Inter-Rater Reliability of Neck Reflex Points in Women with Chronic Neck Pain

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Summary
Background: Neck reflex points (NRP) are tender soft tissue areas of the cervical region that display reflectory changes in response to chronic inflammations of correlated regions in the visceral cranium. Six bilateral areas, NRP C0, C1, C2, C3, C4 and C7, are detectable by palpating the lateral neck. We investigated the inter-rater reliability of NRP to assess their potential clinical relevance. **Methods:** 32 consecutive patients with chronic neck pain were examined for NRP tenderness by an experienced physician and an inexperienced medical student in a blinded design. A detailed description of the palpation technique is included in this section. Absence of pain was defined as pain index (PI) = 0, slight tenderness = 1, and marked pain = 2. Findings were evaluated either by pair-wise Cohen's kappa (κ) or by percentage of agreement (PA). **Results:** Examiners identified 40% and 41% of positive NRP, respectively (PI > 0, physician: 155, student: 157) with a slight preference for the left side (1.2:1). The number of patients identified with >6 positive NRP by the examiners was similar (13 vs. 12 patients). κ values ranged from 0.52 to 0.95. The overall kappa was κ = 0.80 for the left and κ = 0.74 for the right side. PA varied from 78.1% to 96.9% with strongest agreement at NRP C0, NRP C2, and NRP C7. Inter-rater agreement was independent of patients' age, gender, body mass index and examiner's experience. **Conclusion:** The high reproducibility suggests the clinical relevance of NRP in women.

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Zusammenfassung
Hintergrund: Nackenreflexpunkte (NRP, Adler-Langer-Punkte) sind schmerzhafte Bindegewebsareale an Hals und Nacken, die bei chronischen Entzündungen des viszeralen Kraniums auftreten können. Je 6 Punkte, NRP C0, C1, C2, C3, C4 und C7, lassen sich beidseits palpatorisch unterscheiden. Wir untersuchten deren Reproduzierbarkeit, um Hinweise auf ihre mögliche klinische Relevanz zu erhalten. **Methode:** 32 aufeinanderfolgende Patienten mit chronischen Nackenschmerzen wurden in einem verblindeten Studiendesign durch einen erfahrenen Arzt und eine ungeübte Anfängerin (Medizinstudentin) auf NRP untersucht. Die Untersuchungstechnik der NRP wird detailliert beschrieben. Die Schmerzhaftigkeit wurde mittels eines Schmerzindex (PI) von 0–2 definiert, wobei leichter Druckschmerz als 1 und deutlicher Schmerz als 2 bezeichnet wurde. Die Ergebnisse wurden mittels Cohen's kappa (κ) und prozentualer Übereinstimmung (PA) ausgewertet. **Ergebnisse:** Die Untersucher fanden 40 bzw. 41% positive NRP (PI > 0): Arzt: 155, Student: 157, mit leichter Bevorzugung der linken Seite (1,2:1). Beide Untersucher konnten Patienten mit >6 positiven NRP gleich gut identifizieren (12 vs. 13 Patienten). Die κ-Werte bezogen auf die einzelnen Punkte waren hoch bis sehr hoch und reichten von 0,52 bis 0,95. Der κ-Wert für alle positiven NRP war sehr hoch mit κ = 0,80 für die linke und hoch mit κ = 0,74 für die rechte Seite. Der PA lag zwischen 78,1% und 96,9%. Die höchsten Übereinstimmungen fanden sich bei NRP C0, NRP C2 und NRP C7. Die Reproduzierbarkeit wurde weder von Alter, Geschlecht, Body Mass Index noch der Erfahrung des Untersuchers beeinflusst. **Schlussfolgerung:** Die hohe Reproduzierbarkeit bei weiblichen Patienten spricht für eine klinische Bedeutung der NRP.

Introduction

The term 'neck reflex points' (NRP) or 'Adler-Langer points' describes painful changes of the soft tissue in the cervical neck. NRP appear to be a different entity to the activated muscular trigger points (mTrP) of the myofascial pain syndrome. mTrP are palpable, often single painful nodules of the striated muscle [1], and may cause radiating pain (referred pain) when palpated [2]. In contrast, NRP are localized in the soft tissue of the neck and cervical spine and do not induce radiating pain.

