

# Multiparametric comparison of thermal welding versus cold knife tonsillectomy with tonsil size\*

## Thermal welding tonsillektomi ile soğuk bıçak tonsillektominin tonsil büyüklükleri eşliğinde multiparametrik karşılaştırılması

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### Abstract

**Objective:** This study is performed to compare thermal welding tonsillectomy (TWT) technique versus cold knife tonsillectomy (CKT) technique under consideration of postoperative pain, intraoperative bleeding, operation time, and tonsil size.

**Methods:** One hundred and three patients underwent tonsillectomy aged between 5 and 39 years were included into the study. Tonsil sizes were classified with Brodsky's tonsil scale system ranging from 0-4. Duration of the operation and the amount of bleeding were recorded. Postoperative pain was evaluated via visual analogue scale and face pain scale on the 1st, 3rd, 7th and 14th postoperative days.

**Results:** Mean operative time was lower in TWT group than CKT group ( $p<0.01$ ). Mean pain score on 1st, 3rd, 7th postoperative days was significantly higher in CKT than in TWT group ( $p<0.01$ ). Mean pain score on the 7th postoperative day in CKT group of patients with tonsil size 1 and 2 was significantly higher than the patients with tonsil size of 3 ( $p<0.01$ ). Mean pain score on the 3rd, 7th and 14th postoperative days in TWT group of patients with tonsil size 1 and 2 was significantly higher than the patients with tonsil size of 3 ( $p<0.01$ ). The average amount of bleeding in CKT group was significantly higher than in TWT group ( $p<0.01$ ). There were no significant differences on the average amount of bleeding obtained in both group according to the size of tonsils ( $p>0.05$ ).

**Conclusion:** In the present study, it was concluded that the tonsil size does not affect the amount of intraoperative bleeding however increase in the tonsil size decreases the postoperative pain.

**Key words:** Bleeding, operation time, postoperative pain, tonsil size, tonsillectomy.

### Özet

**Amaç:** Bu çalışmanın amacı, *thermal welding* tonsillektomi (TWT) ile soğuk bıçak tonsillektomi (SBT), intraoperatif kanama, operasyon süresi, tonsil büyüklükleri ve postoperatif ağrı parametreleri eşliğinde karşılaştırmaktır.

**Yöntem:** Çalışmaya tonsillektomi uygulanan yaşları 5 ile 39 arasında değişen 103 olgu dahil edildi. Tonsil büyüklükleri 0-4 arasında değişen standart Brodsky skorlama sistemi ile sınıflandırıldı. Operasyon süreleri ve kanama miktarları ölçüldü. Tüm hastaların postoperatif 1, 3, 7, ve 14 günlerde Vizüel Analog Skala (VAS) ve Yüz Ağrı Skalası (YAS) ile ağrı değerlendirildi.

**Bulgular:** Ameliyat süresinin TWT grubunda SBT grubuna göre daha kısa olduğu saptandı ( $P<0.01$ ). SBT grubunda 1. 3 ve 7. gün ağrı skorları ortalaması, TWT grubu ortalamasından anlamlı şekilde yüksek bulundu ( $p<0.01$ ). Soğuk bıçak tonsillektomi grubunda bademcik büyüklüğü 1 ve 2 olan olguların 7. gün ağrı skorları ortalaması, 3 olan olgulara göre anlamlı şekilde yüksek bulundu ( $p<0.01$ ). *Thermal welding* tonsillektomi grubunda bademcik büyüklüğü 1 ve 2 olan olguların 3. gün, 7. gün ve 14. gün ağrı skorları ortalaması, 3 olan olgulara göre anlamlı şekilde yüksek bulundu ( $p<0.01$ ). Soğuk bıçak tonsillektomi grubunda kanama miktarı ortalaması, TWT grubundan anlamlı şekilde yüksek bulundu ( $p<0.01$ ). Her iki grupta da bademcik büyüklüğüne göre olguların kanama durumları arasında anlamlı farklılık bulunmadı ( $p>0.05$ ).

**Sonuç:** Sunulan çalışmada tonsil büyüklüğünün intraoperatif kanama miktarını etkilemediği ancak tonsil büyüklüğü arttıkça postoperatif ağrının azaldığı sonucuna varılmıştır.

