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Injections of Local Anesthetics into the Pharyngeal Region Reduce Trapezius Muscle Tenderness

Stefan Weinschenk[a,b] Markus W. Hollmann[c] Richard Göllner[d] Susanne Picardi[e] Thomas Strowitzki[b] Leon Diehl[f] Lorenz Hotz[e] Thomas Meuser[g] for the Heidelberg University Neural Therapy Education and Research Group (The HUNTER Group)[h]

[a] Outpatient Practice Drs. Weinschenk, Scherer & Co., Karlsruhe, Germany; [b] Department of Gynecological Endocrinology and Fertility Disorders, Women's Hospital, University of Heidelberg, Heidelberg, Germany; [c] Department of Anesthesiology AMC Amsterdam, University of Amsterdam, Amsterdam, The Netherlands; [d] Institute of Educational Science, University of Tübingen, Tübingen, Germany; [e] Department of Anesthesiology and Intensive Care, University of Heidelberg, Heidelberg, Germany; [f] The Kleist Practice of Dental Medicine, Mannheim, Germany; [g] Department of Anesthesiology and Intensive Care, Marienkrankenhaus, Bergisch Gladbach, Germany; [h] The Heidelberg University Neural Therapy Education and Research Group, Women's Hospital, Heidelberg, Germany

Keywords
Neck reflex points · Neural therapy · Neck pain · Pharyngeal injection · Procaine

Summary
Background: Neck pain is a frequent reason for seeking medical advice. Neuroanatomical findings suggest a close connection between the pharynx and the trapezius region. Irritation of the pharynx may induce tenderness of this area. Specific tender points, called neck reflex points (NRPs), can be identified here with high reproducibility. We hypothesized that therapeutic local anesthesia (TLA; or neural therapy, NT) in the pharyngeal region can reduce tenderness in patients with therapy-resistant neck pain. **Patients and Methods:** 17 consecutive female patients with chronic cervical pain and positive trapezius NRPs received bilateral injections of 0.5 ml 1% procaine into the palatine velum. The NRPs were assessed using a 3-level pain index (PI = 0, 1, or 2) before and 3–5 min after each injection. **Results:** We found a significant reduction in tenderness of the NRP of the trapezius region (NRP C7) immediately after TLA/NT. 30 positive NRPs were found before therapy and only 13 after therapy ($p < 0.01$). The average PI of the NRP C7 was 1.24 ± 0.77 before and 0.35 ± 0.59 after therapy (right side), and 1.34 ± 0.59 before and 0.59 ± 0.69 after therapy (left side). The pre- and post-therapy PI values were significantly different on both the right and left sides of the trapezius region ($p < 0.01$). No adverse effects were observed. **Conclusions:** Pharyngeal irritation may induce and maintain therapy-resistant cervical pain in patients with chronic pharyngeal disease. These patients could benefit from remote TLA/NT injections in the pharyngeal region.

Schlüsselwörter
Nackenreflexpunkte · Neuraltherapie · Nackenschmerzen · Racheninjektion · Procain

