

Impairment of the oral stereognosis in the partial anterior open bite

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The study was performed in 20 children with partial anterior open bite and in 20 children of a control group. Stereognosis was evaluated on the basis of correct recognition responses to silicone pieces of the different shapes. Pieces were put on the dorsal surface of the tongue close to its apex. It was evident that the stereognostic ability was impaired in children with anterior open bite. This ability also decreased after infiltration anaesthesia of the tongue. The study indicated that the tongue plays an important role in oral stereognosis.

Key words: oral stereognosis, dental status, open bite, tongue

INTRODUCTION

Stereognosis is the ability to recognise the shapes of objects and is a component of the epicritic sensations which involve fine aspects of touch and include the ability to identify the position that is touched (topognosis), discern vibration and determine its frequency and amplitude, and also to resolve by touch spatial details such as the texture of surfaces and two-point discrimination. Stereognosis measures the ability of cognitive processes in the brain, and the somatosensory information necessary for stereognosis is processed in parallel in the primary and associational sensory cortical areas [6, 7].

Oral tactile information is conveyed through the trigeminal nerve [11]. The trigeminal afferent system is organised to serve both the general and the unique somatic sensory functions of the complex area which includes the facial skin, the cornea, the musculocutaneous tissues bounding the mouth and nostrils, the oral and nasal mucosae, the tongue and teeth and the muscles of mastication [5].

In vertebrates ranging from fishes to non-primate mammals the predominant sensory function

of the trigeminal system is the exploratory function of the face and mouth. In higher mammals, particularly in primates, other specialised sensory functions are taken over by the trigeminal system.

The most highly developed and most complex function assumed by the trigeminal system is its role in speech in humans. In this function both the slowly acting extrinsic muscles of the tongue and the more rapidly acting intrinsic lingual muscles are involved [11].

It is known that the tactile sensitivity of the oral mucosa differs considerably in different parts of the mouth and that spatial gradation of this sensitivity exists [10]. An important role is played in tactile sensory mechanisms and thermal sensory mechanism by the tongue, which is especially responsive to textural and two-point discrimination [5].

General and local pathological processes impair the stereognostic ability of the tongue. This ability has been tested in different ways with different outcomes [11, 13].

The aim of the present study was sensory testing of the tongue in children with partial anterior open bite.

MATERIAL AND METHODS

The study was performed in 20 children (16 girls and 4 boys, aged between 7 and 16 years) with partial anterior open bite and abnormal tongue position during deglutition (Figs.1, 2). The control group consisted of 20 children (14 girls and 6 boys of the same age).

Stereognostic investigation was made with a set of silicone pieces of different shapes (square, circle, semicircle, triangle) according to the standardised test procedure of Berry and Mahood [1]. The pieces were 12 mm in diameter and 3 mm in thickness. Observations were carried out by one examiner. Pieces of different shapes were put on the dorsal surface of the tongue 1 to 2 cm from the apex. The patients tested identified pieces and recognised them on a photograph and in words. Two tests were performed in each case, one without anaesthesia and one after administering 5% anaesthetic gel (Lidogel). The time limit for identification was 60 s. Responses were classified as one of two kinds. The correct and incorrect responses received scores of 1 and 0 respectively. Statistical analysis was made using the Statistica PL v.6.0 program.

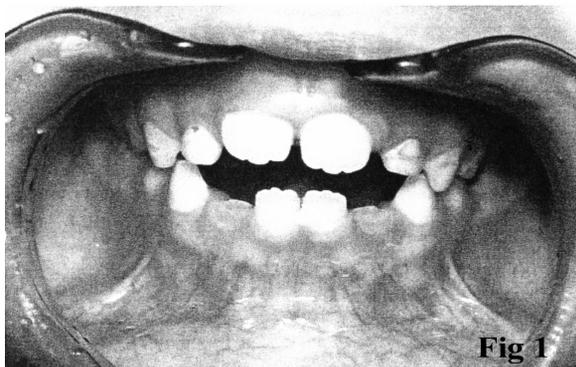


Figure 1. Tooth occlusion in the partial anterior bite.

