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

Thesis

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Dedication

Words can never express my sincere thanks to ***My Family and My Loving Husband*** *for their generous emotional support and continuous encouragement, which brought the best out of me. I owe them all every achievement throughout my life.*

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

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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