Greater Occipital Nerve Block for Chronic Neck Pain provides extended pain relief and improves quality of Life: Comparative Study versus Digital Manual Therapy

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Abstract

Background: One of the main causes of disability in working age is chronic neck pain (CNP). Although there were many different therapy approaches used to treat CNP, each had advantages and disadvantages.

Objectives: Comparison of the outcomes of the greater occipital nerve block (GONB) versus digital manual therapy (DMT) for patients with chronic neck pain (CNP) as regards pain, disability and quality of life (QOL).

Patients: 159 CNP patients were randomly divided into GMT (N=81) and GONB (n=78) groups. DMT was performed as two weekly sessions of 15-min each and 48-h apart for month. Distal and proximal GONB was done using lidocaine (2%) and bupivacaine (0.5%) mixture; 1:1 by volume. At 1-m, 3-m and 6-m after the intervention outcomes were evaluated using the Numeric Ratting Scale (NRS) and the Oswestry Disability Index (ODI) to assess pain and disability. The change in type and frequency of pain medication was recorded and the extent of change in QOL was evaluated using a self-administered questionnaire.

Results: During follow-up, pain scores were significantly lower than baseline scores. However, all DMT patients had recurrent pain and 63 patients had two DMT sessions. Patients of GONB group had significantly lower pain scores than patients. The frequency of patients had minimal disability was significantly higher and that of patients receiving opioids was decreased significantly than baseline frequency especially with GONB. QOL of all patients was improved but improvement was more pronounced in GONB patients who showed significantly higher extent of change in QOL status.

Conclusion: GONB is feasible, safe and effective therapeutic modality for CNP and provides extended pain relief with improvement of QOL. DMT could provide temporary pain relief with improved QOL especially for patients refusing GONB.

Keywords: Greater occipital nerve block; Digital manual therapy; Chronic neck pain; Disability; Quality of Life.

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Introduction

Chronic Neck Pain (CNP) is one of the main contributing factors to disability of people of working age with personal and socioeconomic burden. Non-specific CNP is mainly myogenic in origin and its persistent nature results in muscular imbalance with altered activation patterns of cervical and/or thoracic muscles **(Wolff et al.,2022)**.

The management of CNP varied greatly however, each therapeutic approach has its cons and pros; manual therapy and therapeutic exercise significantly improved overall balance index than placebo **(Bernal-Utrera et al.,2021)**. Joint mobilization or acupuncture sessions might be effective for CNP reduction and improve patients' quality of life (QOL), but acupuncture provided greater analgesic effect **(Voulgarakis et al.,2021)**. Manual soft tissue therapy significantly alleviates CNP and its combined application with posture correction exercises provide significantly greater results and improve the patients' QOL **(Joshi and Poojary.,2022)**. However, its effect is temporary or of short duration, but it is advantageous for being non-invasive and less costly and free of complications **(Wang et al.,2022)**.

The cervical plexus (C1-4) emerges between the longus capitis and the middle scalene muscles and gives its cutaneous branches to supply the scalp and upper neck down to the top of the shoulder and upper chest **(Singh et al.,2015)**, and its deep branches anastomose with the 10th-12th cranial nerves and sympathetic trunk, and the phrenic nerve arises in its close vicinity **(Kikuta et al.,2019)**. These intermingled nerves supplying this body area could explain the associated symptoms affecting patients' QOL and guide attention for the value of nerve decompressions and blocks for management of CNP **(Khashan et al.,2022)**. Suboccipital myofascial release therapy was found to be effective in patients with CNP, but the results were better with the addition of craniocervical manipulation **(Retamal et al.,2021)**. Interlaminar cervical epidural steroid injections can effectively relief CNP with no harmful effect on lung functions **(Chae et al.,2022)**. Local injection of onabotulinumtoxinA improves CNP through its disruption of nerve transmission and control of local release of inflammatory nociceptive **(Dermitzakis et al.,2022)**.

