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# Evaluation of the effectiveness of greater occipital nerve blockade in menstrual migraine

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## Abstract

**Objective** This study aimed to compare the short-term prophylactic efficacy of greater occipital nerve (GON) blockade in menstrual migraine (MM) subgroups and evaluate the long-term effects on patients' quality of life.

**Methods** In this prospective study, 33 patients diagnosed with MM (15 with pure menstrual migraine [PMM] and 18 with menstrually related migraine [MRM]) received bilateral GON blockade once a month, one week before menstrual bleeding, for three months. Patients were evaluated before treatment (month 0) and after treatment completion (months 3 and 6) using the Visual Analog Scale (VAS), Headache Impact Test-6 (HIT-6), Migraine Disability Assessment (MIDAS), and Beck Depression Inventory (BDI) scores.

**Results** MRM patients had a lower age of MM onset ($p=0.024$), higher headache frequency ($p=0.004$), and increased medication overuse ($p=0.027$) compared to PMM patients. After GON blockade, significant improvements were observed in VAS, HIT-6, MIDAS, and BDI scores in both subgroups, with no significant differences between them. The improvement persisted during the medication-free follow-up period (months 3–6). Patients with mild or no depression showed a more substantial increase in quality of life. Patients experiencing a 50% reduction in headache days demonstrated significant improvement in BDI scores.

**Conclusion** GON blockade may be an effective option for short-term and long-term prophylaxis in the treatment of MM, reducing the frequency and severity of headaches and improving quality of life and psychological state. Further research with larger patient cohorts and placebo-controlled trials is necessary to validate these findings.

**Keywords** Menstrual migraine, Pure menstrual migraine, Menstrually related migraine, GON blockade, Short term prophylacy

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## Introduction

Migraine is estimated to range from 1.4 to 2.2%, impacting millions of people and their families worldwide [1]. Migraine is mostly influenced by genetic factors and typically begins in childhood, adolescence, or young adulthood. It is characterized by periodic, often unilateral, throbbing headaches [2].

The prevalence of migraine in women is three times higher than in men [3]. The primary factors contributing to the higher prevalence of migraine in women encompass hormonal fluctuations (particularly variations in estrogen levels), genetic predisposition, and environmental influences. Estrogen has been observed to enhance the sensitivity of the trigeminal nerve system, thereby facilitating the initiation of migraine attacks. Moreover, hormonal alterations throughout the female life cycle (adolescence, menstrual cycle, pregnancy, and menopause) can significantly impact the prevalence and severity of migraines [4].

According to the International Classification of Headache Disorders (ICHD-3), migraine attacks associated with the menstrual cycle are categorized under the subgroup of Menstrual Migraine (MM). The definition of MM is further subdivided into two distinct categories [2]. Pure MM (PMM) attacks occur exclusively during menstruation and are observed in approximately 1% of the population. Menstrually related migraine (MRM) is more prevalent, with an incidence of approximately 6–7%, and can occur outside of menstruation as well [5].

The characteristics of MM attacks significantly differ from those of non-MM atttacks [4]. Previous research has demonstrated that MM attacks tend to last longer, are more severe and occur more frequently compared to non-MM attacks [6]. As yet, there is no spesific treatment that is designed to MM attacks. Nonsteroidal anti-inflammatory drugs (NSAIDs), triptans, and ergot derivatives, commonly used for general migraine treatment, are also recommended for MM. However, the frequent side effects of these treatments, such as menstrual irregularities, poor patient compliance, pregnancy concerns, and comorbid conditions, highlight the need for alternative therapeutic approaches in MM management [7].

Peripheral nerve blocks can also be used in primary and secondary headaches. Peripheral nerve blocks with local anestetics, such as lidocain and bupivakain, for headache treatment target various nerves, including the greater occipital, lesser occipital, supratrochlear, supraorbital, and auriculotemporal nerves. According to previous studies; GON blockade reduces afferent input to this nucleus and complex, thereby diminishing neuronal hyperexcitability and modulating central pain pathways [8]. Thus, GON block was able to improve pain relief for acute and chronic headaches.

In recent years, numerous studies have been conducted on the use of greater occipital nerve (GON) blockade in migraine patients [9, 10]. As an interventional treatment, GON blockade offers an alternative option for patients who do not respond to pharmacological therapies or wish to avoid medication-related side effects. A recent meta-analysis demonstrated that GON blockade treatment significantly reduces headache intensity and frequency (by at least 50%) in migraine patients during the initial and subsequent months post-treatment compared to placebo [11]. However, research on the efficacy of GON blockade in MM patient groups are limited. To date, no studies in the existing literature have directly compared the effectiveness of GON blockade between PMM and MRM subgroups.

