# Ankyloglossia Surgical Treatment: Electrocautery Frenectomy or Frenuloplasty: A Randomized Clinical Trial

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## Abstract

**Introduction:** Ankyloglossia characterized by mild to complete mucosal bands whereby the tongue is tied to the floor of the mouth. This oral anomaly can affect nutrition, speech and oral hygiene, and mechanical/social effects.

**Materials and Methods:** This study was a randomized clinical trial conducted in Tabriz Children's Hospital. All patients were randomly divided into two groups, group A and B, each of which included 20 patients. The electrocautery frenectomy under local anesthesia and simple frenuluplasty under general anesthesia was performed for the patients of A and B groups, respectively.

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**Results:** The patients were evaluated on the first day after the operation in terms of inflammatory signs and symptoms, on the seventh day after the operation in terms of wound healing and any complications, and one month after the operation in terms of scarring and wound contraction.

Nothing by mouth (NPO) time was only 1 hour for electrocautery frenectomy and no need for general anesthesia. There were no postoperative complications (e.g., erythema and eczema) in group A, and only one infant (i.e., 5% of the population) showed symptoms of fever in this group. In group B, on the other hand, 10% of the population showed signs of erythema, and 26% showed signs of eczema at the incision site after the surgery. Speech status was improved in all cases in the electrocautery group.

**Conclusion:** It seems that the frenectomy with electrocautery has better results in terms of short surgery time and postoperative complications compared to the traditional surgical method.

## Keywords

- Ankyloglossia
- Tongue tie
- Frenectomy
- Electrocautery

## Introduction

Ankyloglossia or tongue tie is a common congenital abnormality which the frenulum of the tongue is abnormally short and stiff (posterior ankyloglossia) or is abnormally attached to the ventral surface of the tongue (anterior ankyloglossia). The exact cause of the tongue tie formation is not known, but it is likely caused by excessive growth of the oral mucosa covering the anterior two-thirds of the tongue (i.e., the mobile part of the tongue).[1-2] Despite the various conditions and variable restrictions in ankyloglossia, it is not easy to identify and define it accurately, but its prevalence among infants, based on statistical studies, is reported to be 4-5%. According to the studies, the ratio of its occurrence in male babies compared to female ones is 3 to 1.[2]

There is no definitive criterion for diagnosing ankyloglossia; however, several studies have identified the length of the lingual frenulum, the range of motion of the tongue, the thickness of the fibrous membrane, and the heart-shaped state of the tongue when it is pulled out as the relevant diagnostic criteria.[3] Although this congenital abnormality is seen in isolation in completely healthy infants, there is evidence that it is related to congenital syndromes such as Ehlers-Danlos syndrome, Simosa syndrome, Beckwith-Wiedemann syndrome, and X-linked cleft palate. Furthermore, reports have indicated that the risk of its occurrence is increased by three times when mothers use cocaine during their pregnancies.[4]

Basically, there are concerns that the restriction of movement in a baby's tongue, especially to take it out, results in his/her inability to suck the breast and feed properly, which in turn causes speech problems, problems with the teeth (in terms of aesthetics), and problems with health and oral hygiene in the future.[5] In addition, the problems of a lactating mother in breastfeeding her baby can lead to a complete lack of milk in her breast, damage to her nipple, and, therefore, premature weaning of her baby and inappropriate weight gain.[6]

Due to the common concerns and complications of ankyloglossia, several surgical methods have been developed and used to solve this problem in recent decades. The most common method is a simple cut in the frenulum, which is done without stitches or repairing the remaining tissues. This procedure is usually performed on an outpatient basis without anesthesia or with local anesthesia.[7] Various tools (e.g., sterile surgical blades or cauters) can be used to cut the frenulum. After making the initial incision in the frenulum, the rest of the separation is performed by adopting the blunt method and placing a sponge device under the tongue, and pressing it to the ventral side of the tongue.[8] In this method, the side veins of the frenulum remain undamaged, and the base of the tongue muscle is not pressed.[9] In this method, moreover, extensive bleeding is often prevented, and there is no need to perform suturing. If the tongue muscle is seen, however, it should be covered with mucus.[9] Other methods have also been developed to reduce the possibility of scarring after the surgery and the recurrence of ankyloglossia. These methods have been designed based on

plastic surgery techniques, and they aim at repairing the mucosa so that scarring or contracture in the tissue is avoided.[10] The simplest frenuluplasty technique is vertical-horizontal frenuluplasty. The Z-frenuluplasty method with two or four flaps is a technique basically employed to further reduce the complications such as eating scars. These procedures are performed under general anesthesia.[11-12] Although a variety of methods is available for treating ankyloglossia, there is no agreement on the indications as well as the appropriate time and type of the selected surgery. No scientific literature is available on the exact time for intervention for ankyloglossia; however, it is generally recommended that an intervention should be made before a child begins to speak and pronounce the words.[11]

Taking into account the results from different studies, all intervention methods have certain advantages and disadvantages. This study aimed to determine the best possible method of tongue tie surgery by comparing invasive surgery methods and minimal invasive electrocautery removing tongue tie. Our study results may have provided a criterion for selecting the most appropriate and tolerable method for intervention in ankyloglossia patients, reduced need for anesthesia, and postoperative complications, and reduced the need for hospitalization due to the surgical complications or the language-related functional consequences in the hospital.

