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Tonsillectomy Using the Thermal Welding System

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Key Words
Tonsillectomy · Thermal Welding System · Tissue sealing

Abstract
Objective: To evaluate and introduce a new method of tonsillectomy using the Thermal Welding System (TWS). ***Method:*** The TWS is a new surgical instrument which uses direct heat and pressure to seal and divide tissues. Fifty consecutive patients underwent tonsillectomy with the use of the TWS. Inclusion criteria were chronic tonsillitis, peritonsilar abscess history and obstructive sleep apnea syndrome. Patients undergoing adenoidectomy or any other procedure together with tonsillectomy and patients with bleeding disorders were excluded. Intraoperative bleeding, operative time, complication rates and return to normal diet were evaluated. ***Results:*** There was no measurable bleeding during surgery in any case. No postoperative hemorrhage or other complication occurred. Mean operative time was 23 min. Mean time for return to normal diet was 8.7 days. ***Conclusions:*** The TWS was found quite effective and safe, providing sufficient hemostasis and minimal intraoperative blood loss.

Introduction

Tonsillectomy is one of the most frequently performed otorhinolaryngologic surgical procedures. Many techniques have evolved, including blunt dissection, guillotine excision, electrocautery, cryosurgery, coblation, ultrasonic removal, laser tonsillectomy, as well as monopolar and bipolar diathermy dissection [1–3].

The Thermal Welding System (TWS; Starion Instruments, Saratoga, Calif., USA) is a new surgical device for simultaneous tissue sealing and dividing. It consists of a power supply unit, cautery forceps and a footswitch (fig. 1). The TWS uses a heating element at the tip of the instrument combined with pressure to denature the protein molecules within the tissue. Tissue is squeezed between insulated jaws as focused heat is applied to the local region. The protein molecules in the tissue are denatured and fused to one another, forming a tight seal. More highly focused heat is applied in the center of the tissue within the jaws of the instrument, thereby minimizing any effect on nearby structures [4].

No studies regarding the use of the TWS in tonsillectomy procedures have been reported so far. With this report a new tonsillectomy method with the use of the TWS is introduced.

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Fig. 1. The TWS consists of a power supply unit, cautery forceps and a footswitch.

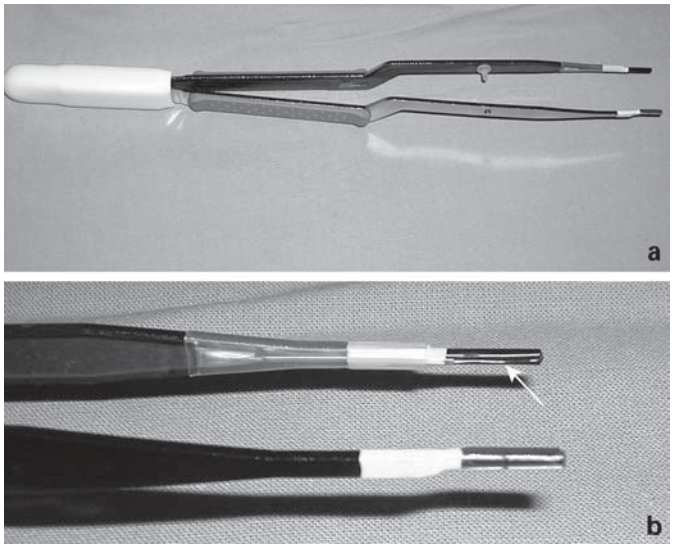

Fig. 2. a The Bayonet UltraSlim Forceps. **b** The tip of the Bayonet UltraSlim Forceps. The active part of the instrument is composed of a nichrome heating element (white arrow) with a thermally insulating backing.

