

Comparison of the Thermal Welding Technique and Cold Dissection for Pediatric Tonsillectomy

Çocuk Tonsillektomisinde Thermal Welding Tekniği ile Soğuk Diseksiyon Tekniğinin Karşılaştırılması

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Objectives: To compare the thermal welding technique (TWT) with cold dissection (CD) for pediatric tonsillectomy.

Patients and Methods: Fifty consecutive children with chronic tonsillitis and/or upper airway obstruction were alternately assigned to the TWT or CD group. Age, gender, operation time, intraoperative hemostasis method, early postoperative pain, time to regain normal diet, and extent of healing of the tonsillar fossa on the tenth postoperative day were evaluated.

Results: Thermal welding technique was significantly better than CD with regard to intraoperative hemostasis ($p=0.0001$). The mean time to regain normal diet was significantly shorter in the TWT group compared to the CD group ($p=0.015$); however, this difference was not clinically relevant. There were no statistically significant difference between the groups in early postoperative pain score ($p=0.542$) and healing of the tonsillar fossae on the tenth day of the surgery ($p=0.152$). Duration of the surgical procedure was significantly shorter in the CD group ($p=0.001$).

Conclusion: Thermal welding technique was found to be effective for tonsillectomy than CD in terms of intraoperative hemostasis.

Key words: Children; tonsillectomy; treatment.

Amaç: Çocuk tonsillektomisinde thermal welding tekniği (TWT) ile soğuk diseksiyon tekniğini (SDT) karşılaştırmak.

Hastalar ve Yöntemler: Kronik tonsillit ve/veya üst solunum yolu tıkanıklığı olan 50 çocuk TWT veya SDT grupları için ardışık olarak ayrıldı. Yaş, cinsiyet, ameliyat süresi, ameliyat esnasındaki hemostaz yöntemi, ameliyat sonrası erken dönemdeki ağrı, normal yemeğe geçiş süresi ve ameliyattan sonraki 10. günde tonsillar fossanın iyileşme durumu değerlendirildi.

Bulgular: Ameliyat esnasındaki hemostaz bakımından TWT SDT'ye göre önemli oranda daha iyiydi ($p=0.0001$). Ortalama normal yemeğe geçiş süresi SDT grubuna göre TWT grubunda daha iyiydi ($p=0.015$). Ancak bu fark klinik olarak anlamlı değildi. Ameliyat sonrası erken dönemdeki ağrı ($p=0.542$) ve ameliyatın onuncu gününde tonsillar fossanın iyileşmesi ($p=0.152$) bakımından gruplar arasında istatistiksel olarak anlamlı bir fark yoktu. Cerrahi girişimin süresi SDT grubunda önemli oranda daha kısaydı ($p=0.001$).

Sonuç: Ameliyat esnasındaki hemostaz bakımından TWT'nin SDT'ye göre tonsillektomide daha etkili olduğu saptandı.

Anahtar sözcükler: Çocuklar; tonsillektomi; tedavi.

Tonsillectomy with or without adenoidectomy is one of the most frequently performed surgical procedures in children.^[1] Whilst a variety of techniques have been used,^[1-7] tonsillectomy in children is currently the most often performed with cold instruments.^[1] Many new instruments have been developed to reduce morbidity following tonsillectomy due to complications, including hemorrhage and postoperative pain. The thermal welding technique (TWT), which is a new technique for tonsillectomy, differs from other electrosurgical procedures in several respects, including the use of direct thermal heating applied to the tissue to achieve the desired protein denaturation effect. A simple resistance heating wire driven by low-voltage direct current produces heat at the tip of bayonet forceps; no electrical current is applied to the tissue.^[8,9] The TWT instrument consists of a universal power supply, Starion cautery forceps, and Starion powerpack footswitch, (Starion Instrument Corp. Saratoga, CA). Few reports have been published that compare electrosurgical instruments with cold instruments for tonsillectomy in pediatric patients.^[3-5,10-12] In this paper, we compared TWT and CD for tonsillectomy in pediatric patients with regard to duration of operation, control of hemostasis, early postoperative pain, length of time to return to normal diet, and healing of the tonsillar fossa ten days after surgery.

PATIENTS AND METHODS

A prospective study was conducted on 50 consecutive children undergoing tonsillectomy plus adenoidectomy from January 2008 through March 2008. Each child was alternately assigned to either the TWT or CD group as they appeared on the surgery list. Patients were enrolled for the intended treatments by H.Y. Parents were blinded to the assigned surgical technique. Inclusion criteria were chronic tonsillitis and/or upper airway obstruction. Children younger than three years and older than 12 years of age and/or children who had hematological disorders were excluded from the study. All procedures were performed by the same surgeon (H.Y.) under general anesthesia through endotracheal intubation.

