



The Effect of Perineural Injection in the Treatment of Carpal Tunnel Syndrome

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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Dedication

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List of Abbreviations

Abb.	Full term
AANEM	American Association of Neuromuscular Electrodiagnostic Medicine
AAOS	American Academy of Orthopedic Surgeons
ADM.....	Abductor digiti minimi
APB.....	Abductor pollicis brevis
BCTQ.....	Boston Carpal Tunnel Questionnaire
CCI.....	Chronic construction injury
CGRP.....	Calcitonin-gene-related peptide
CMAP	Compound muscle action potential
CSA.....	Cross-sectional area
CT	Computed tomography
CTS.....	Carpal tunnel syndrome
D5W	Dextrose 5% in sterile water
DML.....	Distal motor latency
DSL.....	Distal sensory latency
EDX	Electrodiagnostic test
EMG.....	Electromyography
FCR.....	Flexor carpi radialis
FCU	Flexor carpi ulnaris
FDP.....	Flexor digitorum profundus
FDS.....	Flexor digitorum superficialis
FPL	Flexor pollicis longus
FR	Flexor retinaculum
FSS	Functional Status Scale
LLL	Low Level Laser
MMCV.....	Median Motor conduction velocity
mMDL.....	Median motor distal latency
mMRL.....	Median motor residual latency
mMTL.....	Median motor terminal latency

List of Abbreviations Cont...

Abb.	Full term
<i>mMTTLI</i>	<i>Median motor terminal latency index</i>
<i>MMW</i>	<i>Median mononeuropathy at the wrist</i>
<i>MRI</i>	<i>Magnetic resonance imaging</i>
<i>MSCV</i>	<i>Median sensory conduction velocity</i>
<i>NCS</i>	<i>Nerve conduction study</i>
<i>NCV</i>	<i>Nerve conduction velocities</i>
<i>NGF</i>	<i>Nerve growth factor</i>
<i>NN</i>	<i>Nervi Nervorum</i>
<i>NPT</i>	<i>Neural Prolotherapy</i>
<i>NSAIDs</i>	<i>Non-steroidal anti-inflammatory drugs</i>
<i>PA</i>	<i>Palmar aponeurosis</i>
<i>PDI</i>	<i>Perineural deep injection</i>
<i>PIT</i>	<i>Perineural injection therapy</i>
<i>PL</i>	<i>Palmaris longus</i>
<i>PRP</i>	<i>Platelet-rich plasma</i>
<i>PSI</i>	<i>Perineural subcutaneous injection</i>
<i>RL</i>	<i>Residual latency</i>
<i>SNAPs</i>	<i>Sensory nerve action potentials</i>
<i>SNCV</i>	<i>Sensory nerve conduction velocity</i>
<i>SSS</i>	<i>Symptom Severity Scale</i>
<i>TCL</i>	<i>Transverse carpal ligament</i>
<i>TENS</i>	<i>Transcutaneous electrical nerve stimulation</i>
<i>TLI</i>	<i>Terminal latency index</i>
<i>TMNST</i>	<i>Tethered median nerve stress test</i>
<i>TRPV-1</i>	<i>Transient receptor potential vanilloid -Type 1</i>
<i>TTLD</i>	<i>Thenar (S1) to ulnar-thenar (S2) latency difference</i>
<i>US</i>	<i>Ultrasonography</i>
<i>VAS</i>	<i>Visual Analogue Scale</i>
<i>VEGF</i>	<i>Vascular endothelial growth factor</i>

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INTRODUCTION

Carpal tunnel syndrome (CTS) is the most well-known and frequent form of median nerve entrapment, and accounts for 90% of all entrapment neuropathies (*Ghasemi-rad et al., 2014*).

The American Academy of Orthopedic Surgeons (AAOS) Clinical Guidelines on the Diagnosis of CTS defines it as a symptomatic compression neuropathy of the median nerve at the level of the wrist (*Ibrahim et al., 2012*).

It occurs most often in patients aged 30 to 60 years and is two to three folds more common in women than in men (*Sucher & Scheiber 2014*).

Some common factors associated with development of CTS can be congenital or occupational; they also include female gender, pregnancy, obesity, diabetes, Thyroid dysfunction, acromegaly, oral contraceptive pills and benign tumors (*Plastino et al., 2011*).

CTS believed to be present in 3.8% of the general population. One out of five subjects who complains of symptoms such as pain, numbness and a tingling sensation in the hands is expected to have CTS based on clinical examination and electrophysiological testing, idiopathic CTS being the most common diagnosis in patients with these symptoms (*Ibrahim et al., 2012*).

Symptoms tend to be worse at night and clumsiness is reported during the day with activities requiring wrist flexion, the pathophysiology of CTS involves a combination of mechanical trauma, increased pressure and ischemic injury to the median nerve within the carpal tunnel (*Werner and Andary, 2002*).

Therapeutic strategies for CTS range from conservative treatments (e.g. medication, splinting, corticosteroid injection, and extracorporeal Shock wave therapy) to surgical intervention. A Cochrane review indicates that the effectiveness of conservative treatments is only short term and development of new approaches is critical (*O'Connor et al., 2003*). Moreover, conservative approaches are beneficial for most patients who have mild-to moderate CTS (*Aroori and Spence, 2008*).

Perineural Injection Therapy (PIT) is a new treatment of pain developed by a New Zealand physician, Dr. John Lyftogt. PIT combines the treatment principles of both neural therapy and prolotherapy. Like neural therapy, shallow, subcutaneous injections are injected along the path of superficial nerves and like prolotherapy dextrose; a sugar solution is used (*Lyftogt et al., 2007*).

It involves multiple small injections along the path of tender superficial nerves in the area of the pain with a small amount of 5% Dextrose (basically sugar water). The dextrose solution works by immediately blocking the nerve endings (TRPV-1 or Capsacin receptors) that are responsible for the