**Anahtar sözcükler:** Kanama, operasyon süresi, postoperatif ağrı, tonsil büyüklüğü, tonsillektomi.

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**Received:** October 17, 2012; **Accepted:** January 4, 2013; **Published online:** April 24, 2013

\*This paper was presented as a poster at the 10th International Otorhinolaryngology, Head & Neck Surgery Congress which was held in Ankara, Turkey on 26-28th April, 2012.

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Online available at:  
www.jmedupdates.org  
doi:10.2399/jmu.2013001005  
QR code:



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Technologic devices developed in recent years aim to minimize peri-, and postoperative morbidity of tonsillectomy which is the most prevalent surgical procedure performed in the field of otorhinolaryngology worldwide. In parallel with technologic advances, application of this surgical procedure is realized easily in a relatively shorter operative time.

In the medical literature, tonsillectomy techniques are simply categorized as cold and thermal techniques.<sup>[1]</sup> These techniques include classical cold knife tonsillectomy (CKT), guillotine excision, monopolar or bipolar electrocauterization, potassium titanil fosfate laser, harmonic ultrasonic scalpel, ligasure procedure, radiofrequency ablation and thermal welding tonsillectomy (TWT). Thermal welding technology (TWT; Starion Instruments Co., Saragota, CA, USA) is an innovative technique, which combines thermal energy and pressure to dissociate tissues by coagulation and decreases intraoperative bleeding, operative times and pain. TWT is frequently used in recent years in that it especially decreases operative times and postoperative morbidities.<sup>[2,3]</sup>

In this study CKT and TWT techniques were compared as for parametres of postoperative pain, intraoperative bleeding, operative times and tonsil sizes.

## Materials and Method

One hundred and three cases who underwent tonsillectomy in ENT clinics of Lutfiye Nuri Burat State Hospital between 2008 and 2010 were included in the study. Ethics Committee and Scientific Researches Evaluation Board of our university approved the study. Tonsillectomy indications include recurrent tonsillitis and chronic tonsillitis. Any significant difference was not found between both groups as for tonsillectomy indications ( $p>0.05$ ). Patients aged less than 3 years, those who had suffered from tonsillitis, acute respiratory tract infection, peritonsillar abscess, bleeding diathesis and required adenoidectomy were not included in the study. A proportion of pediatric patients consisted of cases who had had adenoidectomy previously, while others did not require adenoidectomy in that they were above a certain age and had not adenoid hypertrophy. Preoperatively, tonsil sizes of the patients were evaluated by Brodsky Tonsillar Hypertrophy Grading Scale scoring system. All patients and their parents were informed of surgical complications and the study protocol and their consent forms were obtained. The cases were operated under endotracheal anesthesia by the same surgeon. The patients were randomly assigned to CKT and TWT groups inde-

pendently from their tonsil sizes. All patients were placed in the Rose position and Davis Boyle Mouth Gag was placed intraorally. Thermal welding tonsillectomy was performed using (TWT) Starion Thermal Welding System (Starion Instruments, Sunnyvale, CA, USA). This system consists of an energy source connected to an ultraslim bayonet forceps and a foot pedal. Contrary to the application in the cold technique, mucosal incision was not performed. Tonsils were retracted medially and using an ultraslim forceps and a 4-level thermal energy, dissection was started from upper level of anterior plica down to the lower pole. Hemostatic control was performed with the same forceps. In cold knife tonsillectomy (CKT) tonsil was grasped with an Allis clamp and retracted medially. After mucosal incision, tonsil was elevated with a tonsil spoon from upper to lower pole and dissected. Tonsillar lodge was packed snugly till other tonsil was dissected. Bleeding points in the tonsillar lodge were controlled with 3-0 vicryl sutures. After completion of the procedures, Davis-Boyle mouth gag was removed and the patient was extubated. Operative time was calculated as the time interval from the placement of the mouth spanner to its removal. For all patients amount of bleeding was determined by adding the volume of blood in the suction bottle to the amount of serum used for irrigation. After hemostatic control, the patients were discharged on the first postoperative day. Paracetamol was used for analgesia. Amoxicillin-clavulanic acid was given to all patients as postoperative antibiotherapy.

Visual Analogue Scale (VAS) and Facial Pain Scale were used to measure intensity of pain with scores ranging from 0 to 10 at the 1st, 3rd, 7th and 14th postoperative days. Facial Pain Scale was evaluated by the parents of the children under 7 years. Pain assessments were realized in the mornings before eating, drinking and receiving any analgesic drug. The pediatric patients switched to normal diet on the 9th postoperative day. The patients were called for return visits on the 3rd and 7th postoperative days. On the 14th postoperative day pain grading forms were collected.

