided the shapes of the sella turcica into 9 groups. However, due to the fact that he mainly depended upon the shape of the clinoid processes, other parts of the sella turcica seemed to be not properly considered in his classification. Thus, when his method of classification was applied, 50% to 60% of the sella turcica were difficult to classify with respect to their variabilities.

According to the Jewett classification, only in the lowest average age was found a group I where the posterior clinoid process was long with a curve, and the anterior clinoid process was absent.

Group V of Jewett<sup>13)</sup> cases were found in the highest average age group (after puberty), and the characteristics were a thick process, a wide infundibular space, and shallow floor.

Jewett<sup>13)</sup> also said, in his conclusions, that the sella turcica is unrelated to weight, height, age, size, and formation.

Gordon and Bell<sup>9)</sup> considered that the Jewett classification is unnecessarily subdivided, and thus, they divided the shape of the sella into three general group; (1) group A-circular

Table 5. Measurements of Group III

	Ma+Fe	Male		Female	
	Male	Mean±m	S.D.	Mean±m	S.D.
A	14.33	14.39±0.36	1.68	14.27±0.40	1.81
B	11.23	10.86±0.38	1.76	11.61±0.27	1.23
C	8.68	8.94±0.23	1.08	8.78±0.28	1.29
D	6.88	6.85±0.24	1.14	6.91±0.27	1.22
E	6.77	6.77±0.23	1.09	6.78±0.26	1.19
F	7.08	7.10±0.20	0.93	7.07±0.25	1.16
G	56.59	58.68±0.62	2.91	54.40±0.91	4.16
H	63.56	65.71±0.25	1.19	61.30±0.26	1.20
$\angle\theta$	94.16	102.69±3.59	16.82	102.37±1.66	7.59
$\angle BF$	16.19	18.05±2.39	11.19	14.25±1.38	6.32
$\angle Bfa$	82.38	81.89±1.71	8.00	82.90±1.66	7.59
$\angle BSN$	20.53	21.70±1.94	9.12	19.29±1.83	8.37
$\angle FF$	86.74	84.88±2.32	10.90	88.70±2.44	11.19
$\angle Ffa$	8.57	8.37±1.48	6.93	8.78±1.81	8.30
$\angle FSN$	81.34	79.35±2.65	12.42	83.21±2.49	11.42
$\angle FY'$	25.20	26.36±2.11	9.90	23.98±2.41	11.03
$\angle FNBo$	64.51	62.14±2.44	11.43	67.00±2.41	11.06
$\angle FH$	49.07	48.25±2.48	11.62	49.92±2.74	12.25
$\angle BY'$	53.11	52.32±1.67	7.82	53.94±1.80	8.25
$\angle BNBo$	36.96	38.46±1.76	8.24	35.38±1.57	7.17
$\angle BH$	51.51	53.15±1.64	7.69	49.49±1.36	6.35

shape, (2) group B-oval shape, and (3) group C-flattened or saucer shape. They added that, in general, group A and B are common and group C is rare.

Inaba<sup>15)</sup> established a standard angle  $\angle\theta$ , and on the basis of that angle, he divided the kinds of the shape of the sella turcica into four types to avoid the conflicting opinions that has occurred after Bell's on the classification.

Shoji<sup>14)</sup> used Inaba's classification<sup>15)</sup> when he studied the shape of the sella.

The present author also established  $\angle\theta$  and measured other angles related to this  $\angle\theta$ , and Inaba's classification was considered to be significant to study the skull and profile of the face anthropologically. His analytical method was also applied to this study.

Group I that has designed as an acute angle could be compared with Bell's group A. Group III that was designed as the obtuse angle could be compared with Bell's group B. Group II and group IV could be the same as the Bell's group C of the western people. The results are presented in Table 2—6.

The shape of the sella turcica of juvenile Koreans was most frequent in group I and group III, and the next order was group II and IV.