The goal of the present article is to compare the short-term prophylactic efficacy of GON blockade in different MM subgroups and to evaluate the long-term effects of this treatment on patients' quality of life. For this purpose, we randomly assigned patients from different MM subgroup to receive GON blockade treatment and then compared the frequency, severity, and duration of migraine attacks before and after treatment, as well as the patients' reported quality of life over a follow-up period. We hypothesized that the GON blockade would be effective in MM and that both subgroups would experience an improvement in long-term quality of life.

## Methods

Patients diagnosed with MM who presented to the neurology outpatient clinic between January 2023 and July 2024 were prospectively examined following Ethics Committee approval (File No: 227, Date: 08.11.2023) A total of 41 patients diagnosed with MM were included in the study, of which 8 patients (PMM: 4, MRM: 4) were excluded due to non-compliance with follow-up. The medical data of the remaining 33 patients (PMM: 15, MRM: 18) were analyzed after obtaining informed consent.

Patients diagnosed with MM according to ICHD-3, with regular menstrual cycles, who had used at least two prophylactic medications without benefit, were unwilling to use oral medications and were considering pregnancy were included in the study. Exclusion criteria were determined as the presence of other primary and secondary headaches, use of hormone therapy or other prophylactic medications within the past 6 months, breastfeeding, and pregnancy. Cranial MRI was performed on all patients to exclude secondary headaches. Patients' demographic characteristics, body mass index (BMI), headache onset, location, triggers, accompanying symptoms, monthly headache days, and medication overuse status were evaluated. BMI was classified as normal (20–25 $kg/m^2$), overweight (25–30 $kg/m^2$), and obese (30 $kg/m^2$ and above).

Headache intensity was assessed using the Visual Analog Scale (VAS) score, ranging from 0 to 10 points [12]. Headache frequency and disability status were measured using Headache Impact Test-6 (HIT-6) [13] and Migraine Disability Assessment (MIDAS) scores [14]. Depression assessment was conducted using the Beck Depression Inventory (BDI) [15], with scores divided into two categories: category 1 for scores 0–16 (minimal-mild depressive) and category 2 for scores 17–63 (moderate-severe depressive). The group whose MIDAS scores, which determine the number of painful days, decreased by 50% at months 0 and 3 was identified as treatment responders, while the group without decrease was identified as non-responders [16]. Patients utilizing NSAIDs for 15 days or more were categorized as the 'medication overuse' (MO) group, while those without medication overuse were classified as the group 'without medication overuse' (wMO) [17].

For short-term prophylaxis, patients received bilateral GON blockade once a month for three months, one week before the expected menstrually bleeding date. For the following three months, participants were monitored without receiving any additional preventive treatments. The GON blockade procedure involved injecting a standard dose of 2 cc (20 mg) lidocaine hydrochloride at each injection site [10]. Evaluations were conducted before treatment (month 0) and after treatment completion (months 3 and 6).

### Statistical analysis

The data were analyzed using IBM SPSS.26 software. Descriptive statistics for continuous variables were presented as mean and standard deviation, while descriptive statistics for categorical variables were presented as number (n) and percentage (%). Relationships between categorical variables were examined using the Chi-square test. The Shapiro-Wilk and Kolmogorov-Smirnov normality tests were employed to assess whether continuous variables exhibited normal distribution. The t-test was utilized for comparing continuous variables between groups. Repeated measures analysis was conducted using the GLM repeated measures test to compare measurements across groups. For all analyses, a p-value of $< 0.05$ was considered statistically significant.

**Table 1** Demographic characteristics and headache features of patients

| | PMM ($n=15$) | MRM ($n=18$) | MM($n=33$) | *P* |
|---|---|---|---|---|
| Age (years) | 41,3 ± 6,4 | 38,9 ± 5,7 | 40 ± 6.1 | 0,271 |
| BMI<br>Normal<br>Overweight/obese | 4(%26.7)<br>11(%73.3) | 6(%33.3)<br>12(%66.7) | 10(%30.3)<br>23(%69.7) | 0,702 |
| Educational Status<br>Primary school and below<br>Middle school and above | 10(%66.7)<br>5(%33.3) | 6(%33.4)<br>12(%66.6) | 16(%48.4)<br>17(%51.6) | 0,070 |
| Age of onset MM (mean ± SD) | 31,3 ± 7,2 | 24,4 ± 9,0 | 27.58 ± 8,8 | **0,024** |
| Headache Frequency (days/month) (mean ± SD) | 6,0 ± 4,5 | 12,2 ± 6,9 | 9.3 ± 6.6 | **0,004** |
| Medication Overuse (MO) | 5(%33.3) | 14(%77.8) | 19(%57.5) | **0,027** |
| Response to Treatment | 12 (%88.0) | 12(%66.7) | 24(%72.7) | 0,458 |