The resultant pain relief after block of the occipital nerves was considered as an indication for occipital nerve decompression surgery especially in cases that were failed to respond to physiotherapeutic management for CNP and chronic headache **(Blake et al.,2019)**. However, the outcomes of occipital nerve decompression cannot establish it as beneficial management for CNP or certain types of chronic headache and is associated with significant risks **(Swanson et al.,2022)**.This study compares the therapeutic effect of the greater occipital nerve block (GONB) for patients with CNP in comparison to eight sessions of DMT and the impact of this effect on patients' QOL.

Patients and methods

Design: Randomized clinical trial. During the study duration from Nov 2020 to Aug 2022 all patients

presented to the outpatient clinics by CNP with or without chronic headache were eligible for evaluation. The study included 159 patients divided into 2 groups after randomization.

Randomization: Using computer-generated sequence by 1:1, patients were randomly allocated into either DMT or GONP groups.

Setting: Departments of Physiotherapy & Rehabilitation Medicine and Public Health, Faculty of Medicine, Tanta and Benha Universities.

Inclusion criteria: Patients had CNP associated with headache and free of exclusion criteria were included in the study.

Exclusion criteria: Patients had diagnostic criteria of cervical radiculopathy, nerve entrapment, congenital muscle dystrophies or atrophy, medical conditions associated with or causing headache, allergy to the used drugs and refusal to participate in the study.

Ethical Considerations: The preliminary approval of the study protocol was obtained from the Ethical Committee, Benha University at Nov 2020 and the final approval was obtained at the end of follow-up for the last enrolled case by RC: 8.8.2022. All study participants signed the written consent for study participation and receiving the assigned therapeutic line.

Interventions

1. **Digital Manual Therapy (DMT):**
   DMT was performed according to the recent recommendations **(Valentini et al.,2020)** as two 15-min sessions separated by 48-h per week for eight sessions. DMT was applied as previously described **(Arnold et al.,2008)** to the connective tissue at the back of the neck using moderate pressure. Pressure intensity was evaluated by the patient using 0-10 numeric scale and therapy was started by light pressure with increasing intensity till reaching the moderate pressure when patients' sensation by pressure was evaluated by 6 on the numeric scale **(Ekici et al.,2009)**. DMT was performed in a room with dim light and soft calming music, with the patient lying prone. Pressure was applied to the occipital and cervical musculature of the back of the neck and started from the midline towards the periphery to promote emptying of the venous and lymphatic network towards the greater vessels to increase the regional blood flow **(Cimmino et al.,2008)**. Neck pain severity was evaluated before and after the session, and patients were asked to record their pain sensation in-between the sessions on the same numeric scale. Also, patients were asked to register their need for analgesia in-between the sessions and to register type, dose and effect of the used analgesics.
2. **Bilateral Greater Occipital Nerve Block (GONB)**
   GONB was performed as previously described **(Young et al.,2008)** using a mixture of lidocaine (2%) and bupivacaine (0.5%) as 1:1 by volume. The distal injection technique entails the localization of the occipital artery at the junction of medial

third and lateral two-thirds of a line drawn between the external occipital protuberance (EOP) and the mastoid process while the patient was in the setting position with flexed neck; the GON was localized just medial to the artery where no muscle is present and was assured by eliciting tenderness on applying mild pressure to the defined point. Then, 1.5 ml of anesthetic mixture was injected on each side. The Proximal injection technique entails injection of 1.5 ml of the anesthetic mixture on each side at site of GON exit from the muscles at 3-cm below and 1.5-cm lateral to the EOP

Outcome evaluation tools: All the following tools were applied before intervention and at one, three and six months later to evaluate the outcome.

1. **Numeric Ratting Scale (NRS)** to assess pain severity and higher scores indicates severe pain **(Williamson and Hoggart.,2005)**.
2. **Oswestry Disability Index (ODI)** to assess disability secondary to pain using the Oswestry Disability Questionnaire **(Fairbank et al.,1980)** that covers 10 items scored by 0-5 points with higher total score indicated increased disability secondary to pain.
3. **The type and frequency of using pain medication** were evaluated by a 5-point scale with 0 indicates no medication used; 1 & 2 indicates occasional or regular use of non-opioid medications, and 3 & 4 indicates occasional or regular use of opioids.
4. **The extent of change in symptoms and QOL**: a self-administered questionnaire was designed to assess the extent of change in QOL status according to the previous guidelines for similar evaluation after steroid injections therapy for cervical radiculopathy **(Anderberg et al.,2007)**. The questionnaire was transformed to an online form, uploaded on Google and sent as a link to each patient in What's app message. The questions were answered directly online and submitted to the concerned observer.