Zusammenfassung
Hintergrund: Nackenschmerzen sind ein häufiger Grund für einen Arztbesuch. Neuroanatomische Untersuchungen legen eine enge Verbindung zwischen dem Pharynx und dem muskulären Weichgewebe der Nacken- und Trapeziusregion nahe. Irritationen des Rachens können zu Schmerzen in der Trapeziusregion führen. Diese dolenten Punkte, auch Adler-Langer-Druckpunkte oder Nackenreflexpunkte (NRP) genannt, sind gut reproduzierbar. Wir untersuchten, ob eine therapeutische Lokalanästhesie (TLA; oder Neuraltherapie, NT) im Rachenraum bei Patienten mit therapieresistenten Nackenschmerzen die Schmerzhaftigkeit des NRP der Trapeziusregion (NRP C7) verringern kann. **Patienten und Methoden**: 17 konsekutive Patientinnen mit chronischen zervikalen Schmerzen und positiven NRP der Trapeziusregion erhielten eine beidseitige Injektion von je 0.5 ml 1% Procain in das Velum palatinum (34 Injektionen). Die Schmerzhaftigkeit der NRP wurde vor und 3–5 min nach der Injektion mittels eines 3-stufigen Schmerzindex (PI = 0, 1 oder 2) ermittelt. **Ergebnisse:** Wir fanden eine signifikante Reduktion des Druckschmerzes der NRP nach TLA/NT. Von 30 positiven NRP C7 vor der Behandlung waren nach der Behandlung noch 13 ($p < 0,01$) positiv. Der durchschnittliche PI lag bei 1,24 ± 0,77 vor und bei 0,35 ± 0,59 nach der Therapie (rechts) sowie bei 1,34 ± 0,59 vor und 0,59 ± 0,69 nach der Therapie (links). Die Prä- und Posttherapie-PI-Werte zeigten signifikante Unterschiede sowohl auf der rechten als auch auf der linken Seite der Trapeziusregion ($p < 0,01$). Es wurden keine unerwünschten Nebenwirkungen beobachtet. **Schlussfolgerungen:** Chronische Rachenentzündungen können zervikale und Nackenschmerzen induzieren und aufrechterhalten. Eine Fernbehandlung mit TLA/NT im Bereich des Pharynx ist eine Therapieoption, um Patienten mit solchen Beschwerden zu helfen.

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Dr. Stefan Weinschenk
Bahnhofplatz 8
76137 Karlsruhe, Germany
stefan.weinschenk@med.uni-heidelberg.de

Introduction

Neck pain is one of the most frequent reasons for seeking medical advice in primary care [1]. The rates of recurrence and chronic manifestation are high. Frequently, these pains are therapy resistant, so that the influence of remote sources was considered as a possible cause [2]. Patients utilize a variety of classical and complementary treatments against pain of the cervical spine [3].

The visceral cranium is a potential site for such remote influences on neck and shoulder pain. The Spanish dentist Ernesto Adler empirically described specific tender points of the cervical muscles and soft tissue. He postulated that they are segmentally correlated with chronic inflammation of the frontal and maxillary sinuses, the teeth, and the pharynx [4]. These specific tender points of the cervical and neck region are called neck reflex points (NRPs) [5], formerly also known as Adler-Langer points [6]. They were named NRP C0–C7. NRP C0 is located in the insertion of the splenius capitis muscle (Linea nuchae), C1–C4 are positioned in the lateral muscles of the cervical spine, and C7 is found in the transversal part of the trapezius muscle (around the Jian Jing acupoint). NRP findings seem to be highly constant: In a different investigation, we demonstrated that NRPs could be detected in 2 independent double-blinded examinations with very high reproducibility (κ = 0.87) [7].

Langer [6] proposed a reflectory influence of the pharyngeal region on the trapezius muscle region, via the cervical segment C7. Uehleke et al. [8] found a high correlation of chronic pharyngeal inflammation with tenderness and stiffness of the trapezius muscle. Adler and Langer called the NRP found in the trapezius muscle NRP C7, although an anatomical connection to the C7 segment has still not been proven. This NRP should perhaps be called NRP7; nevertheless, we decided to keep using the historical name for this publication. A correct denomination will be discussed in the future.

The neuroanatomical background of NRPs may be explained by the close connection of afferent trigeminal and glossopharyngeal nerve fibers with efferent (antidrome) sensory fibers in the medullary dorsal horn of the cervical roots C1–C7 [9, 10]. An efferent effect of a trigeminal input on the cervical region has thus been proposed [11, 12]. Sessle et al. [13] described a close connection of cutaneous and tooth pulp afferents with visceral, neck, and muscle efferents in the trigeminal subnucleus caudalis, i.e. the medullary dorsal horn, as a possible cause of neck pain.

