Introduction

Symptoms and signs of ankyloglossia with deviation of the epiglottis and larynx (ADEL) in babies include crying hard, inability to suckle during breastfeeding, frequent suffocation during suckling, low temperature and cold extremities, pale aspect, dark shadows under the eyes, and stiff joints. They do not sleep well in the beds but tend to sleep better while cuddled, moving in cars, or while sucking their thumbs.

Infants with ADEL tend to be timid and irritable, have difficulty in playing alone, have the habit of thumb sucking, have shallow sleep patterns and tend to move frequently while sleeping. Adults with ADEL tend to feel fatigue, they frequently do not feel they slept well, they have stiff shoulders and lumbago. The symptoms and signs outlined above can be caused by respiratory insufficiencies and may be related to the tongue and to the epiglottis and larynx pulled up and forward [1-4].

Symptoms and signs of ADEL disappear after cutting several bundles of genioglossus muscles under the oral cavity as the deviation of the epiglottis and larynx can be corrected in this way. This procedure is named correction of the glosso-larynx (CGL) [5,6]. Immediately after the procedures, in babies the skin changes from pale and cold to pink and warm, crying sounds change become clearer bright and their joints change become softer. Eye contacts well and cheerful lough occur more easily.

Important improvements are observed in infants and adults, especially as related to sleep. Moreover, improvements in respiratory functions and body temperature are observed. These changes are important as they can translate into physical and mental improvements, lowering the effects of potential stresses and infections [7,8].

Previous studies showed that respiration can be inhibited in patients with ADEL and that it can be improved following CGL. These outcomes may be related to positional changes of structures in the neck, specifically changes in the hyoid bone complex (HBC), which is supposed to play and important role in respiration and swallowing [9].

In this study the author assessed movements of the hyoid bone before and after CGL by using Y-ray Photographs (XPs) to assess the mechanisms at the level of HBC that may be related to the improvements observed following CGL and, specifically, to test the hypotheses that the hyoid bone tends to move downwards and forward following CGL.

Cases and Method

A total of 190 patients (117 females, 73 males; 17 to 78 years old (yo), average 40.1 yo) that underwent CGL from 2013 to 2015 were studied by using XPs before and after CGL. To assess possible positional changes in the hyoid bone, two measures were extracted from XPs and compared before and after CGL. Namely, the height of point V and length of segments VH (Figure 1) as defined in detail in the followings. A horizontal line was drawn to connect the outer most part of the hyoid bone (point H) to the vertebrae (point V) and to compute the distance between the two points (length of segment VH), as shown in Figure 1.

To define the height of point V along the vertebrae, four possible positions were considered on each vertebrae: the upper part (e.g., IIIup), the central part (e.g.,III), the lower part (e.g.,IILdn) and the joit between two vertebrae (e.g.,III/IV).

Possible differences in mean height of point V and mean length of segment HV in the study sample before and after CGL were assessed by using a contingency table (StatView) and Student t-test (Microsoft Excel). Values of p lower than 0.05 were considered statistically significant.
Results

Distributions of the height of point V observed before and after CGL in the study sample are shown in Figure 2. The figure shows that, overall, the height of point V ranged from the central part of third vertebra (III) to the central part of the fifth (V) vertebra both before and after CGL and that there was a clear tendency for the distribution to the shift towards lower vertebrae following CGL. The median value observed before CGL was the third vertebra whereas the median value following CGL was upper fourth vertebra. A significant difference was observed between two distributions ($\chi^2 p<0.0001$), suggesting a downward shift in position of point V following CGL.

The average lengths of segment VH before and after CGL was 4.4cm and 4.7cm respectively (Female 4.1 cm and 4.4 cm, Male 4.9 cm and 5.2 cm) (Figure 3). There was a significant difference between the distribution of length VH before and after CGL ($p<0.0001$), suggesting an increase in distance between the hyoid bone and the vertebrae following the procedure.

Discussion

Phylogenetically the hyoid bone moves caudally in vertebrates. In fishes the hyoid bones is in the head with the jawbones. The hyoid bones of amniota evolved from the second to the fourth pharyngeal arch. They tend to move downwards. The anterior horns of the hyoid bone of cats and dogs are long and consist in four parts. Their dorsal of anterior horns extend at the tympanic bulla, and correspond to the lesser horns of humans [10-12].

The hyoid bones of humans are attached to the stylohyoid ligaments that originate from stylohyoid processes. Muscles attached the upper and lower edge of the hyoid bone are different from those attached to common bones. The thyroid cartilage is attached to the outer edge of the hyoid bone by the thyrohyoid ligament. The thyroid cartilage encircles the larynx together with the cricoid cartilage. The HBC includes the hyoid bone and the thyro-cricoid cartilages and is able to move. For example, the upright position of neck and mobility of HBC are associated human speech production [9,13,14].

This study showed that the hyoid bone moved downwards of about one vertebra and ventrally of about 0.3cm following CGL. These outcomes may be interpreted in light of the observed improvements following CGL in individuals with ADEL.

In fact, disappearance of symptoms and signs of ADEL following CGL, for example, increased respiratory function and body temperature may be related to downward and forward movements of the HBC that might accelerate physiological functions. More generally, evidence suggests that the HBC can play a role not only in respiration and swallowing, but also in circulation, general metabolism and immune function.

I compared the length of the stylohyoid process of a copy of skull of Homo Neanderthalensis and skull of Homo Sapiens. The former is very short than the latter. Analysis of copy of Homo Neanderthalensis skull appeared to confirm this as the hyoid bone of Homo Neanderthalensis is higher than that of Homo Sapiens [15,16]. Therefore, the HBC of H. Neanderthalensis might be shorter and as a result the movements might be more limited. Related to this, the metabolisms of H. Neanderthalensis have been lower than that of the H. Sapiens, possibly contributing to higher chances of death, compared to H. Sapiens.

Conclusion

There exists a complex in the neck that plays a role in respiration and swallowing. It is named hyoid bone complex (HBC). In addition to respiration and swallowing, it also influences circulation, metabolism and immune function. In general, upward forces on the HBC may inhibit respiration and may also induce accidental swallowing whereas downward forces may not only improve respiration and swallowing, but may also accelerates metabolism. ADEL inhibits respiration in children and adults.

There is evidence that the symptoms and signs of ADEL can be improved following CGL. Moreover, the hyoid bone tends to move downwards following CGL as shown by this study. Specifically, analysis of XPs in 190 cases that received CGL showed that the hyoid bone moved downward of about one vertebra and forward of 0.3cm. These outcomes may be related to
the improvements observed following CGL. Specifically, movements of the HBC following CGL may improve physiological functions and systemic activity.

References

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