Statistical analysis

The results of the study were analyzed by the IBM® SPSS® for Windows statistical package (Version 22, 2015). P value <0.05 was considered statistically significant.

Results

The study was started at Nov 2020 and extended to June 2022 to allow 6-m follow-up for the last enrolled cases. Two hundred and thirty-five patients were preliminary evaluated, but 27 patients were excluded; eleven for having cervical disc disease, six patients had medical conditions causing attacks of headache, five cases had trigeminal neuralgia, three cases had referred headache secondary to the presence of impacted wisdom tooth and two cases had chronic rhinosinusitis. The remaining 208 patients were randomly allocated into two groups (n=104), but 20 patients of GONB group refused the procedure and preferred shifting to DMT group. Forty-nine patients were excluded after randomization, six

patients of GONB did not attend the follow-up, 31 patients did not attend the eight DMT sessions and twelve of DMT group were missed during follow-up. Thus, 159 patients completed the study protocol till the end of 6-m follow up; 81 patients in DMT group and 78 in GONB group (**Fig. 1**). As shown in (**Table.1**), patients' enrolment data are comparable.

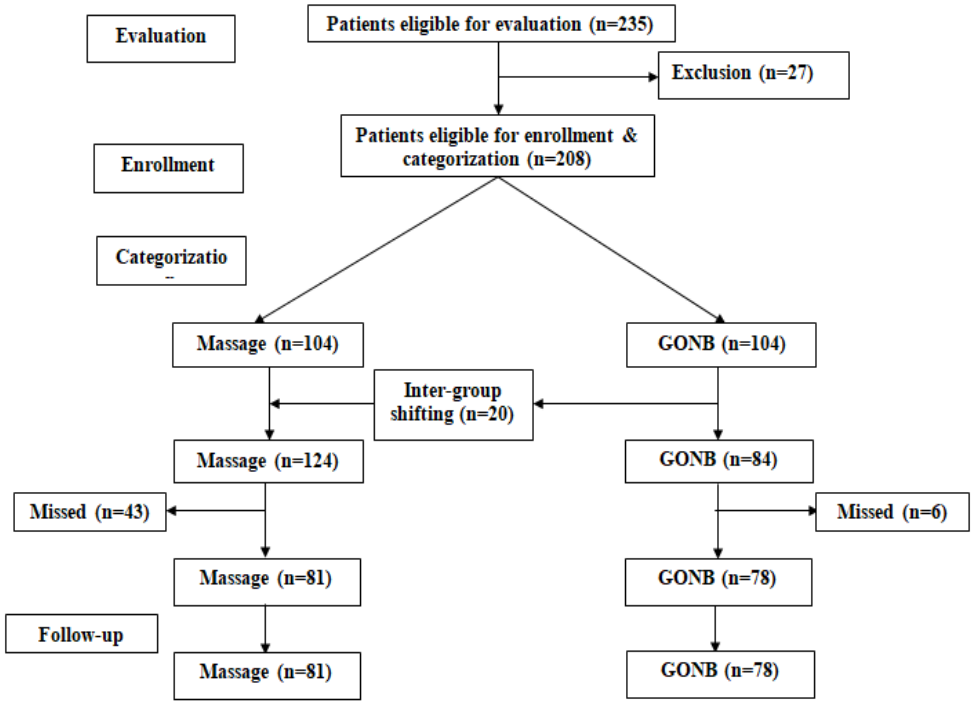

Fig. (1): Study Flow Chart

Table 1. Patients' data

Data **Group**	**DMT (n=81)**	**GONB (n=78)**
Age (years)	30±3.6	29±4.1
Gender; Male: Female	28:53	37:40
Weight (kg)	88±7.2	90±6.1
Height (cm)	167.5±2.9	168.3±2.7
Body mass index (kg/m^2)	31.4±2.2	31.8±1.9
Duration of pain (years)	5.2±1.9	4.9±1.8