When the data of this study was compared with the data of adult Japanese, the order of frequency was somewhat different from each other. The order of adult Japanese was groups I, II, III, and IV, and the order of frequency of juvenile Koreans was I, III, II, and IV. Generally, group I and group III appeared as the overwhelming majority in the shape of the sella



Table 6. Mean of Group II & IV

	Group II			Group IV	
	Ma+Fe	Male	Female	Ma+Fe	Female
A	13.96	15.10	12.25	16.5	16.5
B	10.00	11.10	8.35	13.5	13.5
C	8.68	9.13	8.00	8.5	8.5
D	7.00	7.50	6.25	5.0	5.0
E	7.12	7.63	6.35	4.9	4.9
F	7.12	7.63	6.35	5.7	5.7
G	58.72	58.70	58.75	56.0	56.0
H	64.90	68.00	60.25	65.5	65.5
$\angle\theta$	90.00	90.00	90.00	125.0	125.0
$\angle BF$	15.70	17.00	13.75	22.0	22.0
$\angle Bfa$	81.60	79.83	84.25	76.5	76.5
$\angle BSN$	22.70	23.33	21.75	25.0	25.0
$\angle FF$	75.20	77.33	77.00	104.0	104.0
$\angle Ffa$	13.20	18.50	5.25	22.0	22.0
$\angle FSN$	67.50	66.83	68.50	100.0	100.0
$\angle FY'$	37.60	38.00	37.00	6.0	6.0
$\angle FNBo$	52.20	51.50	53.25	81.0	81.0
$\angle FH$	38.56	38.43	38.75	65.5	65.5
$\angle BY'$	50.00	48.17	52.75	49.0	49.0
$\angle BNBo$	38.30	39.17	37.00	44.0	44.0
$\angle BH$	52.28	52.63	51.75	59.8	59.8

turcica of juvenile Koreans.

## 2) Amount of Distances

The growth rate of the sella turcica is as fast as the growth of the other parts of skull, and reaches the skull growth almost at birth. Especially the growth and completion of the sella turcica precede those of any other parts. Therefore, it does not show any correlation with aging. According to Graber<sup>8)</sup> at the age of 8-9, 90%~95% of the growth of the sella is usually completed. From that time on, the growth rate is so slow that the degree of the growth of the sella turcica is not so recognizable.

Therefore, it could be said that the size and the shape of the sella turcica of the adult maintain themselves throughout the whole life of a person without much recognizable changes.

As are presented in Tables, the distances of the sella turcica were not much variable. However, distance (G and H) between the sella and the profile of the face were great in variability when they were compared with the data of the distance of the sella itself. The reason could be that the growth of the sella itself was almost completed at this age but the growth of the face was still going on.

When the male value of the distance of lines G and H were compared with the female value, the male value was greater than the female value. It might be that at this age, the growth of the anterior and posterior cranial base length is greater in male than in female.

### 3) Amount of Angles

It has been said that there are few differences between the picture which was made by discharging the central ray of roentgen and the picture made by usual cephalometric roentgenography when the measured data on each picture were compared. Anyhow, by using the presently used roentgenographic cephalometry and by establishing  $\angle\theta$ , this study could be done anatomically.

The comparison between  $\angle\theta$  and other angles was made, and also morphological observation was made.

$\angle\theta$  of the cephalometric radiograph of the sella turcica could be used as the standard in the morphological analysis of the profile of the skull.

$\angle\text{FNBo}$ ,  $\angle\text{FH}$ ,  $\angle\text{BY}'$ , and  $\angle\text{BH}$  are considered to be significant to see the direction of the growth and growing size of the profile of the skull.

In group III the fact that the  $\angle\text{BY}'$  is greater in female than in male probably indicates that the female mandibular symphysis grows downward.

BY means of  $\angle\text{FH}$  and  $\angle\text{BH}$ , the posterior cranial base length of the skull and the width and the depth of the sella turcica could be compared. The greater the  $\angle\text{BH}$ , the more protrusion of the profile and the more anterior cranial base length than the posterior cranial base length is. This tendency appeared toward the ancient men. Conversely, the smaller the  $\angle\text{BH}$ , the lesser the anterior cranial base length than the posterior cranial base length is. This tendency was appeared toward the modern men.

## V. CONCLUSIONS

The author conducted the study of the sella turcica of 94 subjects by using cephalometric roentgenograph.

On the basis of the data obtained, following conclusions might be drawn:

(1) The frequency of the type of the sella turcica was in the order of group I, III, II, and IV. The number of the group II was only one male and three females. The number of group IV was one female.

(2)  $\angle\theta$  could be a standard as one studies the shape of the sella turcica and the growth direction and the shape of the profile of the skull.

(3) By studying  $\angle\text{BY}'$  the growing direction of the mandibular symphysis could be recognized, and by studying  $\angle\text{BH}$ , the growing direction of the profile could be measured.

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