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**ARAŞTIRMA YAZISI** / ORIGINAL ARTICLE

# The Efficiency of Peripheral Nerve Blockade and Trigger Point Injections in the Treatment of Chronic Tension-Type Headache

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**ABSTRACT**

Purpose: Greater and lesser occipital nerve blockade (GONB/LONB) using local anesthetics with and without corticosteroids, and supraorbital and supratrochlear nerve blockade (STNB) using local anesthetics and trigger point injections (TPI) are commonly employed for the treatment of primary and secondary headache disorders. In this study, we aimed to investigate the efficiency of peripheral nerve blockade in the treatment of chronic tension-type headache.

Patients and Methods: A total of 174 patients who received GONB and/or STNB with or without TPI between June 2013 and October 2016 were included in this study. The patients were divided into three groups as GONB, GONB+STNB, GONB+STNB+TPI and followed up for four weeks with VAS score. In the GONB alone group, triamcinolone and bupivacaine were used, and in the remaining two groups, only bupivacaine was administered.

Results: The mean age of the study population was 43.2±7.2 years. Female dominance was present. There were no statistically significant differences between the three groups regarding age and gender. Furthermore, headache frequency and VAS scores of the groups did not significantly differ before treatment; however, significant differences were observed (in both) between and within groups after treatment. The response rates were significantly higher (50% and 75%) in the last treatment group.

Conclusion: In this study, TPI combined with GONB and STNB was superior to GONB+STNB and GONB alone regarding headache frequency. We also found that in all groups, post-treatment VAS scores and headache frequency were lower compared to pre-treatment values.

**Keywords:** Chronic tension-type headache, Peripheral nerve blockade, Greater Occipital Nerve Block, Supratrochlear Nerve Block, Trigger Point Injection

**KRONİK GERİLİM TİPİ BAŞ AĞRISI TEDAVİSİNDE PERİFERİK SİNİR BLOKAJI VE TETİK NOKTA ENJEKSIYONLARININ ETKİNLİĞİ**

**ÖZET**

Amaç: Lokal anestezik madde tek başına veya kortikosteroid ile kombine yapılan büyük veya küçük oksipital sinir blokajları (GONB/LONB), lokal anestezik madde ile yapılan supraorbital sinir blokajı (SONB) veya supratroklear sinir blokajları (STNB) gibi periferik sinir blokajı uygulamaları ve tetik nokta enjeksiyonları (TPI) primer veya sekonder baş ağrıları tedavilerinde kullanılabilir. Çalışmamızda bu uygulamaların kronik gerilim tipi baş ağrısında etkinliğini araştırmayı amaçladık.

Hastalar ve Yöntemler: Haziran 2013 ile Ekim 2016 tarihleri arasında kronik gerilim tipi baş ağrısı tanısıyla GONB, STNB ve TPI yapılan 174 hasta belirlenen gruplara ayrıldı ve enjeksiyonun 4 hafta öncesi ve 4 hafta sonrası takiplerinde VAS ve ağrı frekansları retrospektif karşılaştırıldı. Birinci grup sadece GONB, ikinci grup GONB+STNB ve üçüncü grup aynı anda üç uygulamanında yapıldığı hastalardan oluşturuldu. GONB bupivakain ve triamsinalon ile diğer uygulamalar bupivakain ile yapıldı.

Bulgular: Hastaların yaş ortalaması 43.2±7.2, kadın cinsiyet biraz daha fazla tespit edildi. Her üç grup arasında cinsiyet ve yaş ortalamaları arasında istatistiksel fark tespit edilmedi. Gruplar arasında tedavi öncesi ağrı sıklığı ve VAS değerleri arasında istatistiksel fark yok iken, tedavi sonrası bu parametreler arasında grupların kendi içinde ve arasında anlamlı fark tespit edildi. Grup üçte %50 ve %75 yanıt oranlarında anlamlı farklılık tespit edildi.

Sonuç: Çalışmada, STNB + GONB ile TPI'nin frekans açısından tek başına STNB+ GONB kombinasyonu veya GONB'ye kıyasla daha iyi sonuçlar verdiğini tespit ettik. Ayrıca tanımlanan tüm enjeksiyon yöntemlerinin etkili olduğunu ve tedaviden sonra VAS skorunu ve baş ağrısı sıklığını azalttığını tespit ettik.