Statistical Analyses: Data were analyzed using the NCSS (Number Cruncher Statistical System) 2007&PASS (Power Analysis and Sample Size) 2008 Statistical Software (Kaysville, Utah, USA). Parametric tests were applied to data of normal distribution and non-parametric tests were applied to data of questionably normal distribution. Student t-test and Mann-Whiney U test were used to compare independent groups. The distribution of categorical variables in both groups was compared using Pearson chi-

square and Fisher's exact tests. Data are expressed as mean±SD or median (interquartile range), as appropriate. Statistical significance was assumed for p<0.05.

**Results**

The study was performed on 103 (46 female, 57 male) cases. TWT group was consisted of 54 (49 pediatric, 5 adult) (52.4%), while CKT group was consisted of 49 (43 pediatric, 6 adult) (47.6%) patients. Mean age of all the patients was 11.18± 6.68 years (TWT group, 10.00±4.97 yrs and CKT, 11.97± 6.09 yrs) Groups were comparable as for age and gender of the patients (p>0.05). Patients were operated with the indication of recurrent (TWT group, n=40; 74% and CKT group, n=36; 73%) or chronic tonsillitis (TWT group, n=14; 26%, CKT group, n=13; 27%) without a significant intergroup difference (p>0.05). In the CKT group seven and in the TWT group nine pediatric patients were under 7 years of age, still without any significant intergroup difference.

**Operative time:** Mean operative times were 11.09 ± 1.90 min for TWT and 23.67±6.20 min for CKT groups. A significant difference was found between 2 groups regarding operative times (p<0.01).

**Tonsil size:** Based on Brodsky's Grading Scale, Grades 1 (n=10; 20.4%), 2 (n=19; 38.8%) and 3 (n=20; 20.4%) tonsil sizes were detected in cold knife tonsillectomy group with respective percentages. None of the tonsils in the CKT group was of Grade 4 size. In the TWT group Grade 1 tonsils were not detected, while Grades 2, 3 and 4 tonsils were found in 26 (48.1%), 26 (48.1%), and 2 (3.7%) cases, respectively. When all cases of both groups were considered, tonsil sizes of Grades 1, 2, 3 and 4 were encountered in 9.7% (n=10), 43.7% (n=45), 44.7 (n=46) and 1.9% (n=2) of the cases, respectively (Table 1).

**Evaluation of postoperative pain:** Distribution of postoperative pain scores are presented in Table 2. Accordingly, in the CKT group mean±SD of pain scores measured on the 1st, 3rd and 7th postoperative days were found to be significantly higher than that of the TWT group (p<0.05). Pain scores estimated on the 14th day were not statistically significantly different between groups (p>0.05). When pain scores of the patients with tonsil sizes of Grade 2 and 3 were compared, in the TWT group intensity of perceived pain was lower in Grade 2 patients on the 7th (Table 3) and in Grade 3 (Table 4) patients on the 3rd and 7th postoperative days relative to the CKT group. When pain scores of the patients in the CKT group with tonsil sizes of Grade 2 and 3 were com-

**Table 1.** Distribution of tonsil sizes based on types of the tonsillectomy techniques.

Tonsil size	Cold knife (n=49) n (%)	Thermal welding (n=54) n (%)	Total (n=103) n (%)
1	10 (20.4%)	0 (0.0%)	10 (9.7%)
2	19 (38.8%)	26 (48.1%)	45 (43.7%)
3	20 (40.8%)	26 (48.1%)	46 (44.7%)
4	0 (0.0%)	2 (3.7%)	2 (1.9%)

**Table 2.** Evaluation of pain scores based on tonsillectomy techniques.

Pain score	Cold knife (n=49) mean±SD (median)	Thermal welding (n=54) mean±SD (median)	p value
1st day	5.59±2.99 (6.00)	3.55±2.04 (4.00)	0.001*
3rd day	4.53±2.70 (4.00)	3.30±2.49 (2.00)	0.015†
7th day	2.41±2.04 (2.00)	0.70±1.46 (0.00)	0.001*
14th day	0.28±1.00 (0.00)	0.85±2.50 (0.00)	0.385