## Results

During an 18-month study period, 33 patients diagnosed with MM at our hospital's neurology outpatient clinic who met our study criteria were prospectively evaluated. Table 1 illustrates the demographic characteristics, MM subtype and onset age, headache frequency, medication overuse and treatment benefit status of the examined population.

Analysis of the demographic data revealed that the mean age of 33 patients was 40.0 ± 6.1 years. The mean age, BMI, and educational status of patients diagnosed with MM did not demonstrate significant differences among MM subgroups. However, the age of MM onset was significantly lower ($p = 0.024$) in MRM patients, compared to the PMM patient group, while headache frequency ($p = 0.004$) and MO were significantly higher ($p = 0.027$). Both subgroups exhibited improvement following treatment, with no significant differences observed between the groups.

In the evaluation of the presentation, triggers, features, and associated symptoms of headache, no significant difference was observed between MM groups (Table 2).

In both diagnostic groups, the initially measured VAS, HIT-6, MIDAS, and BDI scores were significantly higher than the measurements at 3 and 6 months ($p < 0.001$ for both groups). There was no significant difference between the 3-month and 6-month results. No significant effect of diagnostic groups on treatment outcomes was observed (Table 3).

When participants were grouped according to BDI categories, baseline measurements of VAS, HIT-6, and MIDAS scores in both groups were significantly higher than those at the 3rd and 6th months. No significant differences were observed between the results at the 3rd and 6th months. The BDI category did not have a significant impact on treatment outcomes. The only significant difference among the categories was that participants in BDI categories 1–2 had significantly lower baseline and 3rd-month MIDAS measurements compared to those in BDI categories 3–4 ($p = 0.010$ and 0.021, respectively) (Table 4).

When participants were grouped according to MO status; baseline measurements of VAS, HIT-6, and

**Table 2** Headache characteristics, triggers, and associated symptoms of the patients, as well as the total number of patients

| | | PMM (*n* = 15) | MRM (*n* = 18) | MM (*n* = 33) |
|---|---|---|---|---|
| **Presentation of the headache** | Prominent during fasting | 5(%33.3) | 6(%33.3) | 11(%33.3) |
| | Prominent in the night | 1 (%6.6) | 8(%44.4) | 9 (%27.7) |
| | Prominent during exercise | 3 (%20) | 3(%16.6) | 6 (%18.1) |
| | Prominent with laughing | 2(%13.3) | 1(%5.5) | 3 (%9) |
| | Same during daytime | 12 (%80) | 8(%44.4) | 20(%60.6) |
| | Prominent with straining | 1 (%6.6) | 1(%5.5) | 2 (%6) |
| | Prominent in the mornings | 1 (%6.6) | 2(%11.1) | 3 (%9) |
| | Prominent in the cough | 1 (%6.6) | 1(%5.5) | 2 (%6) |
| **Headache triggers** | Stress | 15 (%100) | 18(%100) | 33 (%100) |
| | Fatigue | 15 (%100) | 16(%88.8) | 31(%93.9) |
| | Seasonal relationship | 1 (%6.6) | 4(%22.2) | 5 (%15.1) |
| | Alcohol | - | 2(%11.1) | 2 (%6) |
| | Fasting | 11(%73.3) | 14(%77.7) | 25(%75.7) |
| | Odor | 7 (%46.6) | 11(%61.1) | 18(%54.5) |
| | Loud noise | 13(%86.6) | 13(%72.2) | 26(%78.7) |
| | High-intensity light | 10(%66.6) | 11(%61.1) | 21(%63.6) |
| **Features of headache** | Penetrating-Jabbing | 1 (%6.6) | 1 (%5.5) | 2 (%6) |
| | Dull | 2 (%13.3) | 1 (%5.5) | 3 (%9) |
| | Compressive | 3 (%20) | 5 (%27.7) | 8 (%24.2) |
| | Throbbing | 14(%93.3) | 16(%88.8) | 30(%90.9) |
| | Lightning | - | - | - |
| | Sudden | 6 (%40) | 6 (%33.3) | 12(%36.3) |
| **Associated symptoms** | Nausea | 15 (%100) | 16(%88.8) | 32(%96.9) |
| | Vomiting | 7 (%46.6) | 11(%61.1) | 18(%54.5) |
| | Photophobia | 13(%86.6) | 16(%88.8) | 29(%87.8) |
| | Phonophobia | 13 (%86.6 | 16(%88.8) | 29(%87.8) |
| | Dizziness | 12 (%80) | 16(%88.8) | 28(%84.8) |
| | Vertigo | 1 (%6.6) | - | 1 (%3) |
| | Allodynia | 3 (%20) | 6 (%33.3) | 9 (%27.7) |
| | Tinnitus | 2 (%13.3) | 1 (%5.5) | 3 (%9) |