**Anahtar sözcükler:** Kronik gerilim tipi baş ağrısı, Periferik Sinir Blokajı, Büyük Oksipital Sinir Blokajı, Supratkroklear Sinir Blokajı, Tetik Nokta Enjeksiyonu

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Headache disorders are frequently encountered neurological diseases that cause disabilities. One of these disorders is tension-type headache (TTH), which is the most common type of chronic recurring headache pain. It is also the leading type of headache with a life time prevalence of 30–78% in the general population (1). In the treatment of TTH, different medical and non-medical options, such as amitriptyline, sertraline, mirtazapine, alprazolam, valproate, gabapentin, ibuprofen, paracetamol(acetaminophen), BTX-A, cognitive-behavioral therapy, EMG biofeedback, acupuncture, and peripheral nerve blockade have been reported (2-5). However, except for globally accepted medical treatments, there is not enough data about techniques, such as peripheral nerve blockade. Shortly after, animal studies showed that trigeminal and occipital inputs were conjoined in the caudate nucleus of the trigeminal nerveand blockade or stimulus of those nerves within their innervation zones were used to treat headache disorders (6). Today, the use of peripheral nerve blockade is accepted and reported effective in patients who cannot tolerate medical treatment, those with various systemic diseases which medical treatment is contraindicated, those who did not achieve satisfactory results with other accepted methods, and pregnant women (7). Peripheral nerve blockade techniques for headache disorders include greater or minor occipital nerve block (GONB or LONB) with local anesthetics with or without corticosteroids and blockade of supraorbital and supratrochlear (SONB-STNB) branches of trigeminal nerve with a local anesthetic material (7). In the literature, studies have reported the effectiveness of these methods in the treatment of headache disorders (8-11). Trigger point injection (TPI) is also used and reported effective in the treatment of primary and secondary headache disorders (12,13). However, there is not a sufficient amount of research in the literature that compares these techniques. Therefore, in this study, we compared the effectiveness of GONB, STNB, and TPI in the treatment of TTH.

## Materials and methods

### *Patient Selection*

A total of 479 diagnosed cases with TTH according to ICHD-2 and treated with peripheral nerve blockade or TPI in our clinic between June 2013 and October 2016 were included in this study. All patients had been being followed up for four weeks before and four weeks after the procedure (eight weeks totally). Data regarding visual analog scale (VAS) and headache frequency were obtained during the follow up. According to the exclusion criteria, 305 patients were excluded from the study (Figure 1),

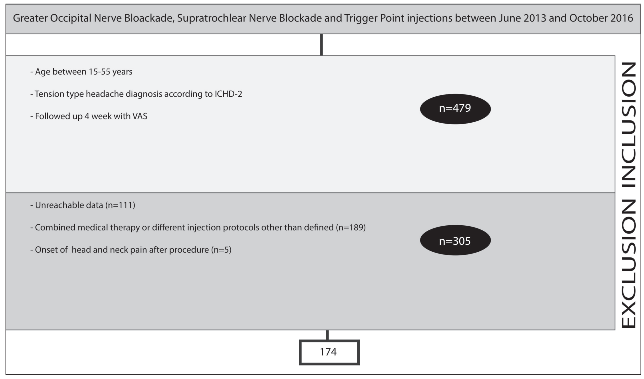


**Figure 1**. Flow diagram of the study population.

and the remaining 174 patients were found suitable for the final assessment and divided into the following three treatment groups: GONB (Group 1), GONB plus STNB were administered with the same doses (Group 2), and GONB plus STNB combined with TPI performed on at least two muscle groups (Group 3). Headache frequencies and VAS scores before and after treatment were analyzed in each group and 50% and 75% treatment response rates were calculated for each group.

### *Injection technique*

Before all procedures, injections' sites were cleaned with alcohol and all preparations were diluted with saline (0.9% NaCl). Greater occipital nerve (GON) injections were performed at the 1/3 medial of the line drawn between the occipital protuberance and mastoid process (7). A mixture of 40 mg triamcinolone and 10 mg bupivacaine was injected using a 22-gauge needle.

STNB was performed by injecting a total dose of 8 mg bupivacaine into 1 cm medial of the superior orbital fissure using a 27-gauge needle (7).

The TPI sites were determined by palpating the superior trapezius, splenius capitis, and levator scapulae. The injection was considered successful after performing bilateral TPI on at least two muscle groups. A total dose of 5 mg bupivacaine for each trigger point was injected using a 22-gauge needle.

### *Statistical analysis*

The summary statistics of the groups were obtained using means (medians) and ranges. Distribution of normality was assessed with the D'Agostino-Pearson test. Continuous variables with normal distribution within two groups were compared by independent and paired t-tests whereas variables with non-normal distribution within two groups were compared using the Mann Whitney and Wilcoxon tests. Three group comparisons were undertaken using ANOVA for normally distributed continuous variables, chi-square test for nominal variables, and Kruskal-Wallis test for continuous variables without normal distribution. A two-tailed p value of < 0.05 was considered statistically significant. All statistical analyses were performed using MedCalc statistics software (version 12.2.1.0, Mariakerke, Belgium).

