

TREATMENT OF CHRONIC NECK PAIN USING DIFFERENT INJECTIONS (COMPARATIVE STUDY)

Thesis

*Submitted in Partial Fulfillment for the Requirement of the Master
Degree in Physical Medicine, Rheumatology and Rehabilitation*

By

Rania Helmy Ahmed

M.B., B.Ch.

Faculty of Medicine - Ain Shams University

Under the Supervision of

Prof. Dr. Nehal Ibrahim El-Sheshtawy

Professor of Physical Medicine, Rheumatology and Rehabilitation

Faculty of Medicine, Ain Shams University

Prof. Dr. Heba Fawzy El-Shishtawy

Professor of Physical Medicine, Rheumatology and Rehabilitation

Faculty of Medicine, Ain Shams University

Dr. Howayda Farouk Zidan

Lecturer in Physical Medicine, Rheumatology and Rehabilitation

Faculty of Medicine, Ain Shams University

**Faculty of Medicine
Ain Shams University**

2019

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سببنا أنك لا تعلم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Mehal Ibrahim El-Sheshtawy**, Professor of Physical Medicine, Rheumatology and Rehabilitation - Faculty of Medicine- Ain Shams University for her keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Prof. Dr. Heba Fawzy El-Shishtawy**, Professor of Physical Medicine, Rheumatology and Rehabilitation, Faculty of Medicine, Ain Shams University, for her kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

*I am deeply thankful to **Dr. Howayda Farouk Zidan**, Lecturer in Physical Medicine, Rheumatology and Rehabilitation, Faculty of Medicine, Ain Shams University, for her great help, active participation and guidance.*

*I would like to express my hearty thanks to all my family especially **my parents & my husband** for their support till this work was completed.*

Last but not least my sincere thanks and appreciation to all patients participated in this study.

Rania Helmy Ahmed

List of Contents

Title	Page No.
List of Tables	i
List of Figures	iii
List of Abbreviations	v
Introduction	1
Aim of the Work.....	6
Review of Literature	
1. Anatomy of Cervical Spine	7
2. Neck Pain.....	17
3. Injection therapy for neck pain.....	42
a. Mesotherapy	
b. Prolotherapy.....	53
c. Dry Needling	62
Patients and Methods	73
Results	86
Discussion	108
Summary	124
Conclusion.....	128
Recommendations	129
References	130
Appendices	
Appendix I.....	155
Appendix II	156
Appendix III	157
Appendix IV	158
Appendix V	160
Arabic Summary	

List of Tables

Table No.	Title	Page No.
Table (1):	Musculature of the neck and back that is involved in head and neck movement.....	16
Table (2):	Neurotransmitters and Receptors Involved in Chronic Pain	28
Table (3):	Dermatological and other medical conditions purported to benefit from mesotherapy.....	46
Table (4):	Tissue levels of Na-ketoprofen (μ g) detected by chromatography following local intradermal therapy (LIT) or intramuscular (IM) administration.....	48
Table (5):	Side effects of dry needling.....	72
Table (6):	Comparison between patient's demographic data, A: Age, B: Gender and C: Duration, in the three groups before injection.	87
Table (7):	Comparison between group I before and after injection as regard A: NPQ, VAS, NDI and B: CPGS.....	89
Table (8):	Comparison between group II before and after injection as regard A: NPQ, VAS, NDI and B: CPGS.....	91
Table (9):	Comparison between group III before and after injection as regard A: NPQ, VAS NDI and B: CPGS.	93
Table (10):	Comparison between the three groups before injection as regard A: NPQ, VAS, NDI and B: CPGS.....	95
Table (11):	Comparison between the three groups after injection as regard A: NPQ, VAS, NDI and B: CPGS.....	97

List of Tables (cont...)

Table No.	Title	Page No.
Table (12):	Comparison between the three groups as regard percentage of change as regard NPQ, VAS and NDI.....	99
Table (13):	Comparison between group I and II as regard percentage of change as regard NPQ, VAS and NDI.....	100
Table (14):	Comparison between group I and III as regard percentage of change as regard NPQ, VAS and NDI.....	101
Table (15):	Comparison between group II and III as regard percentage of change as regard NPQ, VAS and NDI.....	102
Table (16):	Correlation between age and duration of pain and other scores of patients before injection.	104
Table (17):	Comparison between chronic pain grade scale (CPGS): grade before injection as regard age.....	105
Table (18):	Correlation between duration of pain and other scores of patients before injection.	106
Table (19):	Comparison between different CPGS before injection as regard duration pf pain	106