**Table 3** VAS, HIT-6, MIDAS and BDI scores by the groups and total number of the patients before and after treatment

| | | PMM (*n* = 15) | MRM (*n* = 18) | MM (*n* = 33) |
|---|---|---|---|---|
| | | mean + SD | mean + SD | mean + SD |
| **VAS** | **Baseline VAS** | 8,6 ± 1,5 | 8,9 ± 0,9 | 8,7 ± 1,2 |
| | **VAS at the end of 3 month** | 3,6 ± 2,5 | 4,4 ± 1,7 | 4,0 ± 2,1 |
| | **Vas at the end of 6 month** | 4,6 ± 2,6 | 5,1 ± 2,3 | 4,8 ± 2,4 |
| | **p*** | *P* < 0,**001** | *P* < 0,**001** | *P* < 0,**001** |
| **MIDAS** | **Baseline MIDAS** | 31,0 ± 15,2 | 45,3 ± 27,0 | 41,8 ± 26,6 |
| | **MIDAS at the end of 3 month** | 12,5 ± 13,8 | 16,1 ± 12,3 | 14,5 ± 13,0 |
| | **MIDAS at the end of 6 month** | 14,4 ± 12,2 | 12,1 ± 6,6 | 13,1 ± 9,5 |
| | **p**** | *P* = 0,**002** | *P* < 0,**001** | *P* < 0,**001** |
| **HIT-6** | **Baseline HIT-6** | 66,7 ± 16,7 | 66,3 ± 8,1 | 65,9 ± 11,8 |
| | **HIT-6 at the end of 3 month** | 44,6 ± 10,5 | 48,3 ± 8,7 | 46,6 ± 9,6 |
| | **HIT-6 at the end of 6 month** | 49,6 ± 10,7 | 52,7 ± 10,6 | 51,3 ± 10,6 |
| | **p*** | *P* < 0,**001** | *P* < 0,**001** | *P* < 0,**001** |
| **BDI** | **Baseline BDI** | 13,8 ± 6,1 | 15,2 ± 8,8 | 15,0 ± 7,8 |
| | **BDI at the end of 3 month** | 8,1 ± 4,9 | 10,3 ± 6,9 | 9,3 ± 6,1 |
| | **BDI at the end of 6 month** | 12,2 ± 9,7 | 12,1 ± 9,9 | 12,1 ± 9,7 |
| | **P*** | *P* = 0,**005** | *P* = 0,**02** | *P* = 0,**03** |

MIDAS scores in both groups were significantly higher than those at the 3rd and 6th months. The 3rd-month VAS measurements of participants with MO were significantly higher than those without medication overuse (wMO) ($p = 0.028$). The baseline MIDAS measurement values of those with MO were also significantly higher than those wMO ($p = 0.016$). Regarding the HIT-6 scores, among participants wMO, measurements at each time