Ernesto Adler, a Spanish dentist, postulated that tenderness of the NRP can be induced by chronic irritation of the trigeminal nerve [3]. He postulated a correlation between chronic inflammation of the teeth and NRP tenderness on the level of C2 and C3, as well as a correlation of silent inflammation of the maxillary sinuses with tenderness of NRP C1 [3]. Later, he and his student Hans Langer described a correlation of tenderness of a further NRP, called C0 (protuberantia occipitalis) with chronic frontal sinusitis, and of C4/C7 with chronic pharyngeal inflammation [4]. Adler concluded that NRP are segmentally organized reflectory changes of the cervical soft tissue, resulting from chronic inflammations of the visceral cranium. Tenderness of NRP thus could serve to determine foci of inflammation in specific areas of the visceral cranium. NRP were also named Adler-Langer-Points after these authors [4]. Although some naturopaths, who have come into contact with Adler's book, use NRP in diagnosis, their numbers and methods of examination are unknown as, up to now, no systematic surveys in the field have been performed.

The neurobiological nature of NRP still needs to be investigated. Nevertheless, there is a correlation between NRP and clinical disease. Uehleke et al. [5] found a high correlation between chronic pharyngeal inflammation, tenderness at NRP C7 and nocturnal brachialgia. They speculated a causal interrelation. Recently, the HUNTER group described an interrelation of NRP tenderness with the pharyngeal region ex juvantibus [6].

If NRP act as reflectory responses to distinct remote stimuli, they should be reproducible between different examiners for a given patient at a specific time. The aim of our study was to investigate the inter-rater reliability of NRP palpation between an experienced and an inexperienced examiner. Reproducibility of NRP examination is a necessary prerequisite for using them as a diagnostic tool. A standardized and reproducible examination would lay a foundation for clinical use.

Each NRP level may have a different reproducibility. Therefore, we also investigated the statistical variation at the individual NRP levels. As we had hypothesized that NRP represent a real clinical entity, we expected little variation between 2 different examiners.

Patients and Methods

Patients

Consecutive patients (n = 36) visiting an outpatient practice specializing in chronic diseases in Karlsruhe, Germany, between March and May 2011 because of head and shoulder pain of 6–32-month duration were examined. They were asked to give their informed consent for the anonymized data evaluation for this investigation.

Study Design

In the outpatient practice, every patient is routinely examined for NRP at his/her first visit. Because this unit serves as an educational practice center for medical students of the University of Heidelberg, patients are often examined twice, by a teacher and by a student. This setup provides the opportunity to investigate the inter-rater reliability for this diagnostic procedure.

Exclusion criteria for enrolment into this study were: age of <18 years (n = 1) and repeated examinations of the same patient within the above time period (n = 3). 32 patients were included in the study and evaluated; in total, 384 NRP were documented (12 per patient, 6 on the left and 6 on the right side). The study was approved by the review board of the University of Heidelberg (No. 107/2010).

NRP examination

NRP can be detected by palpation at 6 different levels: the protuberantia occipitalis (NRP C0), the lateral edge of the vertical part of the trapezius muscle (NRP C1–C4), and at the middle of the horizontal part of the trapezius muscle