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Cervical vertebrae	9
Figure (2):	Anterior view (A) and posterior view (B) of the atlanto-occipital joints	11
Figure (3):	The ligaments in the cervical region are shown.....	14
Figure (4):	Deep muscles of neck and upper back	15
Figure (5):	A schematic diagram of nociception	22
Figure (6):	Classification of peripheral nerve fibers	23
Figure (7):	Terminate on projection neurons in the dorsal horn of the spinal cord	24
Figure (8):	Main brain regions that activate during a painful experience	26
Figure (9):	Axial pain patterns provoked during discography at each cervical level.....	35
Figure (10):	Diagnostic imaging pathways of neck pain	36
Figure (11):	Lateral view of plain X ray cervical spine.....	37
Figure (12):	Different types of mesotherapy injections	50
Figure (13):	Stages of healing by prolotherapy	55
Figure (14):	Prolotherapy for tendinosis: histology samples	55
Figure (15):	Extra-segmental effects.....	65
Figure (16):	Fu's subcutaneous needling needle	69
Figure (17):	Plunger recommended by Chan Gunn for inserting and manipulating needles	70
Figure (18):	Various lengths of dry needles within guide tubes	71
Figure (19):	The needle used in mesotherapy injection.....	79
Figure (20):	Patient during mesotherapy injection.	79
Figure (21):	The needle used in prolotherapy injection.....	81
Figure (22):	Patient during prolotherapy injection.	81
Figure (23):	The needle used in dry needling injection. A: Guide tube; B: Needle; C: Plug.....	83

List of Figures (cont...)

Fig. No.	Title	Page No.
Figure (24):	Patient during dry needling injection.....	83
Figure (25):	Demographic data of patients in the three groups before injection as regard A: age, B: gender and C: duration	88
Figure (26):	Comparison between group I before and after injection as regard A: NPQ; B: VAS score and C: NDI.....	90
Figure (27):	Comparison between group II before and after injection as regard A: NPQ; B: VAS score and C: NDI.....	92
Figure (28):	Comparison between group III before and after injection as regard A: NPQ; B: VAS score and C: NDI.....	94
Figure (29):	Comparison between three groups before injection as regard A: NPQ; B: VAS score and C: NDI.	96
Figure (30):	Comparison between three groups after injection as regard A: NPQ; B: VAS score and C: NDI.	98
Figure (31):	Comparison of the three groups as regard percentage of change as regard VAS score.	99
Figure (32):	Comparison of group I and II as regard percentage of change as regard VAS score.	100
Figure (33):	Comparison of group II and III as regard percentage of change. A: NPQ; B: VAS score	103
Figure (34):	Correlation between duration of pain and age.....	104
Figure (35):	Comparison between chronic pain grade scale (CPGS) before injection as regard age.....	105
Figure (36):	Comparison between different chronic pain grade scale (CPGS) before injection as regard duration of pain.	107

List of Abbreviations

Abb.	Full term
<i>5-HT</i>	<i>Serotonin</i>
<i>ACD</i>	<i>Acid-citrate dextrose</i>
<i>Ach</i>	<i>Acetylcholine</i>
<i>ADL</i>	<i>activities of daily living</i>
<i>ADSCs</i>	<i>Adipose-derived stem /stromal cells</i>
<i>AMPA</i>	<i>Alpha-Amino-3-hydroxyl- 5-methyl-4-isoxazole-propionate</i>
<i>AP</i>	<i>Anteroposterior</i>
<i>ASIA</i>	<i>American Spinal Injury Association</i>
<i>ASICs</i>	<i>Acid-sensing ion channels</i>
<i>ATP</i>	<i>Adenosine triphosphate</i>
<i>BDI</i>	<i>Beck Depression Inventory</i>
<i>BDNF</i>	<i>Brain derived neurotrophic factor</i>
<i>BMSCs</i>	<i>Bone marrow mesenchymal stem cells</i>
<i>BTA</i>	<i>Botulinum toxin A</i>
<i>BTx</i>	<i>Botulinum toxin</i>
<i>CBC</i>	<i>Complete blood count</i>
<i>CGRP</i>	<i>Calcitonin gene-related peptide</i>
<i>CNS</i>	<i>Central nervous system</i>
<i>COX</i>	<i>Cyclo-oxygenase</i>
<i>CPD</i>	<i>Citrate-phosphate-dextrose</i>
<i>CPGS</i>	<i>Chronic pain grade scale</i>
<i>CRPS 1</i>	<i>Complex Regional Pain Syndrome type 1</i>
<i>CSP</i>	<i>Chronic spinal pain</i>
<i>CVLI</i>	<i>Chronic venous lymphatic insufficiency</i>
<i>DDN</i>	<i>Deep Dry needling</i>
<i>DH</i>	<i>Dorsal Horn</i>
<i>DMAE</i>	<i>Dimethylaminoethanol</i>
<i>DN</i>	<i>Dry needling</i>

List of Abbreviations (cont...)