**Table 4** Temporal changes in VAS, HIT-6, and MIDAS scores based on initial BDI scores

| | | Baseline BDI Category 1 (*n* = 19) | Baseline BDI Category 2 (*n* = 14) | *P* values |
|---|---|---|---|---|
| | | mean + SD | mean + SD | |
| **VAS** | **Baseline VAS** | 8,6 ± 1,3 | 8,9 ± 1,0 | 0,585 |
| | **VAS at the end of 3 month** | 3,4 ± 1,9 | 4,9 ± 2,1 | 0,054 |
| | **Vas at the end of 6 month** | 4,2 ± 2,2 | 5,7 ± 2,5 | 0,070 |
| | **P*** | *P* < 0,**001** | *P* < 0,**001** | |
| **MIDAS** | **Baseline MIDAS** | 30,1 ± 15,7 | 50,6 ± 27,1 | **0,010** |
| | **MIDAS at the end of 3 month** | 10,1 ± 9,8 | 20,5 ± 14,6 | **0,021** |
| | **MIDAS at the end of 6 month** | 11,3 ± 10,0 | 15,7 ± 8,4 | 0,194 |
| | **p*** | *P* < 0,**001** | *P* < 0,**001** | |
| **HIT-6** | **Baseline HIT-6** | 64,4 ± 10,3 | 69,2 ± 15,0 | 0,283 |
| | **HIT-6 at the end of 3 month** | 46,1 ± 11,2 | 47,4 ± 7,1 | 0,703 |
| | **HIT-6 at the end of 6 month** | 50,9 ± 12,5 | 51,7 ± 7,6 | 0,827 |
| | **p*** | *P* < 0,**001** | *P* < 0,**001** | |

**Table 5** Baseline, 3rd-month, and 6th-month VAS, HIT-6, and MIDAS measurement results according to MO status

| | | MO patients (*n* = 19) | wMO patients (*n* = 14) | *P* values |
|---|---|---|---|---|
| | | mean + SD | mean + SD | |
| **VAS** | **Baseline VAS** | 9,0 ± 0,9 | 8,4 ± 1,5 | 0,157 |
| | **VAS at the end of 3 month** | 4,7 ± 1,6 | 3,1 ± 2,4 | **0,028** |
| | **Vas at the end of 6 month** | 5,5 ± 1,9 | 3,9 ± 2,8 | 0,057 |
| | **P*** | *P* < 0,**001** | *P* < 0,**001** | |
| **MIDAS** | **Baseline MIDAS** | 47,0 ± 24,8 | 27,7 ± 15,7 | **0,016** |
| | **MIDAS at the end of 3 month** | 18,2 ± 13,1 | 9,5 ± 11,4 | 0,056 |
| | **MIDAS at the end of 6 month** | 15,1 ± 8,0 | 10,5 ± 10,8 | 0,168 |
| | **p*** | *P* < 0,**001** | *P* < 0,**001** | |
| **HIT-6** | **Baseline HIT-6** | 71,4 ± 12,9 | 59,8 ± 8,4 | **0,007** |
| | **HIT-6 at the end of 3 month** | 49,6 ± 9,1 | 42,5 ± 9,0 | **0,034** |
| | **HIT-6 at the end of 6 month** | 53,3 ± 10,3 | 48,5 ± 10,7 | 0,211 |
| | **p*** | *P* < 0,**001** | *P* < 0,**001** | |

**Table 6** Comparison of BDI scores over time between patients who responded and did not respond to treatment, and the between-group effects

| | | Nonresponders to Treatment (*n* = 9) | Responders to Treatment (*n* = 24) | *P* values |
|---|---|---|---|---|
| | | mean + SD | mean + SD | |
| **BDI** | **Baseline BDI** | 14,1 ± 9,0 | 14,8 ± 7,3 | 0,815 |
| | **BDI at the end of 3 month** | 11,2 ± 8,0 | 8,6 ± 5,2 | 0,284 |
| | **BDI at the end of 6 month** | 13,2 ± 10,1 | 11,7 ± 9,7 | 0,712 |
| | **P*** | *P* = 0,388 | *P* < 0,**001** | |

point were significantly different (0–3 months $p < 0.001$, 0–6 months $p = 0.031$, 3–6 months $p = 0.032$). The baseline and 3rd-month HIT-6 scores of those with MO were significantly higher than those wMO ($p = 0.007$ and $p = 0.034$, respectively). No significant effect of MO status on treatment was detected. (Table 5)

There was no statistically significant difference in BDI measurement scores among those who did not benefit from treatment ($p = 0.388$). For those who benefited from treatment, the initial measurement was significantly higher than at the 3rd month ($p < 0.001$). The benefit from treatment did not have a statistically significant effect on the change in measurement results ($p = 0.576$) (Table 6).

## Discussion

In this study, GON blockade was administered as a short-term prophylactic intervention for MM and was found to reduce the severity and frequency of headaches, as well as enhance quality of life. Moreover, it has been observed that the improvement in headaches persisted over an extended period, and patients also demonstrated improvement in their depression scores.

In addition to hormones and neurotransmitters involved in migraine pathogenesis, demographic factors have also been observed to influence headaches. Consistent with previous research, our study observed a higher prevalence of overweight/obese patients in both MM groups [18]. This finding suggests that elevated BMI may

be associated with increased migraine severity and frequency [19]. There was no significant difference between the groups in terms of age and education level.

