Manual Therapy 23 (2016) 106–113

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

Cervicogenic somatosensory tinnitus: An indication for manual therapy plus education? Part 2: A pilot study

Rob A.B. Oostendorp [a, b, c, *], Iem Bakker [d], Hans Elvers [e, f], Emilia Mikolajewska [g, h, i], Sarah Michiels [j, k], Willem De Hertogh [j], Han Samwel [l]

[a] Department of Manual Therapy, Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel, Brussels, Belgium
[b] Scientific Institute for Quality of Healthcare, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands
[c] Pain in Motion International Research Group[1], Vrije Universiteit Brussel, Brussels, Belgium
[d] Practice for Manual Therapy, Arnhem, The Netherlands
[e] Department of Public Health and Research, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands
[f] Institute for Methodology and Statistics Beuningen, Beuningen, The Netherlands
[g] Department of Physiotherapy, Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University, Toruń, Poland
[h] Rehabilitation Clinic, Military Clinical Hospital No. 10 with Polyclinic, Bydgoszcz, Poland
[i] Neurocognitive Laboratory, Center for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Toruń, Poland
[j] Department of Rehabilitation Sciences and Physiotherapy, Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium
[k] Department of Otorhinolaryngology, Antwerp University Hospital, Antwerp, Belgium
[l] Department Medical Psychology, Canisius Wilhelmina Hospital, Nijmegen, The Netherlands

ARTICLE INFO

Article history:
Received 15 September 2015
Received in revised form
11 February 2016
Accepted 14 February 2016

Keywords:
Somatosensory tinnitus
Tinnitus sensitization
Manual therapy
Education
Cervical spine
Outcome

ABSTRACT

Objectives: The aim of this study was to evaluate the efficacy of Manual Therapy Utrecht (MTU) plus education in patients with cervicogenic somatosensory tinnitus (CeT).
Study design: Pretest–posttest design.
Method: Five hundred and six patients were referred or referred themselves. A subgroup of patients was identified with CeT, and within this a subgroup with tinnitus sensitization (TS). Two CeT groups were created based on the presence or absence of TS. Both groups underwent manual therapy combined with tinnitus education. Tinnitus intensity (VAS-tin 0–100 mm) was the primary outcome measure. Number of treatments and adverse effects were the secondary outcome measures.
Results: A total of 122 patients with CeT (24.1%) were included (average age 53.3 years [±9.8], female 38.5% and duration of tinnitus 7.3 years [±8.9]). Patients were divided into two groups: 55 patients (45.1%) with TS (CeT + TS group) and 67 patients (54.9%) without TS (CeT − TS group). Pretest to posttest differences on the VAS-tin were statistically significant within both groups (CeT − TS group: difference VAS-tin 5.9 [$p = 0.01$]; CeT + TS group: difference VAS-tin 18.2 [$p = 0.00$]), and between the groups in favor of the CeT + TS group (difference VAS-tin 12.3 [$p = 0.01$]). Pretest to posttest differences were clinically significant for the CeT + TS group (difference VAS-tin 18.2 [MCIC = ≥10 mm VAS-tin]) and between the groups (difference VAS-tin 12.3 in favor of the CeT + TS group). The average number of treatment sessions was 9.6 (±2.6) for the CeT − TS group and 10.3 (±2.5) for the CeT + TS group, a non-significant difference. There were no adverse effects in either group.
Conclusions: Despite its limitations, this study provides valuable information on both the characteristics of patients with CeT and TS in a Dutch primary care manual therapy practice and on the potential effectiveness of MTU combined with tinnitus education for the subgroup of CeT + TS patients.

1. Introduction

Tinnitus is defined as the perception of sound in the absence of external auditory stimulation (Hoekstra, 2013). Subjective tinnitus is very common and cannot be assessed objectively. The

* Corresponding author. Postal address: Vrije Universiteit Brussel, p/a Kasteellaan 104, 6602 DK Wijchen, The Netherlands. Tel.: +31 246423419.
E-mail address: rob.oostendorp@planet.nl (R.A.B. Oostendorp).
[1] www.paininmotion.be.

http://dx.doi.org/10.1016/j.math.2016.02.006
1356-689X/

neurological system most commonly associated with tinnitus is the auditory system.

Following numerous studies, it is now established that the somatosensory systems of the upper cervical region and head can play a role in tinnitus. Through review of the literature, the conceptual phase of this study focusses on uncovering underlying mechanisms that link the auditory and somatosensory systems of the cervical region and head to cervicogenic somatosensory tinnitus (CeT) and secondary central tinnitus or tinnitus sensitization (TS) (Oostendorp et al., 2016). The pilot study will explore characteristics of the study population, and identify relevant components and outcomes of manual therapy in patients with CeT. This manuscript describes a pilot study in patients with CeT, either with or without secondary central tinnitus or tinnitus sensitization (TS).

Somatosensory tinnitus is probably underdiagnosed due to a lack of publications of diagnostic tests and therapeutic options on this subject. Important questions from a clinical point of view are whether somatosensory tinnitus in a subgroup of patients can be diagnosed as CeT, and whether treatments targeting the somatosensory system can be utilized to treat patients with CeT.