Mann-Whitney U test; \*p<0.01; †p<0.05; SD: Standard deviation

**Table 3.** Intergroup comparison of pain scores of the patients with Grade 2 tonsil sizes.

Pain score	Cold knife (n=49) mean±SD (median)	Thermal welding (n=54) mean±SD (median)	p value
1st day	5.16±2.85 (6.00)	3.46±1.92 (3.00)	0.051
3rd day	3.79±2.90 (4.00)	4.23±2.35 (4.00)	0.697
7th day	3.79±1.99 (4.00)	1.46±1.84 (0.00)	0.000
14th day	0.74±1.52 (0.00)	1.77±3.41 (0.00)	0.512

Mann-Whitney U test; SD: Standard deviation

**Table 4.** Intergroup comparison of pain scores of the patients with Grade 3 tonsil sizes.

Pain score	Cold knife (n=49) mean±SD (median)	Thermal welding (n=54) mean±SD (median)	p value
1st day	5.20±3.27 (5.00)	3.69±2.24 (4.00)	0.185
3rd day	4.60±2.83 (4.00)	2.46±2.35 (2.00)	0.008
7th day	1.40±1.60 (1.00)	0.00±0.00 (0.00)	0.000
14th day	0.00±0.00 (0.00)	0.00±0.00 (0.00)	1.000

Mann-Whitney U test; SD: Standard deviation

pared, (Table 5), a statistically significant difference was not found between pain scores measured on the 1st, 3rd and 14th postoperative days ( $p>0.05$ ). Mean pain score of the cases with Grade 2 tonsils measured on the 7th postoperative day was found to be significantly higher relative to Grade 3 tonsils ( $p<0.01$ ). However in the TWT group, a statistically significant difference was not found between pain scores estimated on the first postoperative day ( $p>0.05$ ). Mean pain score of the the cases with Grade 2 tonsil sizes determined on the 3rd, 7th and 14th postoperative days was significantly higher than that of the patients with Grade 3 tonsils ( $p<0.01$ ).

Evaluation of the intraoperative bleeding: In the CKT group, mean amount of bleeding was significantly higher relative to the TWT group ( $p<0.01$ ). In the CKT group, mean blood loss estimated for 49 cases was  $100.51\pm58.49$  cc, while in the TWT group it was  $37.50\pm9.57$  cc for 4 cases. Among all cases, amount of bleeding in patients with Grades 1 and 2 tonsils was compared with those with Grades 3 and 4 tonsils (Table 6). Any statistically significant difference was not found between these 2 groups as for amount of bleeding ( $p>0.05$ ).

## Discussion

Tonsillectomy is still the most frequently performed operation in the field of otorhinolaryngology. Various tonsillectomy techniques have been described.<sup>[1]</sup> Recent investigations aim to find innovative techniques so as to minimize especially postoperative pain, operative times and intraoperative bleeding.<sup>[4-7]</sup> Thermal welding is a newly developed technique which enables simultaneous hemostatic control and dissection.

In some studies comparing CKT and TWT, significantly milder pain intensity in the TWT group has been reported.<sup>[4,8,9]</sup> However, in some other publications, any significant difference was not found between 2 groups as for perceived pain.<sup>[7]</sup> However, Ozan et al.<sup>[5]</sup> reported that for the first 2 postoperative days, morning pain scores were significantly lower in the thermal welding group, while from the 3rd postoperative day and at nights, pain scores were not significantly different between both groups. However none of the studies performed have investigated the correlation between tonsil sizes and intensity of perceived pain. In our study, in cases with Grade 2 tonsil size in the CKT group, pain scores estimated on the 7th postoperative day were found to be significantly higher relative to those with Grade 3 tonsil sizes ( $p<0.01$ ). In the CKT group, postoperative median pain scores esti-

**Table 5.** Comparative evaluation of pain scores in patients with Grade 2 and 3 tonsil sizes.

Pain score	Tonsil size		p value
	2 mean±SD (median)	3 mean±SD (median)	
Cold knife			
1st day	5.16±2.85 (6.00)	5.20±3.27 (5.00)	0.901
3rd day	3.79±2.90 (4.00)	4.60±2.83 (4.00)	0.496
7th day	3.79±1.99 (4.00)	1.40±1.60 (1.00)	0.001*
14th day	0.74±1.52 (0.00)	0.00±0.00 (0.00)	0.270
Thermal welding			
1st day	3.46±1.92 (3.00)	3.69±2.24 (4.00)	0.721
3rd day	4.23±2.35 (4.00)	2.46±2.35 (2.00)	0.004*
7th day	1.46±1.84 (0.00)	0.00±0.00 (0.00)	0.001*
14th day	1.77±3.41 (0.00)	0.00±0.00 (0.00)	0.005*