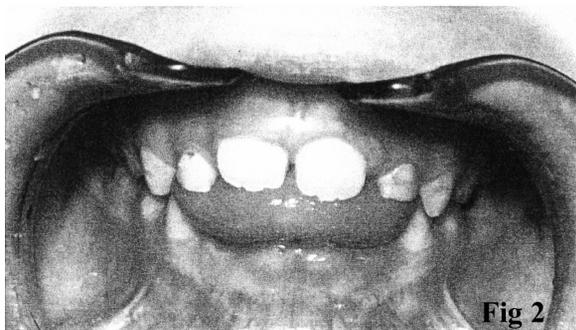


Figure 2. Tongue thrust during swallowing.

RESULTS

In general, a higher percentage of correct responses in recognition of silicone pieces were recorded in children from the control group (Fig. 3). In this group the time needed for identification of particular pieces was also shorter as compared with children with open bite (Fig. 4). It was found that the form of a test piece has a great influence on the quality of response and on the time needed for a given test in both groups of children under investigation (Figs. 5, 6).

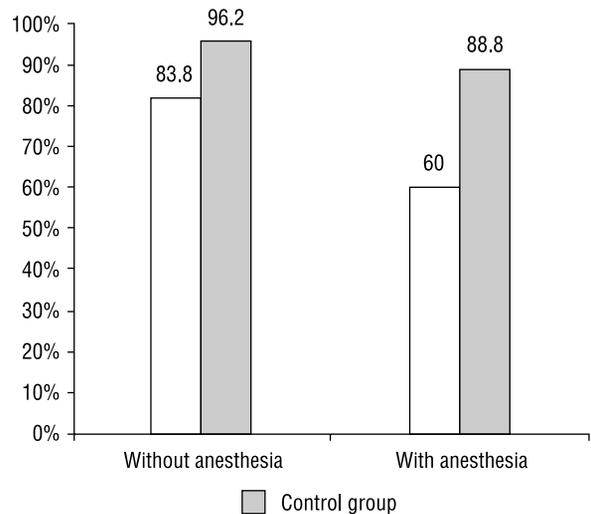


Figure 3. Diagram showing the percentage of correct responses in children with partial anterior open bite and in children of the control group.

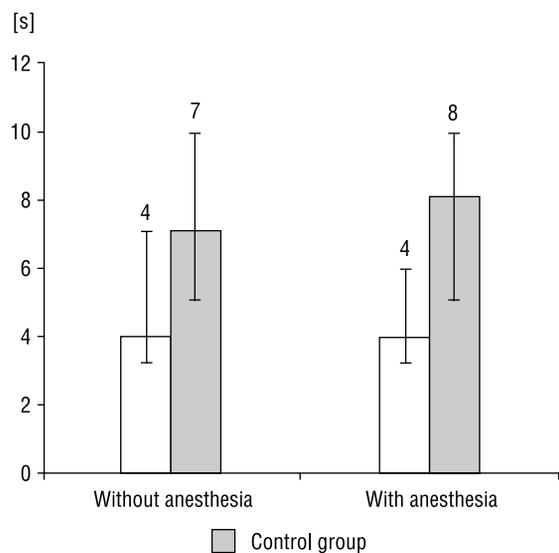


Figure 4. Diagram showing the time needed for recognition of silicone pieces in children of both groups.

