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Prevalence of STB in Patients with and without CLP in the Mexican Population

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Abstract

Objective: *To determine the prevalence of STB in lateral skull radiographs of patients with and without cleft lip and palate in a Mexican population.*

Materials and Methods: *The sample consisted of 70 radiographs of patients aged 9 to 25 years taken between 2010 and 2019 with cleft lip and palate, and 70 radiographs of patients without cleft lip and palate taken on the same dates at the Cleft Lip and Palate Clinic (CLAYPA). Lateral skull radiographs were used, which were traced on a light box using an ultrafine tip 0.3 mm marker on letter-size acetate sheets of 216 mm x 279 mm. The sella turcica of all patients was measured using different points to determine the length and diameter of the sella, using an Ortho Organizer brand protractor ruler. Analysis of variance (ANOVA) was used to observe the association between variables where p = 0.000.*

Results: *High correlations of STB type III were observed in patients with CLP and, in men, and STB type II is more common in patients without CLP in women, while at the same time, we see that patients with CLP have a reduced sella length compared to those who do not have CLP.*

Conclusions: *We see how STB is related to patients with CLP. Comparing this study with previous research described, it can be observed that most used different study groups; however, many of the data obtained do not differ much from the results of this study.*

Keywords: Cleft Lip, Sella Turcica, Children, Cephalometry, Young Adult

Introduction

The sella turcica is a saddle-shaped bone structure located anatomically on the intracranial surface of the body of the sphenoid bone.

- It is an anatomical reference used as a reference in Orthodontics, to determine the relationship of the maxilla and mandible with the skull and between them in the use of lateral radiographs [1, 2].
- The prenatal and postnatal development of the sella turcica with the pituitary gland are interrelated since the formation of the pituitary gland must be formed before the sella turcica is formed, anomalies of the pituitary gland will affect the morphology of the sella [3].
- Axelsson, described different variations of the sella turcica in his research in a Norwegian population finding 5 different types: An oblique anterior wall, a double contour of the

sella, an irregularity in the posterior part of the dorsum of the sella and a pyramidal shape of the sella, and a shortened interclinoidal distance in the form of a bridge called Sella Turcica Bridging (STB) [4].

Sella Turcica Bridging (STB), is a pathology where the interclinoidal distance is affected by reducing and consequently calcifying [5, 6]. Due to an abnormal development of the anterior and posterior clinoid processes, these bone structures can fuse and form bone bridges [1]. Several studies have found that there is a relationship between variations in the sella turcica and certain dental syndromes and anomalies [1, 7-11]. In the healthy population, STS varies from 1.1% to 13% [12].Alterations in the morphology of the sella turcica can alter the morphology of the pituitary gland and due to this, cause variations in the hormones excreted by this gland [13].

STB can be positively correlated with the impaction of canines by palatines. This may be due to the fact, that, they have a shared embryogenic origin (being the neural crest) between the sella turcica and the canines (including progenitor cells and maxillary/frontonasal/palatal cells) as well as genetic mutations that affect the midface, teeth and the sella turcica. 9 STB has important implications during neurosurgery, as it alters the regional anatomy, Lateral radiographs are a good and more accurate method than cone beam to identify STB [14, 15].

It has been found that there are various prevalences of STB with different syndromes such as Down syndrome, Williams syndrome, or Axenfeld syndrome and in patients with cleft lip and palate [16].

Cleft palate is a failure in the fusion of the maxillary processes, resulting in a cleft in the hard and soft palate. Cleft palates are caused from the fourth week of development, which is when the face develops, where they will appear depends on which processes fail at the time of fusionCleft lip and palate (CLP) in Mexico has a variable incidence between .53 per 1000 births per year and can occur in an isolated, combined, unilateral, or bilateral manner and is caused by genetic and environmental factors. Cleft lip and palate can be only lip, only palate, or unilateral or bilateral cleft lip, and palate, it can affect soft tissues and can be limited to the uvula, only lip is seen in 15% of cases, and only palate in 40%. In the world, the prevalence is approximately 1.7 per 1000 births [17]. This incidence is more associated with people with low socioeconomic status. It is more common in men to have cleft lip and palate in a 2:1 ratio and it is more common in women to have only palate in a male/female ratio of 0.5:1 [18-20].

In a study done on bone maturation using the wrist in people with cleft lip and palate, it was found that these types of people have a more delayed bone maturation in the early stages of development compared to people without cleft lip and palate [21]. At least 94% of patients with cleft lip and palate have some dental malformation and it complicates orthodontic treatment for an average of 3.4 years [22].