Mean, standard deviation, ratios

At one month follow-up, pain scores of patients of DMT group were significantly lower in relation to baseline scores. At the 3rd month, 37 patients of massage group (41.7%) had recurrent pain with non-significantly (P=0.052) lower mean score compared to their baseline mean score (6.1±1.1 vs. 6.5±0.9, respectively) and these patients received another eight DMT sessions. Unfortunately, 23 of these 37 patients (62.2%) had second recurrence at 6-m follow-up, but their pain score was significantly (P=0.015) lower compared to their baseline scores (6.9±0.8 vs. 6.4±0.5, respectively). At 6-m follow-up, the remaining 44 patients of DMT group developed recurrent pain with a mean pain score of 5.3 (±0.8) that was non-significantly

(P=0.267) lower compared to baseline score (5.5±1.1), 26 patients received another setting of 8-sessions, while the remaining 18 patients refused (**Fig. 2**). Collectively, pain scores of patients of massage group were significantly lower at 1-m (P<0.001), 3-m (P<0.001) and 6-m (P=0.005) compared to their baseline pain scores. On contrary, patients who received GONB enjoyed pain improvement till the 3rd month of observation with significantly (P<0.001) lower pain scores than their baseline scores, but by the 6th month 13 patients reported increased pain severity but their pain scores and scores of the total patients were still significantly lower than baseline scores. Collectively, pain scores of patients received GONB were significantly lower during the 6-m observation period compared to scores of patients who received DMT sessions (**Table 2, Fig. 3**).