## Materials and Methods

This randomized clinical trial aimed to determine and compare the complications and outcomes of the frenectomy by surgical procedure and electrocautery in infants with ankyloglossia in Tabriz Children's Hospital between 2020 and 2021. Informed consent was obtained from all subjects before inclusion in the study. This study was approved by the research ethics committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1400.634) and the Committee for Ethics of Medical Experiments on Human Subjects and was conducted in accordance with the principles of the Declaration of Helsinki.

The research population included infants with ankyloglossia or tongue-tied problems who were referred to the surgical clinic of Children's Hospital affiliated to Tabriz University of Medical Sciences. The samples consisted of 40 infants meeting the inclusion criteria, which were an indication

of surgical intervention, the presence of a problem in sucking the mother's breast, a clear movement restriction in tongue movements, parents' consent, and a definitive diagnosis supported by history and clinical examination. The age range of patients is from three months to two years. Infants with parents reluctant to continue treatment at any stage, infants with other syndromic problems or anatomical anomalies in the oral cavity (cleft palate), those with coagulation problems, and those with neonatal infections (oral and respiratory) were excluded from the study . The patients were randomly selected by care providers, and the disease was diagnosed based on the clinical examination and the parents' history. Patients were then randomly divided into two groups, A and B. To group A, the electrocautery frenotomy method was applied by using 5% lidocaine spray for local anesthesia under the same standard and equal conditions. During the operation, a cut was made on the frenulum to the floor of the tongue using a cautery, and the movement of the tongue was controlled by moving and pulling it forward. To group B, frenuluplasty was applied by general anesthesia and primary repair. Bleeding was controlled by suturing or cautering. The operations on the patients from both groups were performed in the operating room, and the patients were examined in terms of complications and primary outcomes such as bleeding and inability to breastfeed. The patients were discharged in the absence of any complications. Group A was discharged the same day, but group B was discharged the next day.

The infant's age during the intervention, sex ratio of the groups, quality of breastfeeding, infant's weight, tongue movements, postoperative complications (e.g., bleeding and infection), and severity of ankyloglossia for the infant were evaluated and recorded in a relevant checklist. The severity of ankyloglossia was evaluated for all patients using Kotlow 1999 criteria as follows, and the frequency of each class was measured for each group. All cases were selected from types I, II and III of Kotlow's classification **(Table 1).**

**Table 1:** Kotlow 1999 criteria for classification of patients with Ankyloglossia

| | |
|---|---|
| **Class 1** | Mild ankyloglossia:<br>12 to 16 mm and is mild |
| **Class 2** | Moderate ankyloglossia:<br>8 to 11 mm and is moderate |
| **Class 3** | Severe ankyloglossia:<br>3 to 7 mm and is severe. |
| **Class 4** | Complete ankyloglossia:<br>less than 3 mm |

The movement disorder of the tongue was evaluated based on a change in the shape of the tongue (i.e., the tongue becoming heart-shaped) while removing it from the oral cavity before and after the surgery.

Difficulty in feeding and sucking breast milk was assessed based on the level of satisfaction expressed by the mother before and after the intervention. The presence or absence of intraoperative bleeding and complications related to bleeding, as well as the surgical site infection during the first week after the surgery, were recorded. The infants were examined in order to record the status of their surgical complications and language-related functional problems on the second visit, and then they were examined in terms of the quality of nutrition on the seventh day after the operation.

The data about the investigated variables were recorded in a designed checklist. The data obtained from the study were analyzed by adopting statistical methods and using SPSS version 20 software by authors. The two groups were compared by performing the X2 statistical test, and then they were compared to evaluate the continuous distributed variables using the t-test. A P-value less than 0.05 was considered statistically significant.