Fig. 1. Examination of neck reflex points (NRP): the C1 NRP region (left photo) and the C7 NRP region (right photo) are investigated for tenderness or pain by palpation. Details of the test performance are described in the Methods section, see also [7]. ©Dr. S. Weinschenk 2009.
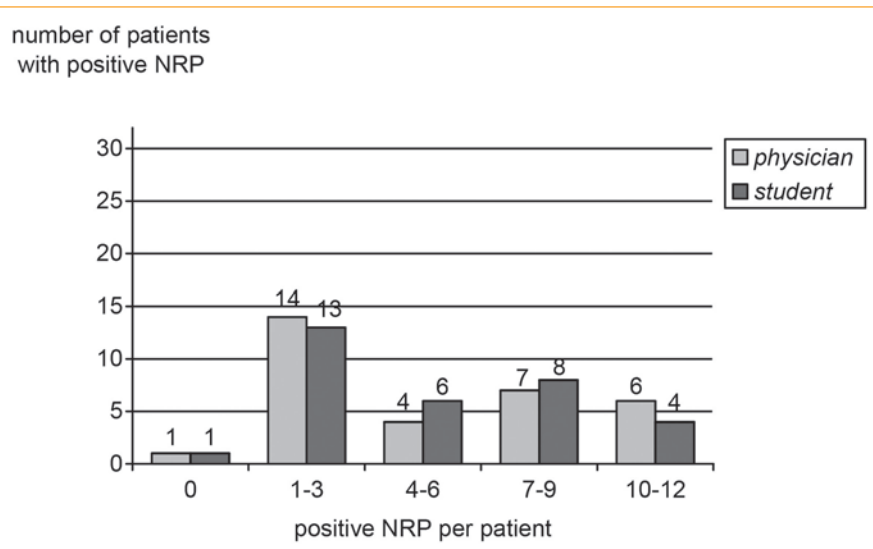
Fig. 2. Patients with positive NRP (pain index (PI) > 0). Differences between the 2 examiners are not significant (p > 0.05).

(NRP C7). C0 was palpated at the protuberantia occipitalis on the scull, C1 in the depression below the protuberantia, C2 at the lateral rim of the vertical part of the trapezius muscle, at the level of the second transverse process, C3 similar to C2, but at the level of the third transverse process, C4 in the depression between the vertical and horizontal part of the trapezius muscle, and C7 in the middle of the horizontal part of the trapezius muscle.

Patients were examined before medical intervention by 2 therapists, an experienced physician (S.W.) and a fourth-year medical student (K.H.), through a blinded design so that there was no exchange of information or findings between the therapists. Examination and documentation were performed in 2 different rooms and in a randomized back-to-back order. Patients were asked to report only present tenderness/pain induced by the current examination and not to mention the results of any previous examinations.

Examination of the NRP followed a standardized procedure described in neural therapy literature [7]. A finger pressure of approximately 4 kp was applied during manual examination, according to the standards of the American College of Rheumatology (ACR) [8]. Examples of the examination procedure are shown in figure 1. Intra-observer reliability was assured by having each examiner perform the individual examination 2 or more times before documenting the results.

The course of the study was divided into 2 phases: a student's learning phase (13 patients), during which the findings were discussed after unblinding between the experienced physician and the student, and a second phase (19 patients) during which there was no unblinding until the data collection was finished.

NRP were quantified using the 3-point scale of mTrP examination according to Andersen and co-workers [9, 10]. This scale has also been proposed for NRP examination [7]. Absence of pain at the respective NRP was defined as pain intensity 0 (pain index (PI) = 0), slight tenderness/pain as PI = 1, and marked pain as PI = 2, thus yielding an ordinal scale for assessing NRP tenderness or pain.

Statistical Analysis

The association between NRP and demographic background variables was assessed through Kendall's Tau. We also applied Cohens' kappa coefficient (κ) for a detailed analysis. The κ coefficient is an appropriate and frequently used measure of inter-rater agreement in diagnostics and medical examination procedures [11]. A κ value of ≤ 0.20 is considered to be an indicator of poor reliability, κ ≤ 0.40 as slight, ≤ 0.60 as moderate, ≤ 0.80 as good, and > 0.80 as very reliable [12].

The κ coefficient was assessed for its statistical significance through a hypothesis test. To examine the probability of detecting a significant κ coefficient,

Table 1. Neck reflex point (NRP) tenderness findings of the 2 examiners on the left and right side. None of the differences between NRP findings are significant

	Left side		Right side	
	Physician	Student	Physician	Student
PI = 0	106	102	123	125
PI = 1	59	60	43	44
PI = 2	27	30	26	23
PI = 1 or 2	86	90	69	67

PI = pain intensity index, tenderness of the NRP given by the patient (0 = no tenderness, 1 = moderate tenderness, 2 = marked tenderness/pain).

a sample size calculation was performed. According to Myburgh et al. [13] and Bron et al. [14], the minimum acceptable κ value was set to 60 for 2 raters and 2 possible ratings. Alpha (α) was set to 0.05 and beta (β) to 0.20. The results of power analysis showed that a κ of 0.60 could be achieved with a sample size of n = 18. Thus, the sample size of the present study was sufficient.