## Results

The mean age of the study population was 43.2±7.2 years, and 58.6% of the sample was female. Demographic data belonging to the three treatment groups are shown in Table 1. There were no statistically significant differences regarding age and gender between the three groups (Table 1). A group-wise comparison showed that differences in pre-treatment frequencies in three groups were not significant whereas Group 3 had a significantly lower post-treatment headache frequency compared to the other groups (p<0.001). Regarding VAS scores, pre-and-post treatment group-wise comparisons did not show any significant difference (Table 1). The intra-group comparisons revealed significant differences in both frequency and VAS scores between pre- and post-treatment values in all groups (Table 2). Figure 2 presents 50% and 75% treatment response concerning headache frequency. Group 3 had a significantly higher (50% and 75%) response rate for this parameter.

**Table 1**. Comparison of demographic and study data belong the three groups and corresponding p values.

| | *Group 1 (n=52)* | *Group 2 (n=64)* | *Group 3 (n=58)* | *p value* |
|---|---|---|---|---|
| **Age ±SD** | 42,4±7,3 | 43,3±7,0 | 43,9±7,2 | 0,537 |
| **Gender (%)** | | | | |
| Male | 21 (%40,4) | 26 (%40,6) | 25 (%43,1) | |
| Female | 31 (%59,6) | 38 (%59,4) | 33 (%56,9) | 0,947 |
| Mean pre-treatment frequency (range) | 19,4 (15–27) | 19,4 (15–27) | 19,2 (15–25) | 0,949 |
| Mean post-treatment frequency (range) | 8,6 (3–16) | 8,3 (3–16) | 6,3 (3–13) | **<0.001** |
| Median pre-treatment VAS (range) | 5 (3–6) | 4 (3–6) | 5 (3–6) | 0,945 |
| Median post-treatment VAS (range) | 4 (2–6) | 4 (2–6) | 3 (2–6) | 0,386 |

**GONB;** greater occipital nerve blockade, **STNB;** supranuclear nerve blockade, **TPI;** trigger point injections.

**Table 2**. Comparison of pre-and-post treatment frequency and VAS scores within the groups with corresponding p values.

| | *Pre-treatment* | *Post-treatment* | *p value* |
|---|---|---|---|
| **GONB** | | | |
| Mean Frequency | 19,4 | 8,6 | **<0.001** |
| Median VAS | 5 | 4 | **<0.001** |
| **STNB** | | | |
| Mean Frequency | 19,4 | 8,3 | **<0.001** |
| Median VAS | 4 | 4 | **<0.001** |
| **TPI** | | | |
| Mean Frequency | 19,2 | 6,3 | **<0.001** |
| Median VAS | 5 | 3 | **<0.001** |

**GONB;** greater occipital nerve blockade, **STNB;** supranuclear nerve blockade, **TPI;** trigger point injections.

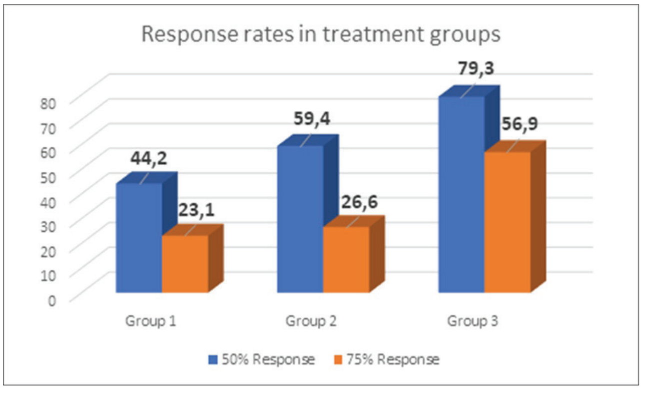


**Figure 2**. 50% and 75% response rates of the three groups. The third group had statistically significant higher 50% and 75% response rates.

## Discussion

In this study, we found that TPI combined with GONB and STNB has superior outcomes related to TTH frequency compared to GONB and STNB or GONB alone. Furthermore, all the injection methods described in this paper were effective in reducing the VAS score and headache frequency after treatment.

TTH is the most frequent type of all primary headache disorders (14) and is associated with significant healthcare costs along with reduced quality of life for the global population (14-16). Many studies investigated the complex trigeminocervical pathophysiology of this commonly seen disorder that causes substantial socioeconomic loss. For instance, in an animal study, excitation of GON was found to be associated with increased metabolic activity in the trigeminal nucleus caudalis and cervical dorsal horn (6). In different studies, authors showed the primary nociceptive afferents ending at the trigeminal nucleus caudalis and GON (17-19). Pain inputs originating from the anterior or posterior head(brain) were reported to converge at the level of brainstem via second-order neurons (20-22). A trigeminal input is defined by nociceptive neurons receiving convergent input from the supratentorial dura and GON. Stimulation of GON increases central excitability of dural afferent input (21) whereas that of nociceptive afferent C-fibers of the dura mater leads to an increased response in trigeminocervical nociceptive neurons to cervical input (23).