Schmidt et al. [14] demonstrated that periodontal disease has a strong influence on chronic pain of the musculoskeletal system; they suspected a trigeminal influence on remote diseases via the cervical and neck regions. Uehleke et al. [8] claimed that therapeutic interventions in the pharynx could elucidate connections between pharyngeal inflammation and cervical spine disorders. Local anesthesia of the pharynx may offer such an intervention. Therapy with local anesthetics (TLA), also known as neural therapy (NT) [15], is in widespread use; however, there are only a few studies verifying its clinical effectiveness [16, 17].

The aim of this pilot study was to investigate whether injections of local anesthetics into the pharyngeal region reduce tenderness of the trapezius muscle region in patients with therapy-resistant chronic neck pain. We evaluated the number of tender NRPs in the trapezius region before and after TLA, considering the postulated reflectory influence of the pharyngeal region on NRP C7. Our data supports the 'stoerfeld' (disturbance field) hypothesis of neural therapy, which postulates remote causes of otherwise intractable chronic diseases [18].

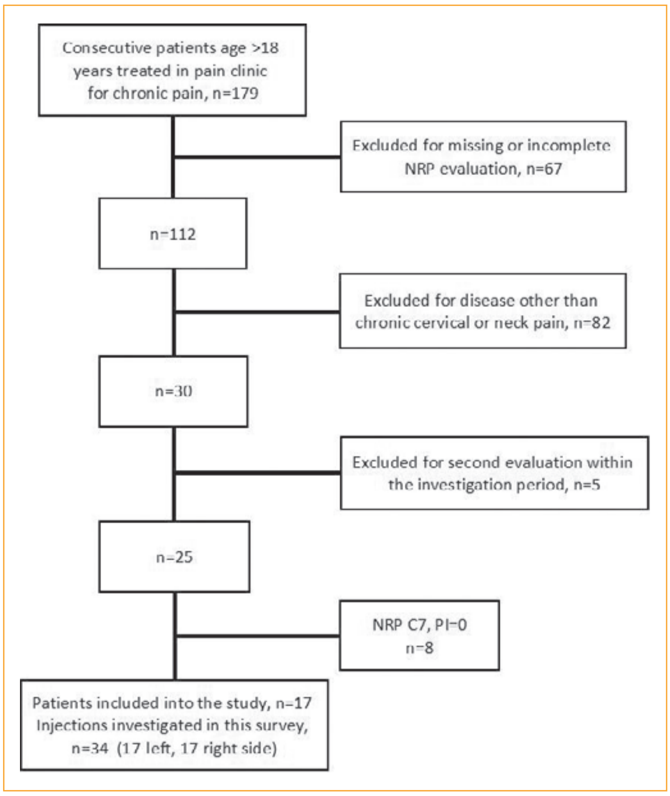

Fig. 1. Flow chart of patient selection according to STARD criteria [26]. Eligible patients are consecutively recruited patients. STARD = Standards for Reporting of Diagnostic Accuracy.

Methods

Patients

This observational diagnostic pilot study was approved by the Ethical Committee of the University of Heidelberg (approval no. 487/2011). In an obstetrics/gynecology (OB/GYN) outpatient practice in Karlsruhe, Germany, 179 consecutive treatments in patients with chronic pain disorders were performed between July 1, 2007 and June 30, 2010. In 112 of these cases, the patients were also examined for NRPs (tenderness of the cervical region) before their therapeutic intervention. 30 of these consecutive patients displayed therapy-resistant chronic pain of the cervical spine (neck pain, ≥ 6 months of complaints). 5 documentations were excluded for multiple examinations in the same patient. Of the resulting 25 patients, 17 were found to have positive NRPs C7 and were identified as eligible for this investigation (fig. 1). All patients gave their informed consent and agreed to an anonymized data evaluation.

Exclusion criteria for patients were: previous TLA/NT within fewer than 7 days (N = 0); second NRP C7 examination and treatment in the same patient during the investigation period (N = 5); and chronic diseases of the nervous system, e.g., multiple sclerosis (N = 0).

