Case Report and Clinical Technique: Argon Beam Electrosurgery for Tongue Ties and Maxillary Frenectomies in Infants and Children

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Abstract

Background: Paediatric dentists have been reluctant to carry out minor surgical procedures, especially involving very vascular tongues. The ExplorAr Plasma Cutting Electrode (APCE) an Australian invention, with the ConMed Argon Beam Coagulator (ABC) has replaced conventional electrosurgical techniques. Operating temperatures with APCE heat the tissue to 110°C rather than the previous 220°C using the conventional electrosurgery.

Indications: APCE has been used for releasing tongue ties (partial ankyloglossia) for infants (1-4 weeks old) to enable suckling, and for older children (3-5 years old) to reduce speech pathology problems and learning difficulties in the formative years of development. All patients have been treated under general anaesthesia on a day-stay basis.

Case Report: An 8 year old girl presented with a marked lingual tongue tie showing restricted movement. Using the APCE, the tongue was resected under general anaesthesia. Postoperative progress was uneventful with rapid healing. Follow-up: At a 4 month follow-up the tissue had healed completely. There was full unimpeded movement of the tongue, and social confidence had improved.

Conclusion: The availability of the ExplorAr Argon Plasma Cutting Electrode with the ConMed Argon Beam Coagulator makes it possible for a bloodless approach to the treatment of tongue ties and frenectomies with little or no post-operative pain due to the decreased power settings, lack of eschar and decreased collateral damage to adjacent tissues using a finer surgical technique.

Background

Tongue ties (ankyloglossia) in infants occur in approximately 5% of neonates [Dolberg et al., 2006]. An extensive review of literature on tongue ties has been reported by Hall and Renfrew [2006]. Paediatric dentists are sometimes consulted to advise and, if necessary, provide treatment to release tied tongues. Occasionally this request may be for an older child. In addition, because the current recommended time for a child's first dental visit is as early as possible, certainly well before one year of age, it is essential that paediatric dentists are familiar with the current necessary techniques for the management of tongue ties [Kupietzky and Botzer, 2005].

Treatment options for tongue ties include observation, speech therapy, frenotomy (without analgesia or anaesthesia) or frenectomy under local analgesia (LA) or general anaesthesia (GA). In the past obstetricians or midwives would often ‘snip’ the tongue tie within minutes of birth but nowadays that is frowned upon and more often paediatric surgeons will carry out such a procedure [Hogan et al., 2005].

Another problem facing paediatric dentists is the short maxillary frenum, which can in some circumstances be related to a mid-line diastema. However, the more frequent problem is simply a short frenum requiring surgery. Interdental release of fibrous tissue avoids relapse of approximated maxillary anterior teeth.

A recent survey by paediatric surgeons in Australia [Brinkman et al., 2004] asked 400 surgeons in different specialties of surgery which preferred treatment method they used for the release of the tongue tie. Of the respondents 73% used surgery, 46% were maxillo-facial surgeons, 37% plastic surgeons and 17% general paediatric surgeons. It appears that no attempt was made to determine the role of Australian paediatric dentists. However, this report showed no clear consensus of the preferred treatment option and there was no mention in this study of the use of electrosurgery.

Electrosurgery, with an Argon Beam of two standard litres per minute (SLPM) is a treatment option. It is quick and efficient and is generally without blood loss. The wattage traditionally used has been high. An Australian inventor (MacKay, 2006) has developed and obtained a U.S.A. patent for new electrodes for use with an electrosurgical device that uses argon gas: the ExplorAr Argon Plasma Cutting Electrodes (APCE) used with the Argon Beam Coagulator, (ABC). This device is based on the concept of electrosurgery which is not new as it was originally developed by Riviere, [1900], the high frequency current ‘electrosurgery’ was used for the treatment of a hand ulcer. A few years later de Forest [1908] produced the first cutting current. It was not until 1932, that the next development by a group of experts, Cushing (neurosurgeon), Bovie (physicist) and Liebel (engineer) created the first modern diathermy. This entered regular use.
In 1970 the advent of solid-state engineering enabled further changes to the technique and equipment which included:
- wave form manipulation,
- micro-processor for generator diagnostics,
- isolated electrical output,
- return plate alarms,
- current leakage alarms.


Conventional Electrosurgery. There are many applications and advantages to using conventional electrosurgery in common surgical procedures. Diathermy refers to the application of radio frequency (RF) energy for the surgical cutting and or coagulation of tissues. Electrosurgery is the delivery of radio frequency (RF) energy to tissue for a desired clinical effect, such as cutting and coagulation [Pearce 1986].

ABC* technology. This was developed as a unique adaptation of electrosurgical coagulation. The following characteristics describe the comparative performance of ABC* technology with conventional monopolar electrosurgery:
- true non-contact coagulation,
- precise directional control,
- reliably adherent eschars (non-‘floating’),
- minimal smoke plume,
- excellent visualisation of target tissue,
- effective on bone and other high impedance tissues,
- increased speed and effectiveness on highly vascularised tissue.

ConMed ABC* with APCE* delivery systems achieve the unsurpassed coagulation and enhanced clinical effectiveness by focusing RF energy into a directional, non-contact, room-temperature beam of argon gas. The electrosurgical current follows a tight path along the argon gas flow, two standard litres per minute (2 SLPM) from the handpiece electrode to the tissue. The flow of argon gas serves to clear the surgical site of fluids to allow coagulation directly to the tissue reducing carbonisation.

Clearing the fluids from the paths of the beam and creating the arc tunnel reticulum directly on the stroma of the target tissue prevents the formation of a floating eschar, thereby producing:
- more rapid coagulation,
- improved eschar integrity,
- less tendency for the eschar to fracture,
- reduced possibility of re-bleeding,
- improved healing time.

Hyperthermic tissue damage is not often taken into account when mapping thermal destruction after tissue exposure to diathermy [Duffy et al., 1992].

The ExplorAr* electrodes. These are an Australian development, invented by Dale Mackay. They arose out of the need to allow plastic surgeons to work on the face/head and neck regions with a precision instrument with a greater degree of safety where there are risks of oxygen leaks from the anaesthetic circuit. The small electrode tip is well illustrated in Figure 1.

Clinical benefits. The benefits of using the Argon Beam Technology are ExplorAr Electrodes include:
- reduced blood loss,
- reduced procedure time,
- enhanced clinical effectiveness,
- less tissue damage,
- enhanced healing,
- reduced risk of infection,
- minimal smoke plume and odour,
- enhanced safety.

Dental Applications. Argon Beam Coagulation and ExplorAr Electrodes can be used in the delicate resection of tongue ties and frenectomies, without the fear of tissue necrosis, blood loss or pain, the discomfort of waiting for sutures to resorb or the need for suture removal. The Argon Beam Generator is used in “Endoscopic Mode” with gas flow of two standard litres per minute (SLPM) and two watts of power. It should be noted that when using conventional diathermy, similar surgery would use 18 watts of power for both cutting and coagulation.

Tongue Ties. Normally the tongue is held by the lingual frenum. If the frenum is short, partial ankyloglossia may reduce tongue mobility. This is illustrated in Fig 2a showing a tongue tie at initial diagnosis in an 8 year old girl.