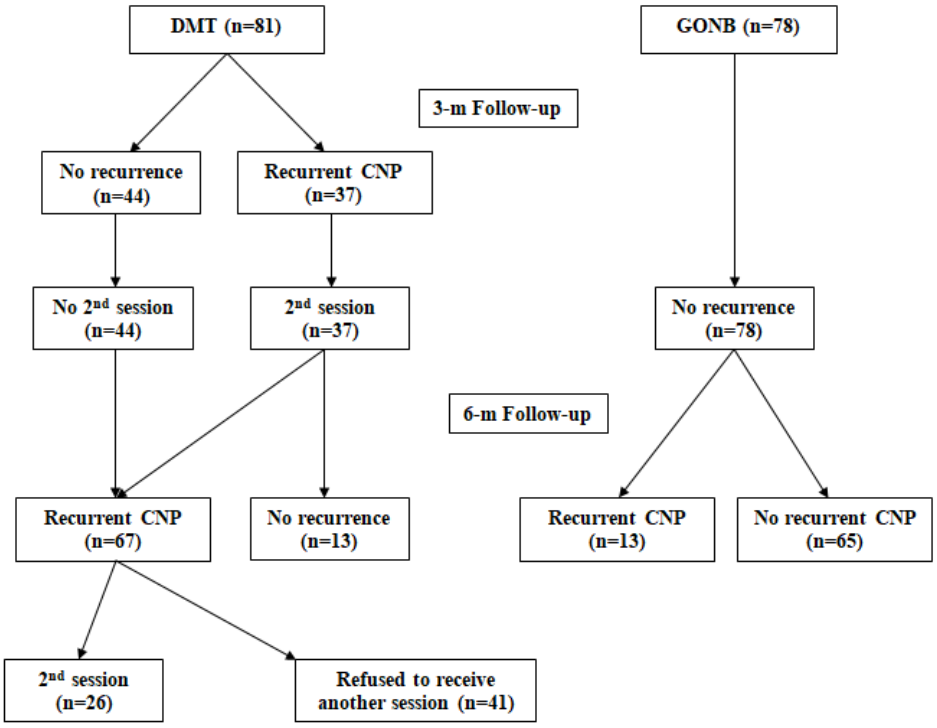

Fig. (2): Follow-up Flow Chart

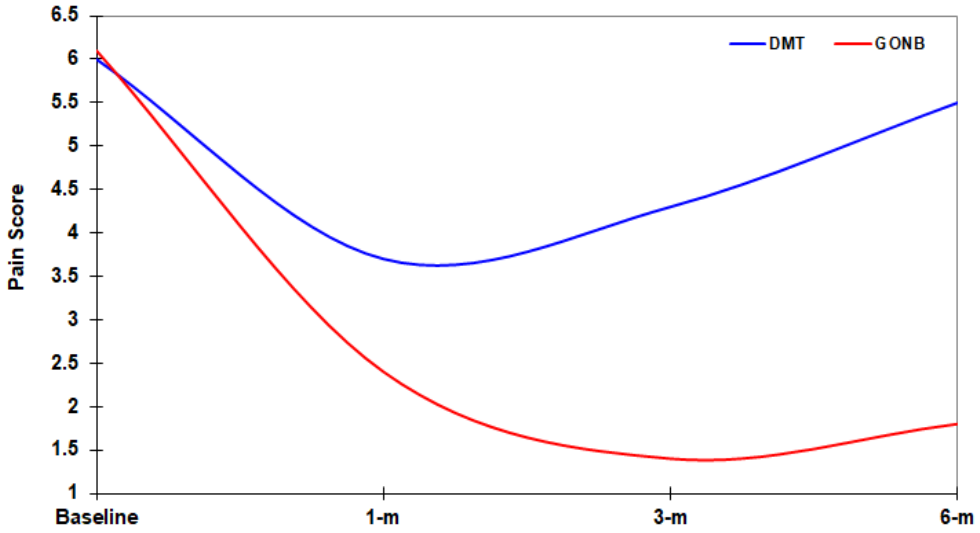

Fig. (3): Mean value of pain score determined during 6-m follow-up of patients of both groups

At time of enrolment, 36 patients (22.6%) had severe disability, 110 patients (69.2%) had moderate disability and 13 patients (8.2%) had minimal disability secondary to pain, while at the 6th month of follow-up, 10 patients (6.3%) had severe, 64 patients (40.3%) had moderate and 85 patients (53.4%) had minimal disability. The frequency of patients had minimal disability at end of observation was significantly (P<0.001) higher compared to that at baseline and in patients had GONB compared to patients of massage group. Moreover, the mean value of ODI score was significantly lower during follow-up in all patients than baseline score with significantly lower scores in patients of GONB than patients of massage group (**Table 2, Fig. 4**).

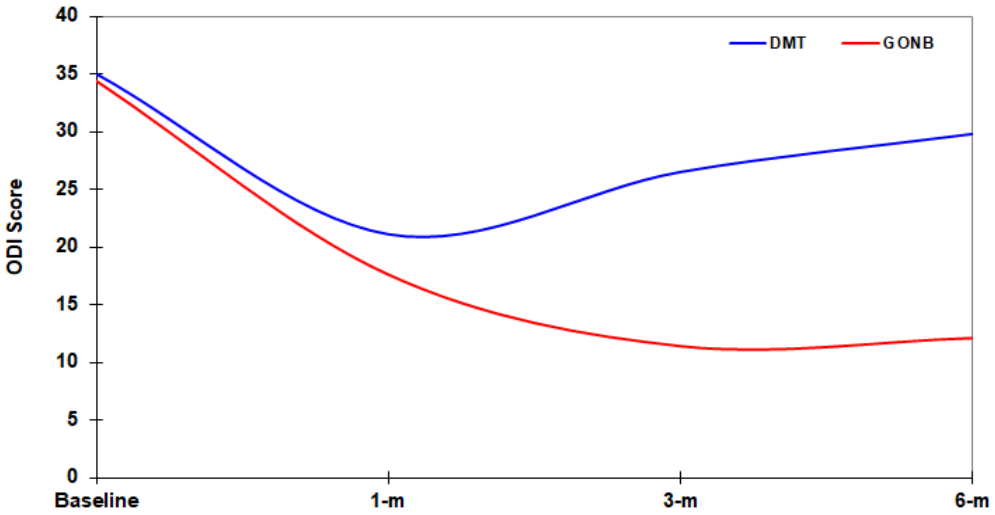

Fig. (4): Mean value of ODI score determined during 6-m follow-up of patients of both groups

At time of enrolment, 59 patients (37.1%) were accustomed to receive opioid analgesia either occasionally (n=50) or regularly (n=9), while the remaining patients received non-opioid analgesia; 16 occasionally and 84 regularly. At the end of follow-up, 24 patients were occasionally receiving opioid analgesia and only two received it regularly, while 115 patients were maintained on non-opioid drugs; 59 occasionally and 56 regularly, but 18 patients were comfortable without analgesia. The frequency of patients receiving opioid analgesia was decreased significantly (P<0.001) at the end of follow-up compared to baseline frequency and in patients of GONB group than those of massage group (**Table 2**).