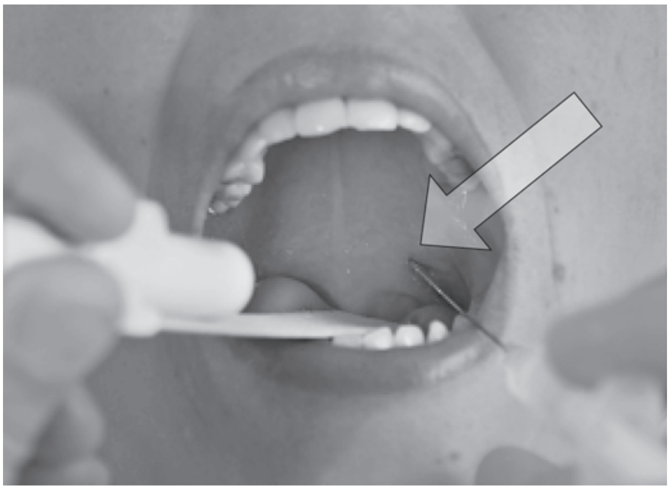

Fig. 2. Technique of injection into the left pharyngeal region. The tip of the arrow points to the injection site at the palatine velum mucosa.

Fig. 3. Palpation of the NRP C7 region (3E15 in acupuncture) [5].

TLA/NT Therapeutic Regimen

Patients with chronic neck pain and positive NRPs were treated with local anesthetics. We performed submucosal pharyngeal injections to the palatine velum, formerly known as 'injection to the tonsils' [19], of 0.5 ml 1% procaine without additives (Steigerwald Inc., Darmstadt, Germany) using a 0.6 × 60 mm needle (fig. 2). All of the 17 patients were treated bilaterally, so that 34 injections into the palatine velum were performed in total. The injection technique followed standard instructions [19]. All injections were performed in the supine position.

Assessment of NRP Tenderness (Pressure Sensitivity)

Trapezius region tenderness was assessed using a standardized technique: manual palpation of the cervical spine before and after treatment [20]. Palpation was conducted by the same therapist, with a defined standard finger pressure of approximately 4 kp according to the tender point criteria of the American Society of Rheumatology (ASR) [21], which had also been used in previous studies [7, 20]. Pressure sensitivity of the NRP C7 was palpated at the transversal part of the trapezius muscle and its surrounding tissue (fig. 3).

The patient was instructed to describe the pressure sensitivity (tenderness) of the NRP upon manual palpation within a 0–1–2 nominal scale ranging from 0 (no pain) to 1 (slight pain) to 2 (marked pain). A tenderness value of 0 was given to patients without pain sensation or withdrawal, 1 was assigned to patients reporting pain sensation but without withdrawal, and 2 was given if a pa-

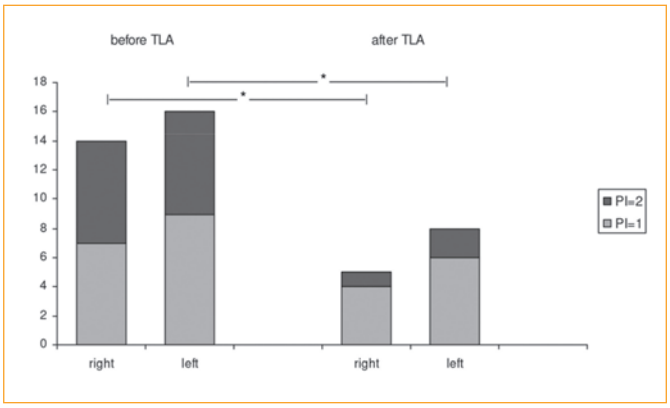

Fig. 4. Number of trapezius muscle tender points NRP C7 before and after TLA in the pharyngeal region. PI = Pain index (1 = slight, 2 = marked tenderness), TLA = therapy with local anesthetics. *Difference between bars is significant on a p < 0.01 level.

tient showed a marked pain reaction like whimpering, moaning, shrieking, or withdrawal of the head or neck. This 3-level score (0, 1, and 2) was used by Andersen and co-workers [20, 22, 23], and has also been recommended for NRP examination [5]. It is easy to understand for patients and allows sufficient assessment of mild versus severe symptoms. Documentation of the examiner's findings was done by an assisting nurse or a medical student.