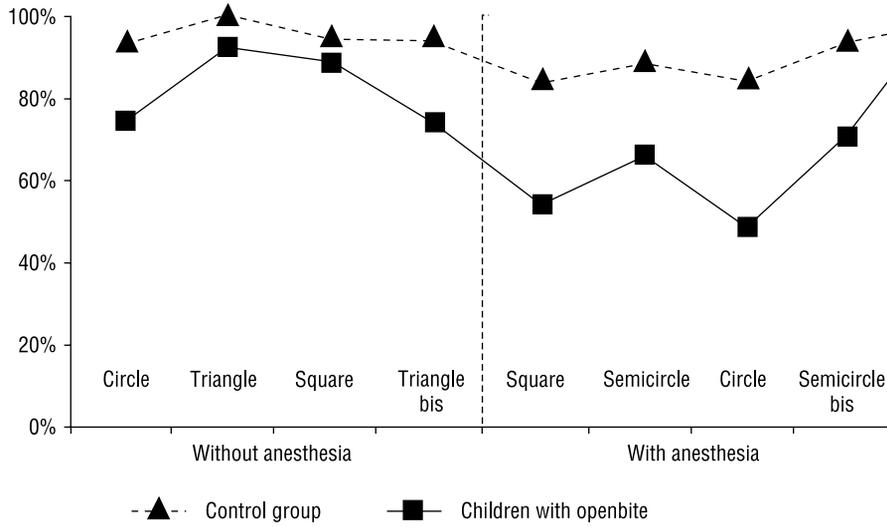


Figure 5. Diagram showing percentage of identification of silicone pieces of different shape in children of both groups.

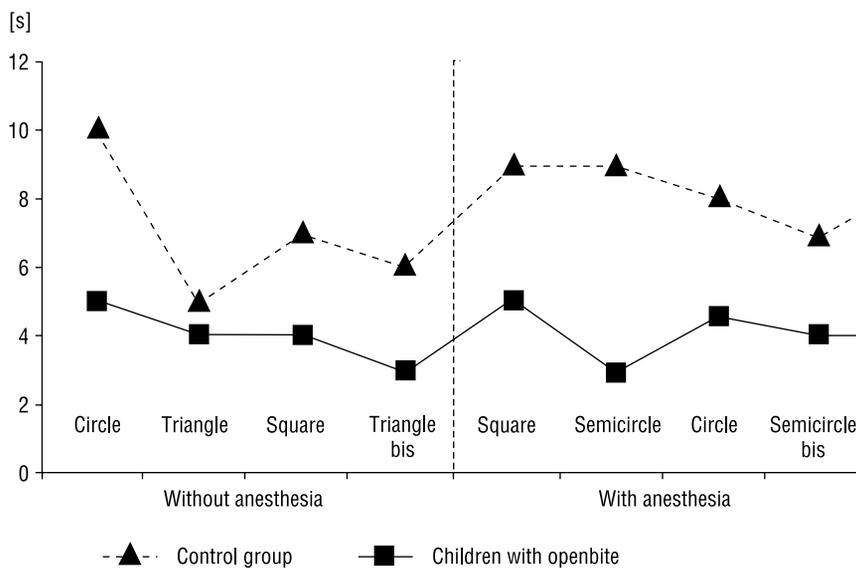


Figure 6. Diagram showing time needed for identification of silicone pieces of different shape.

It was evident that in children with anterior open bite and in children of the control group the triangular pieces were most often identified and in both groups the highest percentage of correct responses was noted in identification of these pieces. Stereognostic ability decreased by about 20% after infiltration anaesthesia of the tongue. The most difficult pieces for both groups to identify were the circular ones. Identification of these pieces also required more time in comparison to triangles and squares.

Our study showed that the tongue plays an important role in impairment of oral stereognostic ability. In patients with open bite the tongue is not properly located and its motor activity is reduced.

DISCUSSION

Colleti et al. [3] and Dahan [4] noted that thrust of the tongue between the incisors impairs the stereognostic ability of the oral cavity.

From the study performed it is evident that the shape of the object has a substantial effect on the stereognostic ability of the tongue and the same is true for sensation from the skin [8, 12, 14].

Assessment of the threshold for detection and two-point discrimination demonstrate a spatial gradation of the sensitivity of the oral mucosa, with the greatest acuity near the lips and a progressive falling-off towards the pharynx [9]. The tongue and palate do not entirely conform to this anteroposterior sensory pattern. The tip of the tongue is especially responsive, the contact threshold (10 mg), two-point discrimination (1.7 mm) and textural discrimination all being comparable to similar measures of tactile acuity at the finger tip [5, 10]. Tactile activity tapers off along the body of the tongue, especially on its ventral surface. Thresholds for detection of light touch are lowest on the tip of the tongue and hard palate [2]. This spatial gradation of thresholds is related to innervation density.

The present study showed that after anaesthesia of the tongue its stereognosis ability decreases. This confirms morphological investigations of innervation density. The study also demonstrated the important role of the tongue in stereognosis and impairment of this sensation in children with anterior open bite.

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