Table 2. Patients' evaluation data during follow-up

Tool	Group	Time	Baseline	1-m	3-m	6-m
NRS pain score	**DMT**		6±1.1	3.7±1†	4.4±1.8†	5.5±0.9*
	GONB		6.1±1.4	2.4±1.1†‡	1.4±1.2†‡	1.8±1.3†‡
Grade of disability	**DMT**	**Minimal**	7 (8.6%)	46 (56.8%)	24 (29.6%)	18 (22.2%)
		Moderate	54 (66.7%)	35 (43.2%)	52 (64.2%)	54 (66.7%)
		Severe	20 (24.7%)	0	5 (6.2%)	9 (11.1%)
	GONB	**Minimal**	6 (7.7%)	58 (74.4%)	73 (93.6%)	67 (85.9%)
		Moderate	56 (71.8%)	20 (25.6%)	5 (6.4%)	10 (12.8%)

			Severe	16 (20.5%)	0	0	1 (1.3%)
ODI score		**DMT**		35±9.3	21.1±7.5†	26.5±8.5†	29.8±9.4†
		GONB		34.4±9.7	17.6±8.2†‡	11.4±8†‡	12.1±9.5†‡
Type of analgesia	**DMT**	**No analgesia**		0	11 (13.6%)	6 (7.4%)	0
		Non-opioid	**Occasional**	9 (11.1%)	28 (34.6%)	23 (28.4%)	18 (22.2%)
			Regular	48 (59.3%)	31 (38.2%)	33 (40.7%)	41 (50.6%)
		opioid	**Occasional**	21 (25.9%)	11 (13.6%)	19 (23.5%)	20 (24.7%)
			Regular	3 (3.7%)	0	0	2 (2.5%)
	GONB	**No analgesia**		0	13 (16.7%)	19 (24.4%)	18 (23.1%)
		Non-opioid	**Occasional**	7 (9%)	36 (46.1%)	42 (53.8%)	41 (52.6%)
			Regular	36 (46.1%)	16 (20.5%)	13 (16.7%)	15 (19.2%)
		Opioid	**Occasional**	29 (37.2%)	11 (14.1%)	4 (5.1%)	4 (5.1%)
			Regular	6 (7.7%)	2 (2.6%)	0	0

*: indicates significance at p<0.05; †: indicates significance at p<0.001; ‡ indicates the significance between both groups

All patients showed improved QOL status since 1-m after intervention; however, patients had GONB showed progressive improvement that summited at the 3rd month. Psychologically, the most prominent improvement was in mood, concentration, quality of sleep, social activities and sexual desire. Physically, the best change was achieved in the ability to do physical activities and to work, work capacity and quality of sexual act. Concerning side complaints, sense of dizziness and instability, ability to read and neck mobility was improved. The extent of change in QOL status was significantly higher among patients who received GONB than those received massage therapy (Table 3). At the 6th month of follow-up of patients of DMT group 14 had worsened, 50 patients had unchanged, 14 patients had improved QOL and only three patients were symptom free, while among patients of GONB, there were only one patient had worsened, 11 patients had unchanged, 35 patients had improved QOL and 31 patients were symptom free with significant difference in favor of GONB, the frequency of patients according to the change of QOL at 1-m, 3-m and 6-m was shown in (**Fig. 5**).