According to our study protocol, each patient was placed in the Rose position and a Davis-Boyle mouth gag supported by Draffin bipods was inserted into the mouth. A tongue retractor of suitable size was used depending on the age of the patient. First, adenoidectomy was performed and packed, and then the left tonsil was grasped with tonsil-seizing forceps and gently retracted medially. Thermal welding technique was set at "1" for sealing and "8" for cutting. First, a small cavity in the upper lateral aspect of the tonsil was created with a power setting of "8" using the right pedal. After the lateral capsule of the tonsil was recognized, dissection was performed by placing one tip of the cautery forceps next to the capsule and the other tip on the surface of the tonsil bed. Soft tissue between the tips of the forceps was sealed for five seconds using the "1" setting with the left pedal and then divided for 1-2 seconds using the "8" setting with the right pedal. This procedure was repeated from the superior aspect of the tonsil to the inferior aspect. After dissection of the tonsil was completed, the tonsil bed was packed with saline-soaked packing. The right tonsil was removed in similar fashion. All packings were removed and the tonsil beds were irrigated with saline solution and inspected. When needed ligation or electrocauterization was used for hemostasis in the TWT group. In the CD group, tonsils were removed in a similar fashion using scissors, tonsil dissectors and snares. Hemostasis was managed by packing and ligation. After absolute hemostasis was achieved, the Davis-Boyle mouth gag was removed and the patient was extubated. Operation time was measured from the time of insertion of the Davis-Boyle mouth gag to the time of its removal. The first cold liquid diet was given to the child 6-8 hours after the operation. Postoperative pain was assessed using analogic visual scales.^[13] Acetaminophen was recommended for pain relief as needed. No antibiotics were prescribed routinely. Children were examined for bleeding, blood clot or residual tissue in tonsil beds and discharged on the first postoperative day. Parents were instructed to feed their child on a normal diet at the fifth postoperative day. If the child could not take a normal diet by

Table 1. Mean operation times

Group	Operation time (min)		
	Mean±SD	Median	Range
TWT	14.6±4.7a	14.5	7-22
CD	10.0±3.2a	10.0	4-22

*p=0.001, Mann-Whitney U test=141; TWT: Thermal welding technique; CD: Cold dissection.

this time, a soft diet was continued until the child was able to receive his/her normal diet. The time to return to normal diet was recorded by the parents. Ten days later, another surgeon (H.O.) who was blinded to the operation technique performed visited the children. The condition of the tonsillar fossa was noted. If there was no slough in the tonsillar fossa ten days after surgery, it was accepted as “good healing”. Data were analyzed by the chi-square test, Student’s t test, Kolmogorov-Smirnov test, and Mann-Whitney U test using SPSS 11.5 software. The study was approved by the local ethics committee. Written informed consent was obtained from all parents.

RESULTS

The two groups were similar for demographic parameters. The mean age of the 19 boys and 6 girls in the TWT group and 13 boys and 12 girls in the CD group was 7.12 years (range 4-12 years) and 6.08 years (range 3-12 years), respectively. No statistically significant difference was noted for age (p=0.113) and gender (p=0.077).

The mean operation time was 14.56 minutes in the TWT group and 10.04 minutes in the CD group, the difference being statistically significant (p=0.001) (Table 1).

Intraoperative hemostasis was achieved by packing alone in 20 children in the TWT group (80%) and in three children in the CD group

Table 3. Healing of tonsillar fossae ten days after surgery

Extent of healing	TWT	CD
	(n=25)	(n=25)
No slough (fully healed)	13 (52%)	8 (32%)
Slough present	12 (48%)	17 (68%)

p=0.152, chi-square test; TWT: Thermal welding technique; CD: Cold dissection.

Table 2. Intraoperative hemostasis procedures used

Procedure	TWT	CD
	(n=25)	(n=25)
Packing only	20 (80%)	3 (12%)
Ligation	2 (8%)	22 (88%)
Electrocauterization	2 (8%)	0
Ligation & electrocauterization	1 (4%)	0

p=0.0001, chi-square test; TWT: Thermal welding technique; CD: Cold dissection.