The objective of the present study is to determine the prevalence of STS in patients with cleft lip and palate and without cleft lip and palate.

Materials and Methods

A non-experimental, observational, retrospective, and descriptive epidemiological study was conducted. Non-probabilistic and convenience sampling was used in an infinite population, in two groups, one with lateral skull radiographs of patients with cleft lip and palate and the second group with lateral skull radiographs of patients without cleft lip and palate; consisting of 70 radiographs per group, taken in a period from 2010 to 2019 in patients from 9 years to 25 years old and living in the metropolitan area of Monterrey.

First, the sella turcica was traced on the radiographs using a letter-sized acetate sheet of 216x279 mm KronalinE brand with a thin-tip Sharpie marker• on a negatoscope, using a 1:1 magnification for all radiographs, all radiographs were traced by an observer in a dark room tracing a maximum of 10 per week. Every 50 x-rays drawn, 10 were selected at random and re-drawn to check for any relevant discrepancies to avoid errors. After this, the different points were selected, which were: Dorsum of the Sella (DS), Tubercle of the Sella (TS), Posterior Part of the Sella (PS).

Finally, the Length of the Sella was measured: Distance from TS to PS and the Diameter of the Sella: Distance from PS to TS.

All the data obtained was recorded and after this, all the results were entered into Microsoft Excel then, finally, to classify the STB, the Leonardi method was used in his 2006 which consisted of [23]:

- If the length of the sella is greater than or equal to ¾ parts of the diameter of the sella, it would be considered type I (no calcification)
- If it is less than or equal to ¾ parts of the diameter of the sella, it would be considered type II (partially calcified)
- Type III (totally calcified) for a radiographically visible diaphragm.

All the data obtained from the patients were processed in the SPSS program, obtaining different statistics and looking for some type of relationship with the STB with gender, age, and whether or not they had CLP.

In cases where there was a class III x-ray, the sella length was automatically taken as 0 because a point from the dorsum of the sella to the tubercle of the sella from which to measure could not be defined.

Among the inclusion criteria were x-rays of patients of both genders between 9 and 25 years of age who had cleft lip and palate, whether or not they had undergone surgery for the CLP group, and the second group had the same characteristics, but without CLP or with orofacial diseases.

Among the exclusion criteria were x-rays where the sella turcica could not be seen, or patients who had orofacial diseases.

Results

The diameter and length of the sella were measured on radiographs of 140 patients, 70 with cleft lip and palate and 70 patients without cleft lip and palate. The average age of the patients with cleft lip and palate and without cleft lip and palate

was 13.34 years and 13.57 years, respectively. The distribution of patients by gender and for each group can be seen in Figure 1. In total, there were 31 women and 39 men in the CLP group, and in the non-CLP group, there were 41 women and 29 men.

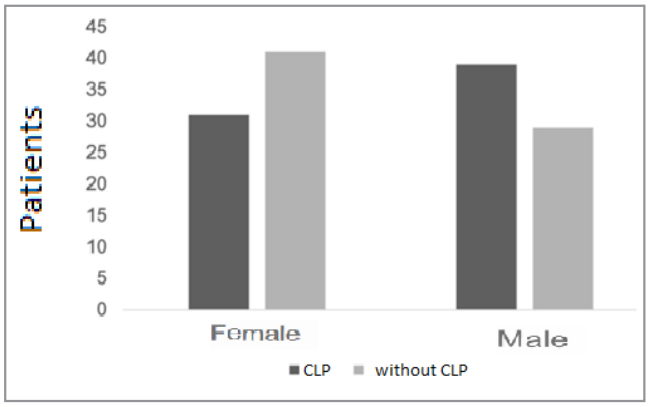

Figure 1: Gender distribution of patients with and without CLP

Figures 2 and 3 present box plots of sella length and sella diameter, respectively, segregated by gender. It can be observed in both figures that sella length has a greater dispersion than sella diameter.

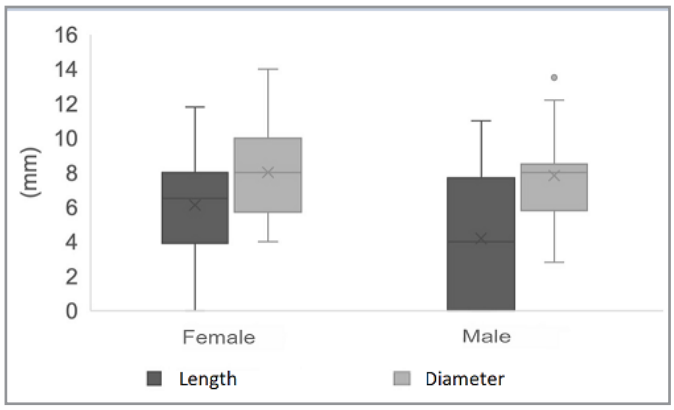

Figure 2: Box plot for patients with CLP, where X is the mean and ° are the outliers.