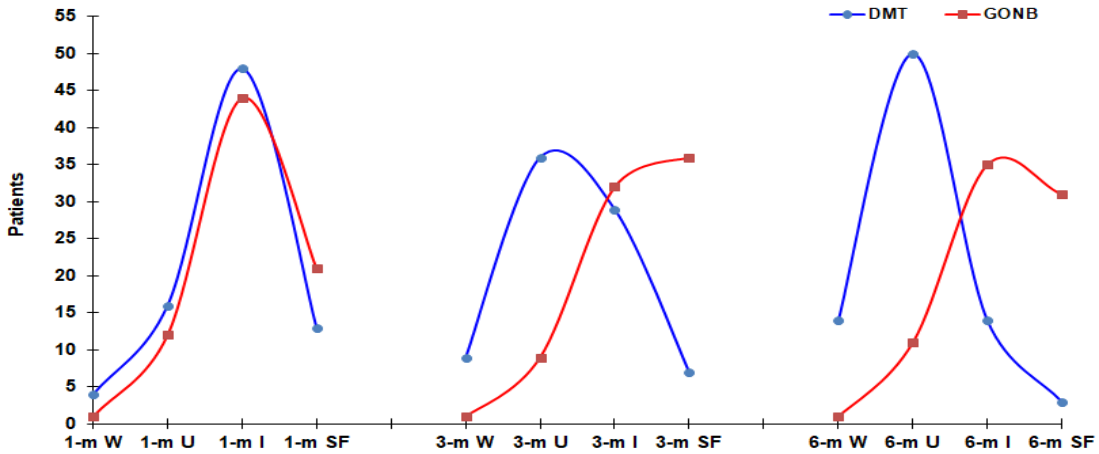

Fig. (5): Patients' distribution according change of QOL of patients of both groups [W: Worsened; U: Unchanged; I: Improved; SF: Symptom free]

Table 3. Patients' distribution according to the quality of change in items of the QOL questionnaire during follow-up in relation to baseline status

Group	DMT group												GONB											
Change	Worsened			Unchanged			Improved			Symptom free			Worsened			Unchanged			Improved			Symptom free		
Item / Time	1st	3rd	6th	1st	3rd	6th	1st	3rd	6th	1st	3rd	6th	1st	3rd	6th	1st	3rd	6th	1st	3rd	6th	1st	3rd	6th
Neck pain	9	15	19	19	32	43	47	34	19	6	0	0	4	2	2	13	10	12	52	41	43	9	25	21
Headache	6	10	12	12	25	46	59	44	23	4	2	0	2	2	2	12	9	10	58	39	42	6	28	24
Neck mobility	5	10	14	16	31	49	55	37	16	5	3	2	2	1	1	14	11	14	55	35	38	7	31	25
Ability to read	4	8	13	18	30	49	52	40	17	7	3	2	0	0	0	13	9	11	53	40	41	12	29	26
Concentration	0	4	10	24	41	55	42	28	13	15	8	3	0	0	0	16	13	15	43	35	38	19	30	25
Mood	3	7	12	16	32	48	40	26	12	22	16	9	0	0	0	10	7	10	39	32	35	29	39	33
Dizziness	0	6	10	12	26	47	38	29	14	31	20	10	0	0	0	9	5	8	26	20	24	43	53	46
Instability	2	10	16	7	37	50	46	24	10	26	10	5	0	0	0	11	8	10	19	15	18	48	55	50
Pain radiation	5	12	17	13	34	48	53	29	13	10	6	3	2	1	1	6	3	5	47	32	36	23	42	36
Social activities	2	5	11	16	45	56	54	26	12	9	5	2	0	0	0	11	10	12	49	32	34	18	36	32
Ability to do physical activities	6	11	16	18	41	50	40	18	10	17	11	5	3	2	2	16	14	16	34	26	29	25	36	31
Ability to work	3	6	10	18	48	58	52	24	11	8	3	2	1	1	1	19	15	17	40	25	27	18	37	33
Work capacity	4	8	14	16	35	48	48	31	16	13	7	3	2	1	1	13	11	13	44	31	33	19	35	31
Quality of sleep	7	13	18	21	45	52	47	21	11	6	2	0	3	3	3	8	7	9	45	32	36	22	36	30
Sexual desire	3	8	15	13	40	51	54	27	13	11	6	2	2	1	1	7	4	6	53	39	43	16	34	28
Quality of sexual act	2	4	16	16	43	51	57	32	14	6	2	0	0	0	0	9	8	10	46	37	42	23	33	26
Total sense of quality of life	6	13	20	12	30	43	47	30	15	16	8	3	2	1	1	12	9	11	37	29	32	27	39	34