## Result

A total of 40 infants with ankyloglossia were included in the present study. The infants were assigned to two groups A (i.e., electrocautery frenectomy) and B (i.e., simple frenuluplasty). About 63% of the population was male, and 37% were female, which was consistent with results from previous studies. The most common age group was the 1-2 age group, and the lowest prevalence was 0-12 months. Class II was the most common form of the manifestations, which was about 62.5%. The relevant information is presented in **(Table 2).**

**Table 2:** Characteristics of patients participating in the study

| Variables | | Intervention groups | | |
|---|---|---|---|---|
| | | Group A | Group B | Total |
| **Sex** | Female | 10 | 5 | 15 (37%) |
| | Male | 10 | 15 | 25 (63%) |
| **Age** | 0-12 months | 7 | 7 | 14 (35%) |
| | 1-3 years | 13 | 13 | 26 (65%) |
| **Classification** | Class 1 | 4 | 4 | 8 (20%) |
| | Class 2 | 12 | 13 | 25 (62.5%) |
| | Class 3 | 4 | 3 | 7 (17.5%) |
| | Class 4 | 0 | 0 | 0 (0%) |

Then the patients were evaluated on the first day after the operation in terms of inflammatory signs and symptoms, on the seventh day after the operation in terms of wound healing and any complications, and one month after the operation in terms of scarring and wound contraction.

In this study, the durations of nothing by mouth (NPO) in two groups were compared. The duration of NPO time for group A patients were 1 hour and for group B were 4-8 hours. In group A, 50% of the infants had a heart-shaped tongue, while 75% of the infants had a heart-shaped tongue in group B. Furthermore, 68% and 75% of the infants in groups A and B were breastfed, respectively. There were no postoperative complications (e.g., erythema and eczema) in group A, and only one infant (i.e., 5% of the population) showed symptoms of fever in this group. In group B, on the other hand, 10% of the population showed signs of erythema, and 26% showed signs of eczema at the incision site after the surgery **(Table 3).** The quality of nutrition and weight were satisfactory in all patients from both groups A and B after the surgery. As for the speech status after the surgery, one patient in group B remained unimproved, and other patients failed to express their loss. Speech status was improved in all cases of the electrocautery group.

**Table 3:** Post-surgery status of patients participating in the study

| Variable | | Group A | Group B | Pvalue |
|---|---|---|---|---|
| Duration of NPO | 2 h | 0 | 1 (5%) | 0.295 |
| | 3 h | 3 (15%) | 0 | |
| | 4 h | 3 (15%) | 4 (21%) | |
| | 6 h | 5 (26%) | 3 (15%) | |
| | 8 h | 9 (42%) | 12 (57%) | |
| Tongue shape | Conical shape | 10 (50%) | 5 (25%) | 0.102 |
| | Heart shape | 10 (50%) | 15 (75%) | |
| Nutritional status | Breast feeding | 14 (68%) | 15 (75%) | 0.723 |
| | Not-breast feeding | 6 (32 %) | 5 (25%) | |
| Post operational complications | Fever | 1 (5%) | 0 | >0.999 |
| | Erythema | 0 | 2 (10%) | 0.487 |
| | Eczema | 0 | 5 (26%) | 0.047 |

## Discussion

In this randomized trial, an attempt was made to determine the best and safest method for frenectomy intervention. The most common method used in our center is frenuluplasty by making an incision on the frenulum and complete remove tie then repair of sublingual space. This study, mainly aimed to investigate and compare the results of frenectomy by surgery and electrocautery. Our study results showed that the quality of nutrition and the weight in both groups of patients who intervened with surgery or electrocautery was

satisfactory after the procedure. However, the patients undergoing electrocautery showed fewer complications than those having the surgery in terms of postoperative complications (e.g., fever, erythema, and eczema). In addition, postoperative speech condition improved more significantly in the patients that having the minimally invasive procedure. The limitations of our study include the limited number of cases in two groups .

Considering the prevalence of about 4-5% of ankyloglossia and the complications and problems that occur during infancy and later in childhood and adulthood, such as feeding disorders, newborn weighing disorders, speech disorders, and the correct pronunciation of words, problems related to oral and dental hygiene, beauty problems, and the issues that will arise for a person in social communication, timely intervention and the use of appropriate intervention method (surgery) is a necessity in dealing with this problem.[13-14] Although various methods have been proposed for frenectomy, the most commonly used procedure is the conventional surgical method.[15] The conventional surgical technique leaves a longitudinal surgical incision and scarring, which may lead to periodontal problems and an unsightly appearance, thereby requiring further corrections.[16] Out of all methods employed for frenectomy, the electrocautery and laser methods offer the advantages of a minimal length of time, no bleeding during the surgery, and no need for sutures.[17] Although CO2 laser are widely employed as treatment methods, electrocautery is much cost-effective than CO2 laser. When electrocautery and CO2 laser are compared regarding the places of mucosal incisions created by scalpel as well as the collateral tissue damage, moreover, electrocautery with constant voltage gets the highest score but causes the least damage. Electrocautery is also more favorable than laser since it does not require safety glasses and removes larger amounts of the tissues quickly. Therefore, the application of electrocautery is likely more justifiable than using the new laser technique in routine practice.[17-18]