Mann-Whitney U test; \* $p<0.01$ , SD: Standard deviation

**Table 6.** Evaluation of bleeding status in 2 subgroups of tonsil size (1+2 and 3+4).

Bleeding status		Tonsil size		p value
		1 + 2 n (%)	3 + 4 n (%)	
Cold knife	Present	29 (100.0%)	20 (100.0%)	-
	Absent	0	0	
Thermal welding	Present	0 (0.0%)	4 (14.3%)	0.112
	Absent	26 (100.0%)	24 (85.7%)	
Total	Present	29 (52.7%)	24 (50.0%)	0.845
	Absent	26 (47.3%)	24 (50.0%)	

Chi-square test; Fisher's exact test

ated on the 1st, 3rd, 7th and 14th postoperative days in patients with Grade 2 tonsil sizes decreased respectively as 6, 4, 4 and 0 points, while in cases with Grade 3 tonsil sizes the corresponding decrements were as 5, 4, 1 and 0 points (Table 5). In cases with Grade 3 tonsil sizes, intensity of perceived pain was milder at all measurement points, only on the 7th postoperative day a statistically significant difference appeared in pain scores which were indicative of wound healing. However in the TWT group, with the exception of the first postoperative day, pain scores estimated on all postoperative days in patients with Grade 2 tonsil size were significantly higher relative to those in the Grade 3 tonsil group ( $p<0.01$ ). In the TWT group, a statistically significant difference in median pain scores of

subgroups with Grades 2 and 3 tonsils becomes apparent immediately after the first postoperative day, but the scores drop to "0" (no difference) 2 days later. However, in the CKT group hardly on the 14th postoperative day intergroup difference was not observed. These results might suggest relatively faster improvement in the TWT group.

Inverse correlation between smaller tonsil sizes and more intense pain can be explained by relatively increased muscle and nerve damage incurred during the dissection of especially adhesive and atrophic tonsillitis. Many studies reported that damage to tonsil capsule and pharyngeal muscles increases postoperative pain and also delays the healing process.<sup>[10,11]</sup> We also compared two tonsillectomy techniques and detected significantly decreased perceived pain intensity in the TWT group on the 1st, 3rd and 7th postoperative days ( $p < 0.01$ ).

When compared with other classical techniques, TWT is a safe method with nearly negligible amount of intraoperative blood loss. Karatzias et al. compared TWT and bipolar tonsillectomy and reported TWT as a bloodless operation.<sup>[12]</sup> Similarly, Yaşar et al. reported lack of any primary or secondary bleeding in the TWT group.<sup>[13]</sup> In our study, bleeding was observed in only 4 cases in the TWT group. Besides in the present study, tonsil sizes and amount of bleeding were compared. Any significant difference was not found between groups as for tonsil sizes and amount of bleeding ( $p > 0.05$ ).

Recent studies have reported development of bacteremia after tonsillectomy.<sup>[14,15]</sup> Therefore, we used antibiotherapy in all of our patients postoperatively.

The objectivity of the Brodsky's Tonsillar Size Grading Scale we used in our study might be debatable. This tonsillar size grading scale is frequently used in studies cited in the medical literature<sup>[16,17]</sup> albeit its some inherent shortcomings.<sup>[18]</sup> Since an evaluation scale with higher degree of objectivity is not available, we have also used the same scale in our study.

TWT offers advantages in minimizing the amount of bleeding and decreasing intensity of pain significantly together with shorter operative times. Chimona et al. reported significantly shorter operative times for TWT when compared with CKT.<sup>[4]</sup> Similar outcomes have been encountered in other publications.<sup>[5,8,13]</sup> Also in our study, mean operative time in the TWT group was significantly shorter relative to the CKT group.

## Conclusion

In our study, we revealed the superiority of TWT over CKT, in that it decreased amount of bleeding, operative times and postoperative pain. As suggested by this study, inverse correlation between tonsil size and intensity of pain should be further investigated in future studies, which will take various parameters as age of the patients, tonsil size and duration of chronic tonsillitis into consideration.

**Conflict of Interest:** No conflicts declared.

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*Please cite this article as:* Çelebi Ş, Çelik Ö, Tepe Karaca Ç, Ulusoy S. Multiparametric comparison of thermal welding versus cold knife tonsillectomy with tonsil size. J Med Updates 2013;3(1):13-18.