Discussion

The GONB provided CNP patients with excellent pain relief for 6-m with decreased pain-induced disability and improved quality of life (QOL) both for psychological and physical items in comparison to their baseline evaluations. Thus, it can be suggested that CNP patients who were free of organic causes mostly have occipital neuralgia that led to exaggerated nerve excitability. Subsequently, daily activities cause the development of clonus contractions of neck muscles and this in turn leads to impaired muscle oxygenation due to vascular compressions with venous and lymphatic engorgement leading to hypoxia-induced pain and accumulation of nociceptive metabolites; nerve blocks can provide relief of pain by explosion of this

circle. In support of this pathogenic circle and its relation to CNP, the recent update of management of occipital pain assured that local anesthetic injection for occipital nerve blocks can be used to prevent compressive symptoms **(Swanson et al.,2022)**.

In line with the efficacy of the rational of nerve blocks for treatment of chronic pain, a recent review assured the efficacy of local anesthetic block of various nerves for relief of CNP and recommended nerve blocks to be a tool in the armamentarium for pain physicians **(Li and Szabova.,2021)**. The obtained results go in hand with an earlier study that reported about 80% pain relief after bilateral and about 50% pain relief after unilateral GONB **(Kim et al.,2015)**. In support of the relation between occipital nerves and development and maintenance of non-specific CNP with or without headache, one study found surgical decompression of the occipital nerves provided complete and extended relief of new daily persistent headache, chronic post-traumatic headache and chronic headache/migraine **(Blake et al.,2019)**. Moreover, a recent study documented the efficacy of surgical decompression of GON in patients who showed relief of pain on local nerve block and found decompression provide relief for about 5 years **(Eskilsson et al.,2021)**. However, nerve decompression procedures were of limited applicability for being invasive, costly, and for being surgery with its concomitant possible complications especially it could not provide 100% pain relieve in 100% of patients **(Swanson et al.,2022)**.

The GONB was provided during a pain-free day so that patient can attend the clinic freely and does not be agony to minimize their apprehension, which probably affects the outcomes of the procedures. In support of this policy, one study found patients who were headache-free and showed less tenderness on palpation to the cervical region on the intervention day improved more after the GONB **(Schwarz et al.,2021)**.

Patients who received digital manual therapy (DMT) were improved with significantly lower pain and disability scores in comparison to their baseline scores; such effect could be attributed to the effect of massage as a pumping mechanism increasing venous and lymphatic drainage with subsequent wash of nociceptive cytokines thus decreasing pain. In line with this assumption, one study found petrissage massage and manual lymphatic drainage reduce passive tissue stiffness and improve the extent of muscle extensibility over time against the muscle tensile strength **(Kablan et al.,2021)**. Thereafter, it was found that daily self-massage along with gentle mobility exercises for patients had post-COVID fatigue decreased pain and sense of fatigue and this was attributed to manual lymphatic drainage **(Heald et al.,2022)**. A recent review and meta-analysis supported the use of manual lymphatic drainage for edema reduction that improved pain sensation, enhanced range of motion and patients' quality of life and satisfaction **(Provencher et al.,2021)**. Recent work documented that a 4-w massage program for patients with CNP can effectively reduce the presence of active trigger points, pain severity, and some aspects of functionality **(Cabrera-Martos et al.,2022)** and was recommended as an inexpensive and safe treatment for pain and/or anxiety **(Mitchinson et al.,2022)**.

Unfortunately, the beneficial effects of DMT were shot-termed and by the 3rd month after the trial about 80% of patients required another

setting of 8-sessions and by the end of 6-m follow-up, all patients had recurrent pain and disability despite the significantly lower scores than the baseline scores. These findings limit the applicability of DMT as a long-termed therapy.

Conclusion:

Chronic neck pain induced deterioration of patients QOL both psychologically and physically. GONB is feasible, safe and effective therapeutic modality for chronic neck pain and provides extended pain relief with improvement of QOL. Massage sessions could provide temporary pain relief with improved QOL especially for patients refusing GONB or wherever, lack of experience hampered implication of the procedure.

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