Similarly, in accordance with previous studies, MRM patients exhibited a lower age of migraine onset, higher headache frequency, and increased MO [20]. This observation supports the hypothesis that the MRM group experiences more refractory and severe headaches compared to the PMM group. The occurrence of headaches in MRM patients during non-menstrual periods may contribute to an elevated risk of MO.

In our study, the characteristics of headaches were examined; it was determined that headache intensity did not show a significant change throughout the day in both groups, but became more pronounced with fasting. This finding may support the role of metabolic factors in migraine pathophysiology. Additionally, stress and fatigue were identified as the most frequent triggering factors in both groups. Thus, the importance of lifestyle factors on migraine headaches has been emphasized once again [21]. Throbbing headache and nausea were the most frequently observed symptoms, which are consistent with the typical clinical features of migraine [2].

Although the exact mechanism of action of the GON blockade is unknown, it is thought to regulate brain excitability at the brainstem level. Studies have shown that cervical stimulation can directly increase brain serotonin levels, and in neuropathic rat models, spinal cord stimulation reduced pain by activating spinal 5-HT receptors [22]. One proposed mechanism for the long-lasting pain relief provided by GON blockade, despite the short duration of action of local anesthetics, involves modulation of the afferent pathway between the ophthalmic branch of the trigeminal nerve, the trigeminal nucleus caudalis, and the greater occipital nerve. This modulation may alter central pain processing pathways, contributing to sustained effects. The administration of local anesthetics decreases sensory input to the trigeminal nucleus caudalis, thereby reducing neuronal hyperexcitability and modulating central pain pathways [8]. These mechanisms suggest how central and peripheral processes contribute to the therapeutic effects of GON blockade.

In a recent meta analysis GON blockade can significantly reduce pain intensity and the number of headache days in migraine patients [11]. In our study, consistent with previous research, significant improvements were observed in patients' VAS, HIT-6, MIDAS, and BDI scores following GON blockade administered over a three-month period. During medication-free follow-ups from the third to the sixth month, this improvement persisted, although no statistically significant temporal difference was noted. These findings indicate that GON blockade is effective in short-term prophylaxis, and this effect is maintained in the long term.

The improvement in depression scores during treatment follow-up has been associated with the psychogenic aspects of migraine therapy. Notably, the significant improvement in MIDAS scores among patients with initially low BDI scores indicates that quality of life increases more substantially in patients with mild or no accompanying depression. This finding emphasizes the bidirectional relationship between migraine and depression, suggesting that this factor should be considered in treatment strategies [23].

It is known that excessive medication use complicates migraine treatment and increases headache severity [24]. In our study, the higher VAS scores at the third month for patients with MO indicate that these patients experience more severe headaches. Furthermore, the higher initial MIDAS scores in this group support the presence of increased migraine-related disability. Analysis of the HIT-6 scores revealed significant improvements sustained during the 0–3 month, 3–6 month, and 0–6 month follow-up periods. This finding demonstrates that the positive effects of GON blockade on quality of life persist in the long term.

Finally, the observation of significant improvement in BDI scores at baseline and third month among patients experiencing a 50% reduction in the number of days with headaches further demonstrates the positive impact of effective migraine treatment on mood [25].

Our study is the first to evaluate the efficacy of GON blockade in patients with MM, offering a promising therapeutic option for cases where other prophylactic treatments are either unsuitable or poorly tolerated. However, it is important to acknowledge certain limitations in our study, including a small sample size and the lack of a placebo control group. Previous meta-analyses have reported a 30% placebo response in migraine studies [26] while recent controlled trials have shown that GON blockade achieves superior outcomes, with response rates of 40.9% for GON blockade compared to 9.1% for placebo [27]. In our study, the observed response rate for GON blockade was 72.7%, significantly surpassing these benchmarks, further underscoring its therapeutic potential. Given the high placebo effect observed in migraine studies, larger-scale, randomized, and placebo-controlled trials are necessary to validate these findings. Another limitation of our study was the selection of patients who were unwilling to use oral medications. While this could introduce selection bias, it primarily stems from ethical considerations, posibility of pregnancy and the patients' preference for an interventional treatment after experiencing failed oral therapies. In this context, GON blockade in MM could be considered a safe option. Despite these limitations, this study may provide a foundation for future research.