(12%). Ligation was used in two children in the TWT group (8%) and in 22 children in the CD group (88%). Both ligation and electrocauterization were used in one child in the TWT group (4%). Electrocauterization was used in two children in the TWT group (8%), but it was not used at all in the CD group. There was a statistically significant difference between the two groups with regard to intraoperative hemostasis (p=0.0001) (Table 2). There were no adverse events during surgery. The mean pain score was 5.8±1.3 (median 6, range 4-8) in the TWT group and 6±1.2 (median 6, range 4-8) in the CD group 6 to 8 hours post-surgery, which was not significantly different (p=0.542, Mann-Whitney U test). The mean time to regain normal diet was 7.3±0.7 (median 7, range 6-9) days in the TWT group and 8.0±1.1 (median 8, range 6-10) days in the CD group; this difference, although statistically significant (p=0.015, Mann-Whitney U test), is not clinically relevant because it represents only a fraction of a day. Ten days after the operation, the tonsils beds were fully healed in 13 children in the TWT group (52%) and in eight children in the CD group (32%). There was no statistically significant difference between the two groups in terms of the healing of tonsillar fossae (p=0.152) (Table 3). No measurable primary or secondary hemorrhage was noted in either group. There were no adverse events post-surgery.

DISCUSSION

Thermal welding technique is distinctive from other electrosurgical tools because its effect operates through application of direct heat energy instead of electrical current. It has been suggested that tissue injury is minimal with TWT^[8,9] and that procedure is suitable for tonsillectomy.^[6,14] It

should also be emphasized that the TWT instrument is not a bipolar instrument, because no electrical current passes through the tissue that is grasped by the forceps jaws.^[6] Although TWT shares obvious similarities with LigaSure, the two techniques are entirely different: LigaSure controls hemostasis by vessel compression and obliteration through the emission of bipolar energy, whereas TWT achieves vessel sealing by tissue carbonization, as in conventional coagulation methods.

Weinstock^[9] has stated that healing after TWT lasted one week and that no eschar was left in the tonsillar fossa after seven days. However, Pizzuto et al.^[11] suggested there was no time difference in the healing of tonsillar fossae between electrosurgical and classical dissection tonsillectomy, whereas other authors have stated that healing of the tonsillar fossa occurred much sooner with the CD method.^[4,5,12] In the present study, we found no time difference between the two groups in terms of the healing of the tonsillar fossae at the tenth postoperative day.

We did not detect any primary or secondary hemorrhage in either group, a result similar to those of several other studies after tonsillectomy.^[2,3,9] Raut et al.^[5] reported rates of primary and secondary hemorrhage after tonsillectomy of 3.1% (1/32) and 12.5% (4/32), respectively, using the CD method on 32 cases, and 5.5% (1/18) and 16.6% (3/18), respectively, with the bipolar scissors method on 18 cases. The incidence of post-tonsillectomy hemorrhage in a large pediatric group studied by Windfuhr and Chen^[15] was 1.6% after CD.

In our study, the mean operation time was longer in the TWT group compared to the CD group; however, we believe this gap will narrow as we gain more experience with TWT. Karatzanis et al.^[16] noted no significant difference regarding mean operative time in adult patients undergoing tonsillectomy. Indeed, some authors have reported a shorter duration of surgery in tonsillectomy performed with electrosurgical instruments compared to CD.^[2,3,12,17] In contrast, Raut et al.^[5] found the duration of the operation to be shorter with the

classical dissection method compared to the bipolar scissors method.

Postoperative pain is an important parameter in evaluating the quality of life during the course of healing and should be assessed in adults and in children >10 years of age, according to the recommendations of Silveira et al.^[12] We observed no significant difference between the TWT and CD groups in terms of early postoperative pain. Raut et al.^[5] found the degree of postoperative pain to be lower with the CD method compared to the bipolar scissors method. Weinstock^[9] claimed the degree of pain to be low in patients who underwent thermal welding tonsillectomy.

We found a statistically significant but clinically irrelevant difference (a fraction of a day) between the TWT and CD groups in terms of time required to return to a normal daily diet, similar to findings in two other studies.^[3,11] Lassaletta et al.^[4] reported a significantly earlier return to a normal daily diet amongst patients treated with the CD method compared to the microsurgical bipolar dissection method.^[4] Similarly, Nunez et al.^[10] found that patients operated on using hot dissection electrosurgical instruments returned to their normal daily diet later than did CD patients operated on with classical dissection. However, some authors have stated that the use of a thermal welding system shortened the return to a normal daily diet.^[6,9]

Finally, it has been stated that disposable tool usage is protective against the variant form of Creutzfeldt-Jacob disease.^[2,5,6,9] The forceps used in TWT are disposable and therefore the method should have a very low risk of transmitting variant Creutzfeldt-Jacob disease. This potential benefit could be factored in when weighing the higher cost of TWT compared to CD. Thermal welding forceps costs about 300 USD. So TWT is much more expensive than CD.