According to the results from a comparison performed among the scalpel, electrocautery, and CO2 laser in terms of the displacement properties, the scalpel enjoys more advantages such as ease of use, low cost, precise cutting with clear margins, and no damage to the unwanted side tissue near the bone; however, and the scalpel faces some disadvantages including

the need for anesthesia, excessive bleeding, insufficient visibility due to bleeding in the operation area, the need for stitches, and the need for postoperative medication.[19] The advantages of electrocautery include the chance to cut an electrode on the sides and the tip, compliance with the clinical needs regarding the angled electrode, and infliction of painless wounds. Disadvantages of electrocautery, on the other hand, include unavoidable burning, low tactile sensation, unfeasible application near the implants, dental damage, lack of safety in explosive environments, and contraindications for use in pacemakers.[19]

Several studies investigated and compared different frenectomy interventional methods and reported significant results. For example, a study by M Calisir and B Ege compared laser methods and the conventional surgical method in terms of the discomfort level, pain level, and levels of activities like eating and talking after labial frenectomy surgery. To this end, 40 patients needing labial frenectomy in both upper and lower jaws were included. The sex ratio of the patients was one to one and all of them were at the same level in terms of socioeconomic status. The patients were then divided into two groups of 20 people in order to estimate the pain level and functional complications after surgery. In one group, first, one side of the patients' tongue was operated on using conventional surgery, while the other side was operated by laser two weeks later. As for the other group, the treatment was initiated by the laser method, and then the surgical method was implemented two weeks later. Both interventions were performed by the same surgeon. Post-operation pain and functional complications were measured using a visual analog scale on the day of surgery and on the next days. The results indicated that the patients treated with laser felt more comfortable while chewing and talking and experienced less pain than those treated with other methods on the day of surgery and days after the surgery.[20]

In a study by Kendre et al., the laser technique was compared to the conventional surgical method regarding pain and discomfort in children after frenectomy. To this end, two 5-year-old patients suffering from speech problems associated with ankyloglossia – which was graded as III ankyloglossia based on Kotlow 1999 morphological classification criteria – were examined. Then their levels of fear and anxiety were estimated using the Modifying Dental Anxiety Scale

(MDAS). The pain and discomfort levels were also evaluated during and after the surgery. One of the patients underwent frenectomy using conventional surgery followed by suturing and application of 2% lidocaine local anesthesia, and seven days later, was visited for follow-up and removal of sutures. The other patient underwent frenectomy using a diode laser and was visited seven days later to follow up and check the complications after the intervention. Their study results indicated that the laser method caused less discomfort, pain, and suffering during and after the operation and was more satisfactory for the patients. Other studies also reported lower postoperative complications (e.g., bleeding, infection, and recurrences of the problem) for an intervention by the laser.[19]

Gujrathi et al. conducted a study to identify the most favorable method of frenectomy by comparing scalpel, electrocautery, and CO2 laser for treating ankyloglossia. In the given prospective randomized clinical trial, all patients were randomly assigned to three groups, A, B, and C, each of which included 18 patients. The frenectomy was performed for groups A, B, and C by adopting the usual scalpel method and using bipolar cautery and CO2 laser. Then the patients were evaluated on the first day after the operation in terms of inflammatory signs and symptoms, on the seventh day after the operation in terms of wound healing and other complications, and one month after the operation in terms of scarring and wound contraction. According to their study results, about 61% of the population was boys, and 39% was girls (ratio 1:6.1). Majority of the patients were aged between 1-4 years, and most of the patients were in class III with severe ankyloglossia (3 to 7 mm) followed by class I with mild ankyloglossia (12 to 16 mm). Their results also revealed that the treatments with laser and electrocautery, which are used for frenectomy operations, were more satisfactory for the patients in terms of pain and postoperative performance than the scalpel method. Electrocautery was the most tolerable technique in terms of postoperative pain. In terms of postoperative edema and less stitches, it was as effective as laser. Considering the operation time, however, the CO2 laser is far more favorable than the electrocautery and scalpel methods.[18]

## Conclusion

Electrocautery treatment for frenectomy provided a better understanding of the postoperative complications than the surgery method such as frenuluplasty. On the other hand, in terms of improving speech status this minimally invasive method of frenectomy delivered more favorable results than the conventional surgical method. Therefore, electrocautery may have been a safer, more effective, and more acceptable alternative to frenuluplasty in terms of clinical outcomes in class I, II and III tongue ties. Although the approaches to the problem associated with avoiding the traditional scalpel have some advantages, further improvements can still be made with regard to the therapeutic aspect.

## Ethical Consideration

This study was approved by the research ethics committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1400.634) and the Committee for Ethics of Medical Experiments on Human Subjects and was conducted in accordance with the principles of the Declaration of Helsinki.

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## Conflict of interests

There is no conflict of interest

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