Abb.	Full term
<i>DNRI.....</i>	<i>Dopamine Noradrenaline Reuptake Inhibitors</i>
<i>DRG.....</i>	<i>Dorsal root ganglia</i>
<i>EDTA.....</i>	<i>Ethylene diamine tetra-acetic acid</i>
<i>ESIs</i>	<i>Epidural steroid injections</i>
<i>ESR.....</i>	<i>Erythrocyte Sedimentation Rate</i>
<i>GBD</i>	<i>Global Burden of Disease</i>
<i>IASP.....</i>	<i>International Association for the Study of Pain</i>
<i>IED.....</i>	<i>Intraepidermic</i>
<i>IM.....</i>	<i>Intramuscular</i>
<i>IQR</i>	<i>Inter-quartile range</i>
<i>LBP.....</i>	<i>Low Back Pain</i>
<i>LIT.....</i>	<i>Local intradermal therapy</i>
<i>LTRs</i>	<i>Local twitch responses</i>
<i>MPS.....</i>	<i>Myofascial pain Syndrome</i>
<i>MRE.....</i>	<i>Magnetic Resonance Elastography</i>
<i>MRI.....</i>	<i>Magnetic Resonance Imaging</i>
<i>MSCs</i>	<i>Mesenchymal stem cells</i>
<i>MTrPs.....</i>	<i>Myofascial Trigger Points</i>
<i>NDI</i>	<i>Neck Disability Index</i>
<i>NK1.....</i>	<i>Neurokinin 1</i>
<i>NMDA.....</i>	<i>N-methyl-D-aspartate</i>
<i>NPQ.....</i>	<i>Northwick park neck pain questionnaire</i>
<i>NSAIDs.....</i>	<i>Non-Steroidal Anti-Inflammatory Drugs.</i>
<i>NSS.....</i>	<i>Normal saline solution</i>
<i>OA.....</i>	<i>Osteoarthritis</i>
<i>OFP.....</i>	<i>Oedematous fibrosclerotic panniculopathy</i>
<i>PAG.....</i>	<i>Periaqueductal grey</i>

List of Abbreviations (cont...)

Abb.	Full term
<i>PC</i>	<i>Phosphatidylcholine</i>
<i>PPP</i>	<i>Point by point</i>
<i>PRP</i>	<i>Platelet rich plasma</i>
<i>PTH</i>	<i>Parathyroid Hormone</i>
<i>RA</i>	<i>Rheumatoid Arthritis</i>
<i>RCR</i>	<i>Rapid contraction response</i>
<i>RIT</i>	<i>Regenerative Injection Therapy</i>
<i>ROM</i>	<i>Range Of Motion</i>
<i>RVM</i>	<i>Rostroventromedial medulla</i>
<i>sCt</i>	<i>Salmon calcitonin</i>
<i>SDN</i>	<i>Superficial Dry needling</i>
<i>SEA</i>	<i>Spontaneous Electrical activity</i>
<i>SIA</i>	<i>Stress-induced analgesia</i>
<i>SNRIs</i>	<i>Serotonin Noradrenaline (Norepinephrine) Reuptake Inhibitors</i>
<i>SSRIs</i>	<i>Selective Serotonin Reuptake Inhibitors</i>
<i>TCAs</i>	<i>Tricyclic Antidepressant</i>
<i>TRP</i>	<i>Transient Receptor Potential</i>
<i>TRPV1</i>	<i>Transient receptor potential vanilloid</i>
<i>VAS</i>	<i>The visual analog scale</i>
<i>WHO</i>	<i>The World Health Organization</i>

INTRODUCTION

Neck pain is an important personal and societal burden, affecting 30–50% of adults in the general population in any given year. Approximately 50–85% of individuals with neck pain do not experience complete resolution of symptoms and some may go on to experience chronic, impairing pain (*Goode et al., 2010*).