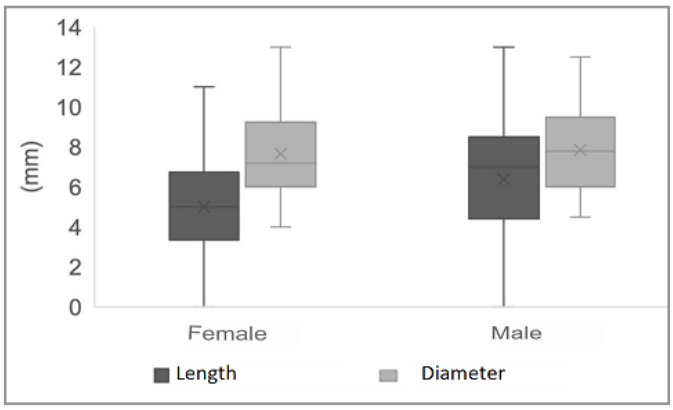

Figure 2: Box plot for patients with CLP, where X is the mean and ° are the outliers.

Table 1 shows the number of cases by type of STB class with and without CLP for each gender. It can be observed that, in all cases, class I was the one with the highest number of patients. We can observe how class III is significantly higher (24.3%) in the CLP group than in the group without CLP (11.5%). By group, we see that in the group with CLP, 34 people (48.6%) have a non-calcified type I sella turcica, 19 (27.2%) have partially calcified type II, and 15 (24.3%) fully calcified type III. In the group without CLP, we see that 41 people (58.6%) have type I, 21 (30%) type II, and 8 (11.5%) type III.

Table 1: Number of cases by gender and class for each study group.

Group	Sex	I N (%)	II N (%)	III N (%)
CLP	Female	18 (25.7)	10 (14.3)	3 (4.3)
	Male	16 (22.9)	9 (12.9)	14 (20.0)
Non CLP	Female	21 (30.0)	14 (20.0)	6 (8.6)
	Male	20 (28.6)	7 (10.0)	2 (2.9)

Variance analyses (ANOVA) were performed to compare patients with and without CLP. The categories used for comparison were: all patients, by gender, and by STB class type. No statistically significant differences were found when analyzing all patients in

the length of the sella or in the diameter of the sella. Likewise, there were no significant differences between the genders between both groups for any of the variables.

Finally, significant differences (p value = 0.000) were found for the length of the sella evaluated between the STB classes for both groups of patients: with CLP and without CLP. Class I had the highest mean in both cases. The means by class for each group of patients, as well as their confidence intervals are shown in Table 2, in Table 3 we see it with standard deviation, and in Table 3 distributed by gender.

Table 2: Comparison for sella length between CLP and non-CLP by class, with confidence interval.

Group	Type I		Type II		Type III	
	Mean (mm)	ICa (mm)	Mean (mm)	IC (mm)	Mean (mm)	IC (mm)
CLP	7.62	(6.92, 8.32)b	4.83	(4.00, 5.87)	0.00	(-0.99, 0.99)
Non-CLP	7.25	(6.72, 7.79)	4.41	(3.55, 5.16)	0.00	(-1.21, 1.21)

aIC is the confidence interval; b (minimum, maximum)

Table 3: Comparison for sella length and sella diameter between CLP and without CLP by class, with their standard deviation.

Group	Variable	Type I	Type II	Type III
		Mean ± DS (N)	Mean ± DS (N)	Mean ± DS (N)
CLP	Sella Length	7.62 ± 2.35 (34)	4.93 ± 2.35 (19)	0.00 ± 0.00 (16)
	Sella Diameter	7.93 ± 2.39 (34)	8.16 ± 2.54 (19)	7.39 ± 2.60 (16)
Non-CLP	Sella Length	7.25 ± 2.02 (41)	4.41 ± 1.31 (21)	0.00 ± 0.00 (8)
	Sella Diameter	7.83 ± 2.28 (41)	7.11 ± 1.79 (21)	8.88 ± 1.48 (8)

In Table 4 we can see the studies of the length of the sella and its diameter comparing the sexes studied by class.

Table 4: Comparison for sella length and sella diameter between CLP and non-CLP by class, and gender with their standard deviation.