To compare the results of the present study with the findings on mTrP examination reproducibility [14], we also calculated the pair-wise percentage of inter-rater agreement (PA). According to [11], the PA is defined as the ratio of the number of agreements to the total number of ratings made.

Results

Patients' Characteristics

Consecutive patients (n = 32) with chronic neck pain persisting for 6–32 months were included in this study. The median age of subjects was 51.9 years (SD = 12.5, range 26–75 years). Median body mass index (BMI) was 22.6 kg/m² (SD = 3.4, range 17.4–33.1 kg/m²); 29 patients (90.6%) were female. The study population represented the average gender and age profile of patients in the outpatient practice affiliated with the obstetrics and gynecology practice in which the study was conducted.

Table 2. Agreement of the physician's and the student's NRP examination of the left and right side calculated by Cohen's κ

	Left side			Right side		
	Agree	Disagree	κ	Agree	Disagree	κ
PI = 0	98	18	0.83	111	20	0.81
PI = 1	41	22	0.72	31	22	0.67
PI = 2	20	8	0.81	19	8	0.81

PI = pain intensity, tenderness of the NRP given by the patient (0 = no tenderness, 1 = moderate tenderness, 2 = marked tenderness/pain); κ = Kappa coefficient (κ values).

Prevalence and Distribution of Positive NRP Overall and per Side

In total, 384 NRP (each 12 NRP of 32 patients) were documented by the student and the physician. NRP are frequent findings in our patients: 31 of 32 patients displayed at least 1 tender (positive) NRP (fig. 1). The physician identified 18/32 (56%) with 1–6 positive NRP (PI = 1 or 2), and 13/32 (41%) with 7–12 positive NRP. Only 1 patient did not have any positive NRP. The student identified a similar number of patients with positive NRP without a significant difference (fig. 2).

The distribution pattern of positive NRP in the physician's and the student's results were also similar. The physician recognized 155 NRP of 384 as being positive (40.4%), with 86 on the left and 69 on the right side of the cervical spine. The student found 157 positive NRP (40.9%), with 90 on the left and 67 on the right side (the differences between NRP found by the physician and the student were not significant for any of the results, table 1).

Figure 2 shows the patients with a certain number of positive NRP identified by the 2 examiners. Table 2 gives an overview of the strong agreement of all NRP. However, such a correlation does not necessarily mean agreement of the examiners. They can identify different patients having positive NRP and yet yield the same number of patients per group. Also, the agreement for each NRP is not derivable from these results. Therefore, in the next step we analyzed the inter-rater agreement for each NRP 0–12. Figure 3 illustrates the number of positive NRP at each level from C0 through C7 on the left and right side, as determined by each examiner. There was no significant difference between the examiners' findings at any level.

Inter-Rater Agreement between the 2 Examiners

To assess the agreement between the examiners' findings, we calculated Cohen's κ and the percentage of inter-rater agreement (PA). Agreement between the 2 examiners' findings was high in almost all NRP examined. We found κ values between 0.95 (NRP C2 left) and 0.52 (NRP C0 right) (table 3). PA calculations also showed a high inter-rater agreement.

No Influence of the Side of the Cervical Spine

The absolute differences between κ values of the NRP of the left and right side ranged between 0.02 and 0.05, showing that both examiners found similar results independent of the side of the patient examined (table 3).
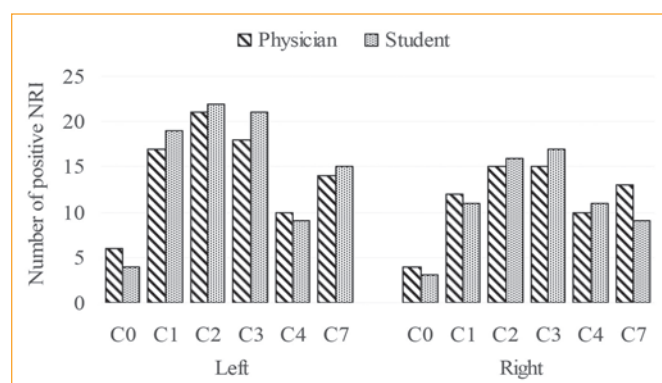
Fig. 3. Positive NRP (PI > 0) at different levels of NRP (C0–C7) for the left and right side of the cervical region. At each single NRP, there is no difference between the findings of the 2 examiners.