We found that TWT provides much better intraoperative control of bleeding in tonsillectomy in children compared to CD. Overall, TWT may be preferable to CD for pediatric tonsillectomy.

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REFERENCES

1. Shah UK, Galinkin J, Chiavacci R, Briggs M. Tonsillectomy by means of plasma-mediated ablation: prospective, randomized, blinded comparison with monopolar electrosurgery. *Arch Otolaryngol Head Neck Surg* 2002;128:672-6.
2. Prokopakis EP, Lachanas VA, Benakis AA, Helidonis ES, Velegrakis GA. Tonsillectomy using the Ligasure vessel sealing system. A preliminary report. *Int J Pediatr Otorhinolaryngol* 2005;69:1183-6.
3. Kirazli T, Bilgen C, Midilli R, Oğüt F, Uyar M, Kedek A. Bipolar electrodissection tonsillectomy in children. *Eur Arch Otorhinolaryngol* 2005;262:716-8.
4. Lassaletta L, Martín G, Villafruela MA, Bolaños C, Alvarez-Vicent JJ. Pediatric tonsillectomy: post-operative morbidity comparing microsurgical bipolar dissection versus cold sharp dissection. *Int J Pediatr Otorhinolaryngol* 1997;41:307-17.
5. Raut VV, Bhat N, Sinnathuray AR, Kinsella JB, Stevenson M, Toner JG. Bipolar scissors versus cold dissection for pediatric tonsillectomy--a prospective, randomized pilot study. *Int J Pediatr Otorhinolaryngol* 2002;64:9-15.
6. Karatzias GT, Lachanas VA, Papouliakos SM, Sandris VG. Tonsillectomy using the thermal welding system. *ORL J Otorhinolaryngol Relat Spec* 2005;67:225-9.
7. Shapiro NL, Bhattacharyya N. Cold dissection versus coblation-assisted adenotonsillectomy in children. *Laryngoscope* 2007;117:406-10.
8. Treat MR. A new thermal device for sealing and dividing blood vessels. Available from: <http://www.starioninstruments.com/PDFs/Treat.pdf>
9. Weinstock BI. An improved method for tonsillectomy using thermal welding technology. Available from: <http://www.starioninstruments.com/PDFs/Tonsil.pdf>
10. Nunez DA, Provan J, Crawford M. Postoperative tonsillectomy pain in pediatric patients: electrocautery (hot) vs cold dissection and snare tonsillectomy--a randomized trial. *Arch Otolaryngol Head Neck Surg* 2000;126:837-41.
11. Pizzuto MP, Brodsky L, Duffy L, Gendler J, Nauenberg E. A comparison of microbipolar cautery dissection to hot knife and cold knife cautery tonsillectomy. *Int J Pediatr Otorhinolaryngol* 2000;52:239-46.
12. Silveira H, Soares JS, Lima HA. Tonsillectomy: cold dissection versus bipolar electrodissection. *Int J Pediatr Otorhinolaryngol* 2003;67:345-51.
13. von Baeyer CL. The Faces Pain Scale - Revised (English, French and 33 other languages). Available from: <http://www.painsourcebook.ca/docs/pps92.html>
14. Karatzanis AD, Bourolias CA, Prokopakis EP, Panagiotaki IE, Velegrakis GA. Tonsillectomy with thermal welding technology using the TLS(2) thermal ligating shear. *Int J Pediatr Otorhinolaryngol* 2007;71:999-1002.
15. Windfuhr JP, Chen YS. Incidence of post-tonsillectomy hemorrhage in children and adults: a study of 4,848 patients. *Ear Nose Throat J* 2002;81:626-8.
16. Karatzanis A, Bourolias C, Prokopakis E, Panagiotaki I, Velegrakis G. Thermal welding technology vs ligasure tonsillectomy: a comparative study. *Am J Otolaryngol* 2008;29:238-41.
17. Chimona T, Proimos E, Mamoulakis C, Tzanakakis M, Skoulakis CE, Papadakis CE. Multiparametric comparison of cold knife tonsillectomy, radiofrequency excision and thermal welding tonsillectomy in children. *Int J Pediatr Otorhinolaryngol* 2008;72:1431-6.