## Conclusion

This study has demonstrated that GON blockade may be an effective option for short-term and long-term prophylaxis in the treatment of MM. GON blockade has reduced the frequency and severity of headaches in MM patients, resulting in significant improvements in quality of life and psychological state. Further research is necessary to validate these findings in larger patient cohorts and to better elucidate the long-term effects of GON blockade.

### Abbreviations

| | |
|---|---|
| BDI | Beck Depression Inventory |
| BMI | Body mass index |
| GON | Greater occipital nerve |
| HİT-6 | Headache Impact Test-6 |
| ICHD-3 | International Classification of Headache Disorders – 3 |
| MİDAS | Migraine Disability Assessment |
| MM | Menstrual migraine |
| MO | Medication Overuse |
| MRI | Magnetic resonance imaging |
| MRM | Menstrually related migraine |
| NSAIDs | Nonsteroidal anti-inflammatory drugs |
| PMM | Pure menstrual migraine |
| wMO | Without medication overuse |
| VAS | Visual Analog Scale |

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### Author contributions

G.C wrote the main manuscript text. All authors reviewed the manuscript.

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### Data availability

The data supporting the findings of this study is available from the corresponding author upon reasonable request.

## Declarations

### Ethics approval and consent to participate

The study was approved by the Ethics Committee of Sancaktepe Prof. Dr. İlhan Varank Research and Training Hospital (File No: 227, Date: 08.11.2023) All methods were performed in accordance with the Declaration of Helsinki, and written informed consent was obtained from the patients after explaining the purpose of the study.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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### References