Current treatments include transcutaneous electrical stimulation, manual compression of myofascial trigger points, and movement therapies focused on neuromusculoskeletal functions, particularly muscular and joint functions of the upper cervical region and head (Levine et al., 2007; Latifpour et al., 2009; Sanchez and Bezerra Rocha, 2011). Alleviation of tinnitus by cervical manipulation has also been reported (Levine et al., 2007).

The aim of this study was to evaluate the efficacy of manual therapy according to the School of Manual Therapy Utrecht (MTU) combined with tinnitus education.

2. Material and methods

2.1. Design

The design of this pilot study was quasi-experimental and applied a pretest–posttest protocol in patients with subjective tinnitus. The study was performed in a primary care manual therapy practice in Arnhem (The Netherlands). The study was designed as a pilot study as defined in the study framework of the Medical Research Council (MRC) (Campbell et al., 2007; Craig et al., 2008).

Over a period of five years (2010–2014), all patients with subjective tinnitus who presented or referred themselves to the practice were asked to participate in the study. The Medical Ethics Committee of Radboud University Medical Centre Nijmegen, The Netherlands, stated that ethical approval was not necessary for the present study. Patients were informed that they could deny participation, or withdrawn from the study without needing to argue or explain why.

2.2. Patients

Prior to referral by a family doctor, medical specialist, or self-referral, all patients were assessed by an otolaryngologist. All patients were classified as having subjective tinnitus ($\geq$6 weeks). Exclusion criteria included use of antidepressants, psychiatric treatment, age < 18 years and subjective tinnitus for less than 6 weeks and no association with neck, shoulder, arm and back pain.

When a patient was willing to participate in the study and was not ruled out by exclusion criteria, the manual therapist scheduled an appointment to inform the patient about the design and purpose of the study. All patients gave permission for anonymous use of data.

The goal of the inclusion criteria was to identify a subgroup of patients with CeT within a group of patients with chronic subjective tinnitus in a primary care manual therapy practice and to identify tinnitus sensitization within the subgroup of patients with CeT. Following definitive inclusion in the study, every patient underwent a basic clinical assessment by the manual therapist, which included a general history (age, gender, social status, neck and/or head trauma, neck pain, shoulder and arm pain, and back pain) and an otological history (duration of tinnitus, modulation of tinnitus by stress, recognition of tinnitus sensitization, hearing functions such as hearing loss, duration of tinnitus complaints, localization and type of tinnitus). A physical examination was also carried out, focusing on musculoskeletal functions of the cervical spine, shoulder and arm (mobility of joints, muscle functions [tone, tenderness and trigger point] and modulation of tinnitus by head, neck, and arm movements) in accordance with other studies (Michiels et al., 2015a,b). The clinical tests were conducted and interpreted as described in standard handbooks of orthopedic (Dutton, 2004) and otological (Huizing and van Zanten, 2003) examination, and diagnostics of manual medicine (Lewit, 1977; Van der Bijl, 1986; Dvořák and Dvořák, 1990).

Based on clinical expertise, clinical reasoning processes and guidelines describing diagnostic criteria for cervicogenic somatosensory headache, dizziness and tinnitus (Sjaastad et al., 1990, 1998; Wrisley et al., 2000; Sanchez and Bezerra Rocha, 2011), the following clinical criteria were considered for CeT: (1) neck pain; (2) impairment of cervical range of motion, preferably rotation; (3) modulation of tinnitus by head and neck movements and posture; (4) tenderness of cervical-occipital muscles. The variables were dichotomized into yes/no. A case was considered positive (yes) for CeT if 'yes' was given for all four criteria.

Based on clinical expertise and using guidelines for clinical recognition of central sensitization and tinnitus sensitization (Zenner et al., 2006; Nijs et al., 2010), the following clinical criteria were considered for tinnitus sensitization: (1) widespread hyperalgesia and pain remote from the symptomatic region, such as shoulder pain and back pain; (2) impairment in quality of vision; (3) burning eyes; (4) modulation of tinnitus by psychological stress, such as sound phobia (fear of sound); (5) modulation of tinnitus by sensory stimulation; (6) presence of headache; (7) presence of dizziness; (8) tingling in arms or legs. The variables were dichotomized into yes/no. Tinnitus sensitization was considered positive (yes) if 'yes' was given for five of the eight variables by analogy with the clinical recognition of central sensitization (Nijs et al., 2010).

Two groups within the subgroup of patients with CeT were created to verify the differences between group 1 (CeT group without TS [CeT − TS]), and group 2 (CeT group with TS [CeT + TS]).

2.3. Intervention

All subjects received manual therapy according to the method of MTU. A combined treatment, based on ten years' clinical experience in treatment of patients with tinnitus, has been developed by one of the authors (IB) (Bakker, 2012). Manual therapy according to the School of Manual Therapy Utrecht (MTU) is a distinct form of manual therapy (Van de Veen et al., 2005). This treatment focuses on static and dynamic posture, preferences of movements, and selective somatosensory mechanical stimulation of joints of the spine, pelvis and extremities by the therapist repeatedly performing very gentle, low velocity passive movements (Van der Bijl, 1977, 1986; De Cock, 1996), in combination with informative advice on TS that is comparable to practice guidelines on how to explain central sensitization to patients with chronic musculoskeletal pain (Nijs et al., 2011). High-velocity movement techniques are not applied.