Stiffness of the palpated region, muscle tension, or myogelosis felt only by the examiner, without the patient reporting pain, did not influence the scaling. After injection of the local anesthetic, the NRPs were re-examined after <5 min.

Statistical Analysis

SPSS (IBM SPSS Inc.) version 19 was used for statistical data analysis of the differences in NRP C7 tenderness pre- and post-injection. We used Spearman's correlation analysis and the paired t-test for data comparison. As this was an exploratory trial, the p-values are descriptive in nature. Statistical significance started at p = 0.05 (2-tailed).

Results

Patient Selection and Characteristics

The average age of the patients was 54.5 ± 13.8 years (mean ± standard deviation (SD); range: 18–82 years) at the time of injection while the average body mass index (BMI) was 22.8 ± 2.5 kg/m^2 (mean ± SD). There were no adverse effects of the therapy. The main side effect was slight drowsiness in 12 patients, lasting for a maximum of 3–10 min. Bleeding or other complications as a result of the injection did not occur.

Correlation of NRP C7 Tenderness before and after Treatment

Before investigating the intervention effects of NRP C7, we calculated the correlation of left and right NRP tenderness in each individual. We found a moderate, but not significant, correlation of 0.43 (p = 0.068) between the left and right NRP C7 tenderness before therapy, and a moderate and significant correlation of 0.59 (p = 0.041) after therapeutic intervention. Left and right NRPs did not correlate crosswise before and after therapy, indicating that the tenderness reduction is a side- and therapy-specific effect (table 1).

Table 1. Correlation analysis of left and right NRP C7 tenderness before and after therapy

Correlations, N = 17				
	C7 R before TLA	C7 L before TLA	C7 R after TLA	C7 L after TLA
C7 R before therapy	1.000	0.427	0.593**	0.162
C7 L before therapy		1.000	0.397	0.472*
C7 R after therapy			1.000	0.613**
C7 L after therapy				1.000

**Correlation is significant at the 0.01 level (2-sided).
*Correlation is significant at the 0.05 level (2-sided).
R = Right side, L = left side.

Table 2. Average tenderness of left and right NRPs C7 before and after therapy in 17 patients

	NRP C7 right	NRP C7 left	t-Test (left/right)
Before therapy	1.24 ± 0.77	1.34 ± 0.59	p = 0.42, n.s.
After therapy	0.35 ± 0.59	0.59 ± 0.69	p = 0.06, n.s.
Difference	0.89 (–72%)	0.75 (–59%)	
t-Test (before/after)	p < 0.01	p < 0.01	

n.s. = Not significant.

Table 3. Number of positive NRPs (PI = 1 or 2) of left and right NRPs C7 in 17 patients before and after therapy

NRP (PI = 1 or 2)	Before therapy	After therapy	Difference
Right side	N = 14/17 (82.4%)	N = 5/17 (29.4%)	p < 0.01
Left side	N = 16/17 (94.1%)	N = 8/17 (47.1%)	p < 0.01
Both sides together	N = 30/34 (88.2%)	N = 13/34 (38.2%)	p < 0.01

Differences in NRP C7 before and after Treatment

The left and right prevalences of tender NRPs before treatment did not differ significantly (table 2). After treatment, we found an average tenderness reduction of 72% on the right side (mean 0.35 vs. 1.24) and of 59% on the left side (mean 0.59 vs. 1.34) (table 2). The pre- and post-therapy difference in average tenderness was significant on both sides of the trapezius muscle region ($p < 0.01$).