1. Natoli JL, Manack A, Dean B, Butler Q, Turkel CC, Stovner L, Lipton RB. Global prevalence of chronic migraine: a systematic review. Ceph: Int J Headache. 2010;30(5):599–609. https://doi.org/10.1111/J.1468-2982.2009.01941.X.
2. Olesen J. International classification of Headache disorders. Lancet Neurol. 2018;17(5):396–7. https://doi.org/10.1016/S1474-4422(18)30085-1.
3. Aguilar-Shea AL, Diaz-de-Teran J. Migraine review for general practice. Aten Primaria. 2022;54(2). https://doi.org/10.1016/J.APRIM.2021.102208.
4. Vetvik KG, Russell MB. Are menstrual and nonmenstrual migraine attacks different? Curr Pain Headache Rep. 2011;15(5):339. https://doi.org/10.1007/S11916-011-0212-4.
5. Maasumi K, Tepper SJ, Kriegler JS. Menstrual migraine and treatment options. Rev Headache. 2017;57(2):194–208. https://doi.org/10.1111/HEAD.12978.
6. Couturier EG, Bomhof MA, Neven AK, van Duijn NP. Menstrual migraine in a representative Dutch population sample: prevalence, disability and treatment. Cephalalgia. 2003;23(4):302-8. https://doi.org/10.1046/j.1468-2982.2003.00516.x. PMID: 12716349.
7. MacGregor EA. Migraine Management during Menstruation and Menopause. Continuum (Minneapolis Minn). 2015;21(4 Headache):990–1003. https://doi.org/10.1212/CON.0000000000000196.
8. Ashkenazi A, Levin M. Greater occipital nerve block for migraine and other headaches: is it useful? Curr Pain Headache Rep. 2007;11(3):231-5. https://doi.org/10.1007/s11916-007-0195-3. PMID: 17504651.
9. Dilli E, Halker R, Vargas B, Hentz J, Radam T, Rogers R, Dodick D. Occipital nerve block for the short-term preventive treatment of migraine: a randomized, double-blinded, placebo-controlled study. Ceph: Int J Headache. 2015;35(11):959–68. https://doi.org/10.1177/0333102414561872.
10. Inan LE, Inan N, Unal-Artık HA, Atac C, Babaoglu G. Greater occipital nerve block in migraine prophylaxis: narrative review. Ceph: Int J Headache. 2019;39(7):908–20. https://doi.org/10.1177/0333102418821669.
11. Muhamad S, Mustafa S. bin A. (2024). Assessing the effectiveness of greater occipital nerve block in chronic migraine: a systematic review and meta-analysis. *BMC Neurology*.
12. Wang X, Zhuo L, Ma Y, Cai T, Must A, Xu L, Zhuo L. Similar responses to EQ-5D-3L by two elicitation methods: visual analogue scale and time trade-off. BMC Med Res Methodol. 2020;20(1):1–10. https://doi.org/10.1186/S12874-020-01008-9/FIGURES/1.
13. Kosinski M, Bayliss MS, Bjorner JB, Ware JE, Garber WH, Batenhorst A, Cady R, Dahlöf CGH, Dowson A, Tepper S. A six-item short-form survey for measuring headache impact: the HIT-6™. Qual Life Res. 2003;12(8):963–74. https://doi.org/10.1023/A:1026119331193/METRICS.
14. Stewart WF, Lipton RB, Dowson AJ, Sawyer J. (2001). Development and testing of the Migraine Disability Assessment (MIDAS) Questionnaire to assess headache-related disability. *Neurology*, *56*(6 SUPPL. 1). https://doi.org/10.1212/WNL.56.SUPPL_1.S20/ASSET/A81CC370-371C-43E4-AADB-77535726FE82/ASSETS/GRAPHIC/G0169F3.JPEG
15. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry. 1961;4(6):561–71. https://doi.org/10.1001/ARCHPSYC.1961.01710120031004.
16. Tfelt-Hansen P, Block G, Dahlöf C, Diener HC, Ferrari M, Goadsby P, Guidetti V, Jones B, Lipton R, Massiou H, Meinert C, Sandrini G, Steiner T, Winter P. Guidelines for controlled trials of drugs in migraine: second edition. Ceph: Int J Headache. 2000;20(9):765–86. https://doi.org/10.1046/J.1468-2982.2000.00117.X.
17. Olesen J. The international classification of headache disorders. 2nd edition (ICHD-II). Rev Neurol. 2005;161(6–7):689–91. https://doi.org/10.1016/S0035-3787(05)85119-7.
18. Lillis J, Graham Thomas J, Seng EK, Lipton RB, Pavlović JM, Rathier L, Roth J, O'Leary KC, Bond DS. Importance of Pain Acceptance in Relation to Headache Disability and Pain Interference in Women with Migraine and Overweight/Obesity. Headache. 2017;57(5):709–18. https://doi.org/10.1111/HEAD.13058.
19. Gelaye B, Sacco S, Brown WJ, Nitchie HL, Ornello R, Peterlin BL. Body composition status and the risk of migraine: a meta-analysis. Neurology. 2017;88(19):1795–804. https://doi.org/10.1212/WNL.0000000000003919.
20. Silberstein S, Patel S. Menstrual migraine: an updated review on hormonal causes, prophylaxis and treatment. Expert Opin Pharmacother. 2014;15(14):2063–70. https://doi.org/10.1517/14656566.2014.947959.
21. Kelman L. The triggers or precipitants of the acute migraine attack. Ceph: Int J Headache. 2007;27(5):394–402. https://doi.org/10.1111/J.1468-2982.2007.01303.X.
22. Song Z, Ultenius C, Meyerson BA, Linderoth B. Pain relief by spinal cord stimulation involves serotonergic mechanisms: an experimental study in a rat model of mononeuropathy. Pain. 2009;147(1–3):241-8. https://doi.org/10.1016/j.pain.2009.09.020. PMID: 19836134.
23. Breslau N, Lipton RB, Stewart WF, Schultz LR, Welch KMA. Comorbidity of migraine and depression: investigating potential etiology and prognosis.

Neurology. 2003;60(8):1308–12. https://doi.org/10.1212/01.WNL.0000058907.41080.54.
24. Diener HC, Limmroth V. Medication-overuse headache: a worldwide problem. Lancet Neurol. 2004;3(8):475–83. https://doi.org/10.1016/S1474-4422(04)00824-5.
25. Buse DC, Silberstein SD, Manack AN, Papapetropoulos S, Lipton RB. Psychiatric comorbidities of episodic and chronic migraine. J Neurol. 2013;260(8):1960-9. https://doi.org/10.1007/s00415-012-6725-x. Epub 2012 Nov 7. PMID: 23132299.
26. Gul HL, Ozon AO, Karadas O, Koc G, Inan LE. The efficacy of greater occipital nerve blockade in chronic migraine: a placebo-controlled study. Acta Neurol Scand. 2017;136(2):138–44. https://doi.org/10.1111/ane.12716. Epub 2016 Dec 2. PMID: 27910088.
27. Chowdhury D, Tomar A, Deorari V, Duggal A, Krishnan A, Koul A. Greater occipital nerve blockade for the preventive treatment of chronic migraine: A randomized double-blind placebo-controlled study. Cephalalgia. 2023;43(2):3331024221143541. https://doi.org/10.1177/03331024221143541. PMID: 36739512.

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