Group		Sex	Type I Mean ± DS	Type II Mean ± DS	Type III Mean ± DS
CLP	Sella Lenght	Female	7.92 ± 2.16	4.70 ± 2.10	0.00 ± 0.00
		Male	7.29 ± 2.58	5.19 ± 2.68	0.00 ± 0.00
	Sella Diameter	Female	8.26 ± 2.42	8.04 ± 2.26	6.47 ± 3.44
		Male	7.57 ± 2.37	8.30 ± 2.94	7.80 ± 2.51
Non CLP	Sella Length	Female	6.77± 1.90	4.50 ± 1.10	0.00 ± 0.00
		Male	7.77 ± 2.07	4.23 ± 1.76	0.00 ± 0.00
	Sella Diameter	Female	7.64 ± 2.31	7.28 ± 1.78	8.58 ± 1.43
		Male	8.04 ± 2.30	6.77 ± 1.90	9.75 ± 1.77

In Table 5 we see only the average length and diameter of the sella in groups with CLP and without CLP, without making class distinctions.

Table 5: Average comparison of sella length and sella diameter between CLP and non-CLP with standard deviation.

Group		Mean ± DS
CLP	Sella Lenght	5.04 ± 3.69
	Sella Diameter	7.91 ± 2.46
Non CLP	Sella Lenght	5.57± 2.93
	Sella Diameter	7.73 ± 2.11

In the group with CLP, 27.2% had partially calcified type II and 24.3% had totally, calcified type III, giving a total of 51.5% with some type of STB and a normal sella in 48.6%; in the group without CLP, we see that 30% had type II and 11.5% had type III, giving a total of 41.5% with some type of STB and a type I sella in 58.6%.

Complete calcification in our study in people without CLP was 2.9% in men and 8.9% in women; partial calcification in women was 20% and 10% in men; in type I sella, 28.6% in men and 30% in women.

In people with CLP, men presented 20% of type III and 4.3% of

women, and partial 12.9% and 14.3% of women, while for type I sella, men presented 22.9% and 25.7% of women.

The average proportions of the sella in length and diameter were 5.04 mm and 7.91 mm for the group with CLP and 5.57 mm and 7.73 mm for the group without CLP, respectively.

Discussion

In comparison to our study, we obtained very similar results to those of Al-Mohana with the Yemeni population in prevalence of type I and III.In another study in the Chennai population, there was a prevalence of 11.5% of STS type III [24]. Which is equal to our study population without CLP.

In a study in the Czech Republic found that people with STS type III are found in 18.3% in subjects with palatal impacted canines compared to the control groups in 8.3% [25, 26]. Very similar results to ours of STS type III.

Karaman, Cigerim, and Kechaiga, from Indonesia, conclude that type II STS is more common in women 66.7% than in men 33.33% and type III STS is more common in men 52.6% than in women 47.4% in people with dental anomalies, if we compare it to our group with CLP we would have the same conclusions, however, in groups without CLP this is not the case. In the general group without distinction of sex, we have that 36.2% were Type I, 33.7% Type II, and 30.1% had Type III; although we also had very similar results in prevalence, of Type II without CLP compared to their study group [27].

In another study in New York 15, they made a comparison with CBCT and lateral skull studies of STS. For type I, type II was found in 45.4%, 37.8%, and type III in 16.8% lateral skull radiographs. However, in CBCT the results were different since they were measured from the left and right side of the sella turcica, for type III in CBCT it was only present in 5.8% of the cases.

However, it should be noted that they measured the STB in a different way, since they used another method with the interclinoidal distance instead of the diameter of the sella. When comparing it with the length of the sella, we obtained very similar results in the 3 types of STB with the Indian study by Siddangalippa et al. It should be noted that we used exactly, the same measurement method.The studies by Agani and Dinçer [28].

In the Turkish population, they evaluated changes in STB in pre-pubertal and post-pubertal growth spurts. For pre-pubertal patients, 84.2% were type I, 5.3% were type II, and 10.5% were type III. For post-pubertal patients, 54.7% were type I, 33.33% were type II, and 12% were type III. In our study, we did not divide the patients into age groups. However, we obtained very similar results to Agani and Dinçer in general for their group of post-pubertal patients.

Conclusions

STB is a little-known pathology where it is not yet known if there is an affectation in people except that it is closely related to patients with malformations in the number, size, and shape of teeth and in retained teeth. In the present, study it was found that people with cleft lip and palate are more likely to have STB type II and III than those who do not have it. It is suggested to do more research on STB to see if growth hormones are affected.

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