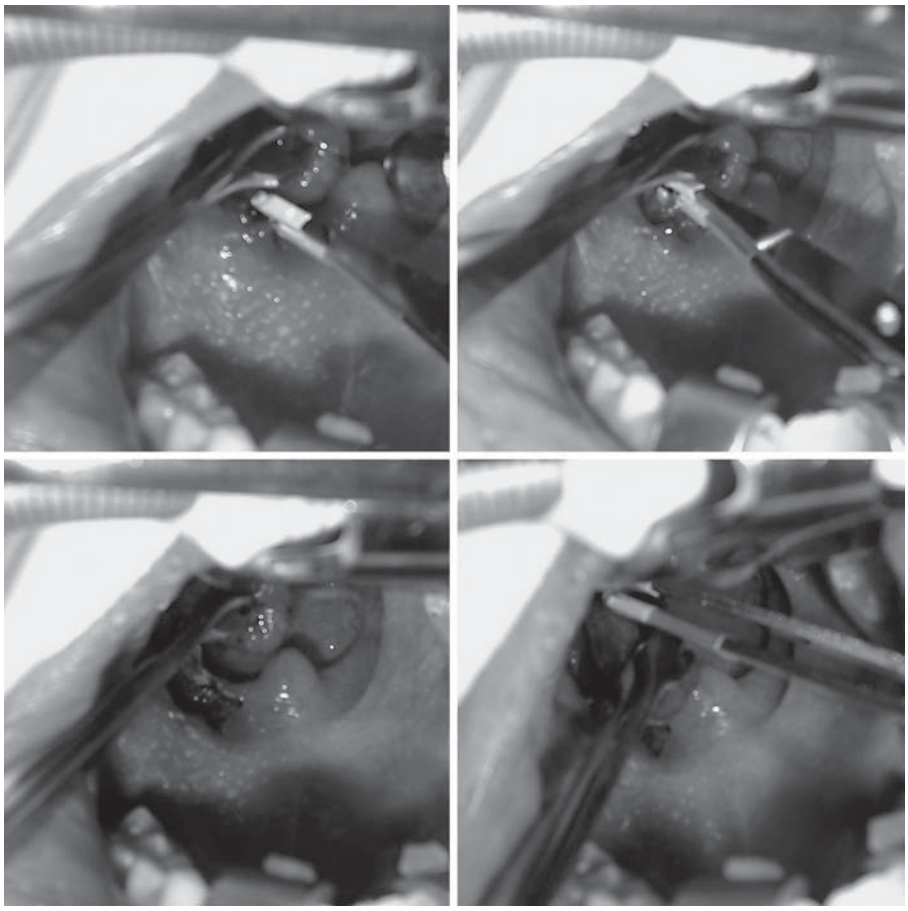

Fig. 3. Tonsillectomy with the TWS using the Bayonet UltraSlim Forceps.

Material and Method

A prospective study was conducted in our Department on 50 consecutive patients undergoing tonsillectomy with the use of the TWS. Indications for tonsillectomy included obstructive sleep apnea syndrome, history of peritonsilar abscess, and chronic tonsillitis. Patients undergoing adenoidectomy, or any other procedure together with tonsillectomy, as well as patients with bleeding disorders were excluded from the study. Among the available handpieces for the TWS power supply unit, the Bayonet UltraSlim Forceps (110-005D) were selected (fig. 2). According to our technique, each tonsil is grasped and retracted towards the midline. No mucosal incision is performed. Tissue bundles of the anterior pillar mucosa are gently grasped, coagulated with the Bayonet UltraSlim Forceps using the '1' setting of the power supply unit, and divided afterwards with the same forceps, using the '8' setting of the power supply unit. In the same manner, dissection of the tonsil from surrounding tissues toward the inferior pole is performed. The inferior pole is coagulated and divided with the Bayonet UltraSlim Forceps, and the tonsil specimen is removed (fig. 3). In case of a visible intact blood vessel or a small bleeding vessel, coagulation is performed with the same forceps, using the '1' setting of the power supply unit. It should be noticed that since there was no previous experience with the TWS, bipolar electrocautery was available for use, in case that the TWS would not provide sufficient hemostasis. Intraoperative blood loss was estimated by measuring the amount in the suction bottle as well as by weighing the cottonoid pledgets before and after the procedure. Operation time, defined as duration of tonsil dissection with hemostasis, when necessary, was recorded at the end of the procedure. All patients' data, including intraoperative blood loss, operation time, postoperative complications and return to normal diet time were recorded in a database. Return to normal diet time was defined as time within which the patient postoperatively returned to diet without pain sensation during solid food intake, as well as without the need for oral analgesic agent uptake. The research protocol was approved by the General Hospital of Larissa review board.

Results

Our series consisted of 50 consecutive patients (33 males and 27 females). The patients' ages ranged from 6 to 32 years (mean age 19 years; 31 children and 19 adults). There was no measurable bleeding during surgery in any of the cases. Bipolar electrocautery was used for hemo-

stasis in 3 adult patients due to unilateral hemorrhage from the tonsillar artery (inferior pole area); bipolar electrocautery was not used in the pediatric subgroup. No peritonsilar or uvular edema was noticed in any of the patients. No postoperative hemorrhage or other complication occurred. The mean operative time was 23 min (range 19–28 min). More specifically, in the children subgroup the mean operative time was 21 minutes (range 19–24 min), while in the adult subgroup the mean operative time was 24 min (range 20–28 min). In the infection (peritonsilar abscess history or chronic tonsillitis) and obstruction subgroups the mean operative time was 23 (range 20–28) and 22 min (range 19–26), respectively. The mean time for return to normal diet was 8.7 days (range 5–12 days).