Table 3. Inter-rater agreement: κ and percentage of agreement for each of the 2 x 6 NRP (left and right side)

NRP	Left side κ	Left side PA	Right side κ	Right side PA
C0	0.78	93.8	0.52	90.6
C1	0.64	78.1	0.75	87.5
C2	0.95	96.9	0.90	93.8
C3	0.81	87.5	0.75	84.4
C4	0.72	87.5	0.72	87.5
C7	0.89	93.8	0.63	81.3
C0–C7	0.80	89.6	0.74	87.5

κ = Cohen's kappa coefficient (κ values); PA = percentage of agreement (ratio of the number of agreements to the total number of ratings made; C0–C7 = median of κ and PA of the respective side.

No Influence of Biometric Factors of the Patient

To examine the dependence of the ratings of the physician and the student on patients' age, gender, and body mass index (BMI), we conducted a Kendall's Tau correlation analysis for the number of positive NRP found. For the examinations by the physician, we found no correlation with patients' age (Kendall's Tau correlation = 0.10, p = 0.43), gender (correlation = –0.14, p = 0.31), or BMI (correlation = –0.14, p = 0.44). The student's examination yielded similar results for each NRP. We found no systematic association, except with 1 of 12 NRP (C0, right side), which had a slight correlation with patient's age in the student's examination only (p < 0.05). All other biometric factors showed a weak to very weak median correlation of –0.05 to 0.06 in the student's findings (table 4).

Table 4. Correlation of NRP examination with patient's age, gender, height, weight, and BMI[a]

	Left						Median[b]	Right						Median
	C0	C1	C2	C3	C4	C7	C0–C7	C0	C1	C2	C3	C4	C7	C0–C7
Physician														
Age	0.22	−0.05	0.02	0.04	0.02	0.19	0.03	0.11	0.24	0.18	0.18	0.15	0.07	0.16
Gender[c]	−0.15	−0.31	−0.09	−0.02	−0.01	−0.09	−0.09	−0.12	−0.24	−0.27	−0.04	−0.01	−0.25	−0.18
Height	−0.17	0.03	−0.01	0.15	0.06	0.10	0.05	−0.07	−0.17	−0.15	0.04	0.06	0.11	−0.01
Weight	−0.23	−0.07	−0.00	0.25	−0.08	0.04	−0.04	−0.14	0.07	−0.22	0.09	−0.10	−0.07	−0.09
BMI	−0.19	−0.08	0.02	0.21	−0.08	−0.00	−0.04	−0.13	0.12	−0.21	0.05	−0.13	−0.14	−0.13
Student														
Age	0.19	−0.14	−0.01	0.04	0.06	0.18	0.05	0.34*	0.21	0.14	0.20	−0.02	0.02	0.14
Gender[c]	−0.12	−0.34	−0.10	−0.09	−0.19	−0.11	−0.11	−0.10	−0.22	−0.27	−0.08	−0.22	−0.19	0.21
Height	−0.15	0.06	−0.07	0.03	0.07	0.06	0.05	0.03	−0.27	−0.11	−0.04	0.08	0.13	−0.04
Weight	−0.28	−0.09	−0.02	0.15	−0.13	0.13	−0.06	−0.10	0.09	−0.23	0.03	−0.18	−0.10	−0.10
BMI	−0.27	−0.08	−0.04	0.11	−0.18	0.09	−0.02	−0.15	0.18	−0.24	0.01	−0.21	−0.17	−0.16

[a]Correlation calculated by Kendall's Tau.
[b]The median of the respective biometric data.
[c]Male = 0, female = 1.
BMI = body mass index.
*$p < 0.05$.

No Influence of the Experience of the Examiner

To assess the influence of the examiners' expertise, we conducted a Kendall's Tau correlation analysis to evaluate the difference between the examination results depending on the phase of the study. There was no significant influence of the student's experience (phase 1 = learning, phase 2 = expert phase) on the number of positive NRP found (Pearson's correlation = 0.28, p = 0.13).