This complex pathophysiology of TTH has led researchers to consider various treatment applications (2). However, except for globally accepted medical treatments, there is not enough data about new techniques, such as peripheral nerve blockade. Furthermore, recent studies have contradictory results. Although there is not sufficient data about the application of peripheral nerve blockade in TTH, many studies have reported the effectiveness of this technique in other primary headache disorders; e.g., occipital neuralgia, cervicogenic headache, migraine and cluster headaches (8,9,24,25). Patients with headaches associated with lumbar puncture and refractory trigeminal neuralgia have also benefited from this technique (26.27). On the other hand, in one of the rare studies on the use of peripheral nerve blockade in chronic TTH, it was reported that GONB performed with 50 mg prilocaine and 4 mg dexamethasone was not effective in a small patient group (4). In another larger study, GONB was found effective in pediatric patients with chronic headache, but in that study, there was only one case of chronic TTH (5). Apart from GONB, blockade of the lesser occipital nerve, auriculotemporal and supratrochlear branches of the trigeminal nerve and supraorbital nerve can be performed. In a study comparing GONB with supraorbital blockade (SOB) in patients with chronic migraine and TTH, the authors found no significantly different response rates for both techniques. They also noted that TTH frequency was reduced by 30% and the response was only confined to the injection area (9). In a different study, a positive response rate of 85% was achieved by applying GONB together with SOB in patients with chronic migraine (28). In the current study, after a four-week follow up, we found that pain frequency and severity were significantly reduced in patients who only underwent the GONB procedure compared to pre-treatment state. All patients reported pain during follow up; however, the rates of 50%-and 75%-reduced frequency were 44.2% and 23.1%, respectively. We also detected a significant decrease in pain frequency and severity in patients who had undergone both GONB and STNB procedures. Again, none of the patients was pain-free during the follow up period, but the rates of 50%- and 75%-reduced frequency were better (59.4% and 26.4%, respectively) compared to the GONB group. The accepted trigeminocervical mechanism of TTH can explain the differences between Groups 1 and 2. However, different mechanisms might also have a role in cases where complete remission is not achieved. Furthermore, this mechanism does not answer the question whether complete resolution of headaches will be maintained after an extended follow-up.

In addition to GONB and GONB plus STNB groups, we examined a third group in which TPI was additionally performed. TPI is used to treat a variety of pain spectrums caused by various musculoskeletal and neurological disorders (29). A trigger point (TP) is a qualitative feature of physical examination in myofascial pain and can also be encountered in primary and secondary headaches (30.31). Although the mechanism of TP is not fully known, it is suggested that it involves the formation of a taut band due to excessive acetylcholine release from neuromuscular junction caused by abnormal endplate potentials. The sustained muscle contraction may lead to local ischemia, hypoxia, and the release of algogenic substances that sensitize peripheral nociceptors (32). Continuous peripheral sensitization may lead to long-term electrophysiological changes in the dorsal horn neurons and supraspinal structures, resulting in central sensitization (33). Central sensitization fed by peripheral sensitization at the level of the spinal dorsal horn/trigeminal nucleus might play a crucial role in the formation of chronic pain (34,35). TPs at the level of head and neck were associated with severity and duration of the headache. Increased frequency of TPs in TTH, migraine and cluster headaches has been reported (8,36-39). Other researchers also noted reduced frequency and intensity of pain during one-year follow up in patients treated with an injection of botulinum toxin-A (BTX-A) into the frontalis, splenius capitis, trapezius, occipitalis and temporalis muscles (40). In another study, TPI with BTX-A was found effective in TTH (3). TPI with lidocaine was also found effective in chronic TTH (12). Consistent with these findings, we found that TPI combined with GONB and STNB caused a significant decrease in pain severity and frequency in patients. Furthermore, we found higher 50% and 75% response rates (79.3% and 56.9%, respectively) compared to the other treatment groups. However, none of our patients were pain-free during follow-up.

There are some limitations in our study. The groups were relatively small. Our results should be supported by larger studies. The second limitation relates to the sham effect of the injection. Finally, our follow-up period was a four-week period. More reliable data can be obtained in long-term follow-up.

## Conclusion

Peripheral nerve blockade with GONB and STNB is effective in patients with chronic TTH. Adding TPI to this therapy further increases treatment efficacy. We consider that blockade procedures combined with TPIs can be particularly beneficial in cases where medical treatment options are not available. Owing to their easy application and low adverse effect profile, TPIs can also be used together with medical treatment to increase treatment response rates or to replace medical treatment that is contraindicated.

The Ethical Review Committee of Ataturk University Research Hospital (file number: 2/16/15.02.2018) approved the study protocol.

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