Discussion

The TWS is a new type of surgical instrument which uses simultaneously direct thermal energy and pressure to coagulate and divide blood vessels and other tissue. The developers of this new thermal instrument hypothesized that the desired protein-denaturing effects could be accomplished most efficiently by using direct thermal heating of the tissue instead of an intermediate form of energy (electric, ultrasonic, laser, radiofrequency, etc.). The thermal energy-producing element is a simple resistance heating wire driven by low voltage direct current. It should be noticed that the TWS is not a bipolar instrument, since no electric current passes through the tissues grasped between the instrument's jaws. The active part of the instrument is composed of a nichrome heating element with a thermally insulating backing. This thermal insulating layer isolates the heating effect of the nichrome wire from the rest of the instrument and prevents the underside of the jaw from becoming hot (fig. 2b). Closing of the instrument jaws presses the thermal element against a conformable silicone 'boot' which is mounted on the other jaw of the device. The silicone 'boot' helps to create a graded thermal profile. The thermal profile consists of a narrow high temperature cut zone that is flanked on each side by a lower temperature coagulating zone. The graded temperature profile is crucial to the functioning of the instrument and enables the device to perform both cutting and coagulation simultaneously. The bilateral and symmetric shape of the profile allows the device to seal both ends of a vessel on either side of the cut zone. Due to radiation of the heat from the nichrome element, the width of the cut zone is somewhat greater than the actual physical diameter of the wire. In this region, the temperature is high enough to actually cut tissue by means of direct vaporization with very little charring. This temperature has been measured in the range of 300–400°C. At distances greater than approximately 500 μm from the center of the wire, the temperature falls down to below 100°C, which is the ideal temperature range to coagulate and seal tissues by means of protein denaturation. The silicone 'boot' has another function that is important for the production of a strong seal on the ends of the cut vessel. This function is to exert pressure or crimp the vessel walls together in the lower temperature coagulation zone. This pressure effect along with the thermal denaturation of the tissue produces coagulation and sealing. The result is a cleanly cut vessel and a coagulated (sealed) zone at the ends of the vessel on either side of the cut [4].

In our series the TWS provided excellent hemostasis during tonsillectomy procedures, since there was no measurable intraoperative blood loss and no postoperative hemorrhage. It should be noted that due to intraoperative hemorrhage from the tonsillar artery (inferior pole area), bipolar electrocautery was used for hemostasis in 3 adult patients, suggesting that particularly in large vessels there may be isolated need for further coagulation or suture ligation. Further studies with larger series may confirm these results.

Due to the aforementioned minimal thermal spread to the adjacent tissues, postoperative pain seems to be minimal. In our series the mean time for return to normal diet was 8.7 days. Even though there are encouraging preliminary data, our series is too small to allow statistical analysis regarding postoperative pain of 'thermal welding' tonsillectomy compared to that of other tonsillectomy techniques.

Among the handpieces available for the TWS generator, the Bayonet UltraSlim Forceps (110-005D) were used. It is a single use footswitch-activated, hand-held surgical instrument, easy to handle without the need for special training. It should be mentioned that the cost of the handpiece (280 EUR/340 USD) is fully covered by the insurance system in our country.

Recently, there have been controversial suggestions of an estimated 1:5,000 risk of acquiring the variant Creutzfeldt-Jakob disease (v-CJD) as a result of tonsillectomy with reusable surgical instruments. The use of disposable instruments was implemented during the year 2000 in the UK [3]. On the other hand, there is an increased morbidity of postoperative hemorrhage in association with the use of disposable instruments [5–7]. The

single-use UltraSlim Forceps are entirely compliant with guidelines for the use of totally disposable instrumentation. We believe that the cost of the handpiece is offset by its safety against v-CJD transmission, as well as the efficacy of hemostasis that it supplies.

In conclusion we believe that the TWS is not another technical variation on a number of cutting coagulating instruments already used in tonsillectomy. It was found quite effective in tonsillectomy procedures, providing sufficient hemostasis, quick return to normal diet, and safety against v-CJD transmission.

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