Discussion

This is the first study to demonstrate that tenderness of specific soft tissue of the cervical spine, so called NRP, is detectable with a very high reproducibility. In this randomized and blinded study, we found a strong agreement for NRP examination between 2 independent and blinded examiners. Our results suggest that NRP can be detected independently of the patient's characteristics and the examiner's experience.

Inter-Rater Agreement in NRP Examination and its Covariates

NRP are clinical symptoms of unknown nature and prevalence. They have not been examined in clinical studies before. In contrast, the examination of mTrP has been investigated by several groups [1, 9, 10, 14–19]. These reported different levels of reproducibility. Gerwin et al. [17] investigated the inter-rater reliability of different mTrP features, and found a strong agreement only in the tenderness in some of the muscles examined. Bron et al. [14] examined mTrP according to the standard procedures described by Travell and Simons [20] and found an inter-rater agreement of 63–93% in mTrP. Andersen et al. [9] examined muscle tenderness in adults with nonspecific neck/shoulder pain using a similar palpation method performed by 4 blinded examiners. They described tenderness at C0 as 'occipital border', C1–C4 as 'neck', and C7 as 'upper trapezius' tenderness. For consistency, they used the intraclass correlation coefficient (ICC) described by Andersen et al. [21], and found an inter-rater agreement of ICC 0.70–0.88. McPartland and Goodridge [16], however, found κ values of only 0.12–0.53 in 18 subjects between 2 examiners. In contrast to mTrP, agreement for NRP examinations has not yet been evaluated. Our previous experience in everyday student education suggests that NRP agreement is stronger than that of mTrP, i.e. NRP are more easily and more precisely detectable, even by inexperienced examiners, although these findings need to be evaluated in a prospective and blinded study.

NRP are defined by their tenderness, not by their palpation. mTrP represent local disorders with special features, e.g. a palpable finding in a certain muscle, and the capability of inducing referred pain. NRP on the other hand are local tender areas postulated to represent diagnostic signs of chronic remote foci of the visceral cranium [3]. However, to be able to use them as a valid diagnostic test, they must be reproducible.

Because NRP are only identified through the hands of the examiner and the pain expressed by the patient, the examination may be imprecise. Results may vary due to individual factors such as different finger pressure and individual pain sensation. A high variation and low reproducibility of the results should be expected. However, this study indicates a low variation of NRP tenderness examination at least between 2 different examiners. The patient could also remember the findings of the first examiner and thus influence the second examination. However, it is unlikely that a patient would memorize the findings of 12 different points each to a 3-point scale, unless these points remained tender in the second examination.

The extent of agreement between the examiners' results also seemed to depend on the level of the NRP tested. For NRP C0, we found an only moderate agreement on the right side of the neck

(table 3), whereas all other NRP showed good or very good inter-rater reliability. The neck anatomy at different cervical levels may explain the difference in reproducibility of the NRP. NRP C0 is palpated at the bone of the occipital protuberance, whereas all other NRP are located in the soft tissue of the cervical neck. Tenderness of the periosteum may be a neurophysiological entity that is different from tender soft tissue.

The correlation of the examiners' findings was not significantly influenced by biometric factors such as patient's age, gender, or BMI. We found a weak, but not significant negative correlation to BMI. The assumption that a thicker neck may reduce the palpation precision of NRP is possible, but not derivable from our data.

Although there was a slight prevalence for left sided NRP (fig. 3), the side of the cervical spine examined did not influence results obtained by the examiners (table 3). This indicates that NRP can be examined bilaterally with a high reliability.

Limitations and Strengths of the Study

A limitation of this survey was the small number of patients examined; however, the overall sample size was sufficient for significance (low α-failure). The investigation was done in an obstetrics and gynecology affiliated outpatient practice, and therefore mainly examined the data of women. Andersen et al. [9] investigated a similar cohort (88% female). At the moment we can only apply our findings to women.

The second examiner was trained for a few days to learn the clinical examination method using a pressure of 4 kp according to the ACR criteria [8]. Finger pressure was not quantified in this survey. The pain expression of the patient may differ for a number of reasons. To ensure a constant pressure, a calibration of the examiners in a laboratory environment would be necessary. However, this was not possible for our observational study within a daily practice setting. We want to emphasize for further study planning that our evaluation was based on the pain expressed by the patient and not on changes of the tissue palpated by the examiner. There may be a need for calibration in studies, but for practical education and training purposes it is not necessary. Because the student's experience had no influence on results, it is probable that this examination could also be performed by inexperienced physicians with reliable results after a short learning period. This speaks for an easy integration of the test into clinical practice.