The limitation of motion can have a devastating effect on activities of daily living. People may have difficulty driving safely and become confined to their homes. Workers may have increasing neck pain at their workplace. They may have problems remaining productive at their jobs, placing their employment at risk (*Borenstein, 2007*). Neck pain may cause absenteeism as frequently as low back pain (LBP). Like chronic LBP chronic neck pain is often unresponsive to treatment and costly in regard to direct and indirect costs (*Goode et al., 2010*). Chronic neck pain is a serious condition that must be treated aggressively (*Borenstein, 2007*).

Myofascial trigger points (MTrPs) can be involved in pain processes in patients with neck pain. Simons et al., defined an MTrP, as a hyperirritable spot in a taut band of a skeletal muscle that is painful on contraction, stretching, or stimulation and elicits a referred pain distant from the point (*Muñoz-Muñoz et al., 2012*). They are typically found proximal to an inflamed or painful joint such as the rectus femoris in patients

with knee osteoarthritis and paraspinal regions in the cervical and lumbar spine (**Karrar and Mackworth-Young, 2015**).

The majority of subjects with chronic impairing neck pain reported taking an over the counter non-steroidal anti-inflammatory drugs (NSAIDs). Twenty-nine percent of subjects reported taking strong narcotics (e.g., morphine and oxycodone), whereas 23.1% reported taking weak narcotics (codeine or propoxyphene) for chronic impairing neck pain. Another commonly used medication was muscle relaxants, with almost one-third of the sample reporting use. Evidence on the effectiveness of medications in the treatment of chronic neck pain is quite limited (**Goode et al., 2010**).

Numerous noninvasive methods such as stretching, massage, ischemic compression, laser therapy, heat, acupuncture, ultrasound, transcutaneous electrical nerve stimulation and pharmacological treatments have been used to alleviate chronic myofascial pain, but no single strategy has been proved to be universally successful (**Kalichman and Vulfsons, 2010**).

Although injection, as interventional method, should be used cautiously in the setting of chronic pain, there is a role for a variety of injections (least interventional methods) to facilitate patients overall rehabilitation program (**Singh et al., 2015**).

Injection therapy is found to be effective in decreasing pain and muscular spasm, increasing the range of motion (ROM) and local blood circulation, and cause fibrotic scar formation on trigger points. Local anesthetic, saline, steroid, NSAIDs, botulinum toxin, and dry needling techniques are used as local injections (**Ay et al., 2010**).

NSAIDs could be injected using mesotherapeutic technique which is mainly consist of subcutaneous injections (into the mesoderm, hence the term “mesotherapy”) of steroids, NSAIDs and local anesthetics, administered alone or in various combinations can be injected (**Hermann et al., 2008**).

NSAIDs exhibit analgesic effects by COX inhibition and the reduction of prostaglandin and other inflammatory mediators. Nitric oxide seems to play a major part in local inflammation, and the injection of analgesic drugs may activate neuronal nitricoxide synthase to produce nitric oxide and consequently peripheral antinociception (**Mammucari et al., 2012**).

Dry needling (DN) is a minimally invasive method which is increasingly used for treatment of MTrPs. DN involves inserting a needle into an MTrP without injecting any medication. This technique is reported to be an effective and efficient treatment for reducing somatic pain and dysfunction associated with MTrPs in a muscle (**Abbaszadeh-Amirdehi et al., 2013**).

There are various DN modalities known for the treatment of MTrPs, and these can be classified in different ways, according to the various classification criteria. The most commonly used classification criterion is the depth of needle insertion. According to this, the different DN modalities can be classified into two categories: superficial DN (SDN) techniques, in which the needle does not reach the MTrP and stays in the tissues immediately overlying it and deep DN (DDN) techniques, in which the needle reaches the MTrP and passes through it (*Del Moral and Salvat, 2015*).

The most likely mechanisms of action of superficial needling are: the stimulation of A- δ nerve fibres performed by inserting a needle into the skin overlying the MTrP, the well-known capacity for stimulation using needles to induce secretion of endogenous opioid peptides (e.g. enkephalins, dynorphins), the gate-control theory: the stimulation of A- β nerve fibers tends to ‘close’ the gate and inhibit the transmission of pain to the superior centres and hypothetical action over the autonomous nervous system, which is known to modulate the activity of MTrPs (*Del Moral and Salvat, 2015*).

Hyperosmolar dextrose or phenol-glycerin-glucose injection, is an irritant substance injected into a joint space, ligament, subcutaneous tissue or tendon insertion site (prolotherapy), is complementary medical treatment, with the main goal being pain relief. Many different solutions have been used through-out the past 100 years that this technique has been