The Design of a New Type of Surgical Forceps for Ankylotomy

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Abstract. In view of the existing clinical problems, we designed a new type of surgical forceps for ankylotomy. Through expounding the structure of the forceps, we analyzed the design and application principle. Using the novel forceps, we can fully expose the mouth floor and fix the tongue body well. The new type of surgical forceps is simple in structure, scientific in design and convenient in use.

1. Introduction

The suitable ankylotomy time is in the children of about 2 years old. The existing techniques were often to pull the central of the front tongue with suture, clamp lingual frenum with vascular clamp and lift up[1], which were existed poor tongue body fixing, pain for children, inadequate exposure of the mouth floor, even more unnecessary surgery risk to children[2-3]. In view of the problems existing in the available technologies, scholars had designed different surgical instruments for ankylotomy such as "surgical retractor for ankylotomy [4]", "surgical clips for ankylotomy [5]", "hemostatic forceps for ankylotomy [6]", etc. to improve the surgical operation. Xuesong Chen[7] had used the self-made tongue traction hook for ankylotomy in clinic so that the exposure of the operative field was clearer. According to the clinical needs, we designed a new type of surgical forceps for ankylotomy. We introduce the novel instrument as follows.

2. Materials and Method

2.1. The Structure of the New Type of Surgical Forceps for Ankylotomy

The novel instrument (figure 1) consists of plier mouth and plier handle. The plier mouth is composed of the left and right plier plate with shallow concave blade shape, which conform to the shape of the tongue abdomen on both sides of lingual frenum. The plier handle consist of axle pole, connecting pole, shank pole and ring shank. A plier joint is bonded between the two axle poles to fix the space of the two axle poles. The two axle poles and the plier joint constitute a revolute pair. An included angle \( p \) is formed between the left plier plate or right plier plate and the plane produced by the left and right axle poles; An included angle \( q \) is formed between the plane produced by the left and right axe poles and the plane produced by the left and right connecting poles; An angle \( s \) is formed between the plane produced by the left and right connecting poles and the plane produced by the left and right shank poles; An angle \( t \) is formed between the plane produced by the left and right shank poles and the plane...
produced by the left and right ring shanks. Through these different included angles, the plier handles were designed a multi-section curved arc structure to conform the curvature of the maxillary. The left and right connecting poles are also provided with a positioning mechanism that can lock the distance between the connecting poles in at least one location or unlock the place. The positioning mechanism consists of a left and right tooth plate and a homing spring.

Figure 1. Schematic diagram of the new type of surgical forceps for ankylosis. 1) plier mouth 1) plier plate 2) plier handle 21) axle pole 22) connecting pole 23) shank pole 24) ring shank 3) plier joint 4) positioning mechanism 41) tooth plate 42) homing spring. Included angle p, included angle q, included angle r, included angle t

2.2. The Use of the New Type of Surgical Forceps for Ankylosis

The specific usage is as follows: (1) During surgery, hold the ring shank in hand to release the positioning mechanism. (2) The left and right plier plates are placed directly under the abdomen of the tongue on both sides of the lingual frenum to make maximum contact between the plates and the tongue. (3) Then close the ring shank to turn the lateral side of the left and right plier plates from outward to upward and inward, thus holding both sides of the tongue to turn upward and curl. (4) When the appropriate state is reached, the positioning mechanism is locked to fix the clamping state of the tongue body. (5) After that, pull up the ring shank and pull in direction with the curvature of the maxillary to lift the whole tongue so that the mouth floor is completely exposed. (6) After operation, release the lock and remove the two plier plates.
3. Result
As the blade-like plier plates being placed on both sides of the abdomen of the tongue and being turned from outward to upward and inward, the tongue body are fixed well and the mouth floor is completely exposed, which is facilitative for surgical operation. The handles of this forceps with multi-section curved art structure conforming to the maxillary shape are convenient for the operator to hold comfortably.

4. Discussion
Ankyloglossia not only will limit the movement of the tongue and affect the speech of children[1], but also cause the lactation difficulties such as nipple pain or trauma which are one of the most important factors affecting breastfeeding[8]. As we know, breastfeeding plays an important role in infant growth. Some studies[9] have shown that performing ankylo tomy for these children with ankyloglossia has a significant effect on alleviating the difficulty of lactation and improving the quality of lactation.

The sufficient exposure of the mouth floor and the good fixation of the tongue body are important factors for the success of ankylo tomy. The majority of surgical patients are around 2 years old, and their compliance and self-control are relatively poor. So, during operation, the tongue body often appears involuntary activities, which greatly affects the operation performing smoothly. Using existing instruments such as vascular clamp, on the one hand, the whole tongue body can not be well fixed which will greatly increase the risk of surgery and surgical time, even can cause bleeding, infection, the submandibular gland duct injuries, asphyxia and other serious complications[2-3], on the other hand, can cause surgical correction of lingual frenum uncompletely, even requiring reoperation, especially for the children with serious ankyloglossia[10].

Compared with the existing surgical instruments, the novel surgical forceps for ankylo tomy with blade shape of plier plates which will get the contact with the tongue body at the largest area can ensure the good fixation of the tongue body and the full exposure during operation. The pliers handles are designed according to the principle of ergonomics in a curved arc structure which conform to the maxillary shape. By reasonably being designed the length of connection pole and the angle between axle pole, connecting pole, shank pole and ring shank, the handles of this forceps are convenient for the operator to hold comfortably. Therefore, the new type of surgical forceps for ankylo tomy in this paper can make up for the shortcomings of the existing instruments, such as poor tongue fixation, insufficient exposure of the mouth bottom, incomplete surgical resection, etc., so as to ensure the safe and successful operation and shorten the operation time.

5. Conclusion
To sum up, the new type of surgical forceps for ankylo tomy in this paper is simple in structure, scientific in design and convenient in use, and has been granted the invention patent of People's Republic of China[11]. The clinical application of the forceps needs to be further carried out for clinical application early.

6. References
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