In addition to the average PI, the number of positive NRPs also decreased significantly (fig. 4). Before therapy, 16 of 34 NRPs C7 were positive with PI = 1, and 14 with PI = 2. After therapy, 17 of 34 NRPs were alleviated: in only 10 NRPs, a PI of 1 was found, and in only 3 NRPs, a PI of 2. Before therapy, 4 NRPs showed no tenderness (PI = 0), whereas after treatment there were 21 NRPs without tenderness. In none of the cases an increase in NRP tenderness following therapy was observed. There was no difference in NRP alleviation between the left and the right side (regression coefficient $\beta = 0.5$, $p = 0.57$). Table 3 shows the alleviation of the NRPs in the right and left trapezius muscle after injecting the local anesthetic into the respective side of the palatine velum. We can, in particular, observe a reduction in the marked pain (PI = 2), whereas the slight tenderness of the NRP C7 (PI = 1) showed a smaller, but still significant, reduction.

Discussion

NRPs – a Possible Therapeutic Approach to Chronic Neck Pain?

The hypothesis of this pilot study was that injections of local anesthetics into the pharyngeal region can reduce tenderness of the trapezius muscle region and thus alleviate pain in patients with therapy-resistant chronic neck pain. We went on to perform TLA, or NT, in these patients by injecting 0.5 ml 1% procaine into the palatine velum. A significant reduction in tenderness of the trapezius muscle region was found immediately after the injections.

Neuroanatomical findings suggest a close connection between the pharyngeal region and the lower cervical zone. Sessle and coworkers described a direct neuroanatomical convergence of the trigeminal nerve and the cervical region in the medullary dorsal horn as a possible reason for cervical pain [13, 24]. Manni et al. [24] specified a direct trigeminal influence on the extensor muscles of the neck. Other authors described a close connection between the trigeminal and the cervical region in animals and humans [9–12, 25]. As there are no efferent neurons in the dorsal horn, these findings suggest a possible reflex arc between the trigeminal neurons and efferent (antidrome) sensory fibers of the muscles in the neck region.

A clinical correlation between pharyngeal irritation and tenderness of the neck was reported by Uehleke et al. [8] based on previous reports by the dentist Ernesto Adler in the 1970s [4]. According to Adler, every area of the visceral cranium projects its disturbances to a distinct reflex zone of the cervical and neck region. For instance, chronic pharyngitis reflects into the trapezius muscle region, where resulting tenderness and stiffness can be detected. Langer called this region ‘C7’; this denomination has been adopted in the literature [5]. However, the denomination may still be revised as the transversal part of the trapezius is innervated by C4 and the deeper muscles by C2–C3.

These reflex zones were called ‘Adler-Langer points’ and are now referred to as ‘neck reflex points’ to emphasize the proposed underlying nature of a reflex mechanism [5]. In their investigation, Uehleke et al. [8] described a statistical correlation of NRP C7 with redness of the throat and nocturnal brachialgia of the ipsilateral arm. However, they did not explain the nature of these correlations but called for interventional studies to further investigate the correlations. Later, Schmidt et al. [14] observed the effects of therapeutic injections with local anesthetics in the trigeminal area. If pain was reduced, the injection was followed by the extraction of wisdom teeth. This was the first report of a therapeutic intervention in the area of the trigeminal nerve that was followed by remote effects on the musculoskeletal system.

Nevertheless, the influence of chronic irritation of the trigeminal and glossopharyngeal afferents on the cervical and neck region cannot be explained by efferent dorsal horn motor neurons. This is because their presence has not yet been confirmed. Based on our findings, we hypothesize that a reduction in chronic irritation of afferent trigeminal and glossopharyngeal neurons, through local anesthesia, results in a reduction of efferent dorsal horn sensory neuron activity and a reduction of cervical muscle irritation. Local anesthesia may interrupt the reflex arc and therefore lessen the cervical tenderness and pain.

Limitations and Strengths of the Study

As the investigation was performed in a pain clinic associated with an OB/GYN outpatient unit, mainly women were examined. Following our inclusion and exclusion criteria, all 17 patients included were female. Thus, the results cannot be applied to a male population. Further investigations of NRPs in both genders are needed.