κ values are very sensitive to unequal distribution of prevalence of findings [22]. Thus, a weighted kappa (κw) could be used [23]. However, the weighted κw value is usually higher than the baseline κ. Because our sample had good κ values it was not appropriate to use this correction factor.

To exclude the influence of biased examiners (if 1 finds significantly more positive NRP than the other), Bron et al. [14] suggested using the percentage of agreement (PA) value instead of the κ value. Calculating the PA value also yielded a high level of agreement. In our findings, there was no bias between the 2 examiners, but there was a slight bias towards the patient's left side, when detecting tender NRP. Differences in prevalence were not the aim of our study, but are interesting topics for further investigations of NRP epidemiology.

Did we need a control group for this study design? We have thoroughly discussed this question before. In contrast to an investigation of NRP correlations with clinical findings, a control group does not impact the results in an investigation of inter-rater agreement only. Thus, we forwent setting up a control group.

Pain intensity was scaled in the 3-level score (0, 1, and 2), used by Andersen et al. [9, 10] and also recommended for NRP examination [7]. The κ value might have been more appropriate by reducing the PI score to a dichotomous scale. On the other hand, some authors advocate a more sensitive scale, e.g. 0–5, or a visual analog score (VAS) of 0–100. However, as these authors also state, the tenderness scale of 0/1/2 (no/little/much) is easy to understand for the patient and simple to use in daily practice even by inexperienced examiners. It can be recommended as an evaluation scale in further studies.

NRP: Clinical Entity with a Neuroanatomical Base?

NRP have been proposed as a useful means to detect chronic inflammation of the head and neck in otherwise unexplainable chronic pain disorders [3, 4, 7]. This relies on their segmental correlation to specific areas of the visceral cranium. Information between the visceral cranium and the cervical spine could be transferred via a fibroblast network [24], or a close trigemino-cervical connection found in experimental studies [25–27]. Sessle et al. [28] described a convergence of cutaneous, tooth pulp, visceral, neck, and muscle afferents in the trigeminal subnucleus caudalis as a reason for referred pain.

Apart from these neuroanatomical findings, there is still little clinical evidence of NRP correlation with remote areas. Information about their possible clinical relevance in pain diseases was provided by Uehleke et al. [5], who described a statistical correlation between pharyngeal inflammation, tenderness of NRP C7, and brachialgia nocturna. Schmidt et al. [29] found a correlation between chronic trigeminal irritation by wisdom teeth and a variety of musculoskeletal disorders.

The high inter-rater agreement has no impact on the validity of NRP as a discriminating and sensitive diagnostic entity. This question cannot be answered by the presented investigation. For this, we would suggest that correlation studies of positive NRP with clinical findings in the visceral cranium, e.g. of a dental apical osteitis in the respective area, are set up.

NRP: A Pathway to New Therapeutic Options?

A high inter-rater reproducibility, as found in our survey, indicates that NRP may represent a clinical entity. NRP may simply be tender points in patients with chronic neck pain. However, if they display reflectory changes as early clinical signs of functional disorders of the visceral cranium, then they should also be influenced by therapeutic interventions at their corresponding remote sites.

To clarify this, interventional therapies at remote sites, such as acupuncture [23], dental-surgical removal of corresponding dental disorders [29], or local anesthesia (neural therapy) [6] of the corresponding visceral cranial region, should be investigated.

Conclusion

The high reproducibility of NRP speaks for a potential clinical relevance: they may correlate with chronic silent inflammation sites of the visceral cranium, which adversely influence the neck region. NRP present a foundation on which to develop new therapeutic approaches for patients with chronic neck and shoulder pain. First clinical observations in our institution with therapeutic local anesthesia reinforce these assumptions [6]. Our results provide a rationale for further studies on the clinical relevance of NRP, their neuroanatomical base, and new therapeutic options for patients with chronic pain disorders.

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