The NRP examination with a defined thumb and finger pressure of 4 kp, according to the ASR criteria, is easy to perform [22, 23], but it may be influenced by subjective factors, such as the individual pain sensitivity of the patient. A further limitation is the single-observer design, where results are subject to the therapist’s perception. This is because, in a non-interventional, observational setting, blinding is neither possible nor permitted. The pre-post design of our investigation aimed to minimize the bias of both the patient and the physician. This seemed to be effective as our statistical cross-analysis shows that artifacts were unlikely. A correlation of tenderness in both sides of the cervical spine, measured before and after therapy, was found. A double-blinded examination performed by 2 different examiners also showed high reproducibility of the NRP results [7]. This also confirms the reliability of our data. Still, artifacts should not be completely excluded. Further double-blinded studies are necessary to confirm our preliminary results.

The 3-level scale (no pain, slight pain, marked pain) of NRP tenderness, introduced by Andersen et al. [22] for trigger points of the cervical spine and used for the estimation of NRPs [5], is vague. Nevertheless, due to practical advantages, it has been preferred by these authors over a 10- or 100-step visual analogue scale (VAS) for this kind of cervical spine investigation.

In spite of the limitations of this pilot study, we observed a marked and significant alleviation in tenderness of the trapezius muscle region following injections into a remote area (the pharynx).

In order to specify the C7 reaction, examinations of other NRPs (e.g., at the C1, C2, C3, or C4 level) must be performed to provide a comparison. The purpose of this pilot study, however, was not to investigate segment specificity of a reaction. Still, this could be done by also performing injections into other parts of the visceral cranium (e.g., the dental or sinus region) in order to evaluate each segment-specific reaction.

Our therapeutic intervention, the injection of a local anesthetic, was performed bilaterally at the pharyngeal palatine velum, an area that was named NRP C7. Reduction in tenderness was observed on the left and right side of the trapezius muscle region. It is unclear whether an injection to the right palatine velum influenced the left side of the neck and vice versa. Side specificity of the reaction would have to be investigated with unilateral injection regimes.

Possible Role of NRPs for Chronic Neck Pain

In this pilot study, we did not examine the magnitude of cervical and neck pain before treatment or its reduction afterwards. The aim was also not to evaluate the patients’ long-term clinical outcome. Our primary endpoint was the immediate reduction in tenderness of the trapezius muscle region after therapeutic injections into the remote area.

Injection into the palatine velum is a procedure frequently performed in neural therapy. The use of this injection site for treating remote disorders, e.g. musculoskeletal diseases, as suggested by Schmidt et al. [14] and by our preliminary data, is still unclear. If trigeminal or glossopharyngeal irritation projecting into the cervical and neck region and to other areas of the body can be interrupted by injections of local anesthetics, a long-term alleviation of the pain should be possible.

We observed a significant reduction in tenderness of the trapezius muscle region immediately after injections of local anesthetics into the pharyngeal region. These results suggest that NRPs can be used as a diagnostic indicator of chronic irritations of the trigeminal and glossopharyngeal region, rather than considering NRPs as subjective sites of pain.

Cervical and neck pain is a major cause of disability and demands much health care [3]. Our results emphasize the importance of finding simple and effective treatments for tenderness in the neck and shoulders of patients with chronic cervical and neck pain. Pharyngeal injections with local anesthetics may benefit such patients.

Implications for the ‘Stoerfeld’ Concept of Neural Therapy

Our investigation proposes a potential therapy for cervical and neck pain, through treatment of the pharyngeal region with local anesthetics. The ‘stoerfeld’ hypothesis of a remote influence of a ‘stoerfeld’ or disturbance field on distant chronic diseases claims that patients with such chronic pain benefit from therapeutic injections into the pharyngeal region and other remote sites. We presented first clinical data supporting this stoerfeld concept, which may be of importance with regard to other chronic musculoskeletal diseases as well.

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Disclosure Statement

As this study was neither sponsored nor funded, the authors have no conflict of interest to declare.

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