A Staged Approach Evaluation of Remotely Supervised Myofeedback Treatment (RSMT) in Women with Neck–Shoulder Pain Due to Computer Work

Rianne M.H.A. Huis in 't Veld, Ph.D.,[1] Barbara C.H. Huijgen, M.Sc.,[1] Leendert Schaake, B.Sc.,[1] Hermie J. Hermens, Ph.D.,[1,2] and Miriam M.R. Vollenbroek-Hutten, Ph.D.[1]

[1]*Roessingh Research and Development B.V, Enschede, The Netherlands.*
[2]*Faculty of Electrical Engineering, Mathematics and Computer Science, University of Twente, Enschede, The Netherlands.*

Abstract

Remotely supervised myofeedback treatment (RSMT) is a relatively new intervention aimed at reducing neck–shoulder pain and disabilities. Subjects are equipped with a garment that can be worn under the clothes during daily work. Dry surface electrodes incorporated in this garment measure muscle activation (sEMG) of the trapezius muscle. The garment is connected to an ambulant device that provides feedback to the subject when muscle relaxation is insufficient. sEMG data are also sent to a secured server that is accessible by therapists for remote counseling purposes. In conformance with the evaluation stages of DeChant, RSMT was evaluated on technical feasibility, patient satisfaction, and changes in clinical outcomes. In addition, subjects were asked about their willingness to pay. The study population consisted of 10 female workers suffering from neck–shoulder pain related to computer work. Results show that in 78% of the remote counseling sessions, sufficient amounts of data were available at the server for the therapist to make an assessment of muscle tension needed for the remote counseling sessions. Subjects were highly satisfied about the usefulness and ease of use of the remote counseling. However, they were less satisfied with the technical functioning of the myofeedback system. Eighty percent of the subjects reported a reduction in pain intensity and disability directly after RSMT. Subjects were willing to contribute a maximum of 200 euro for RSMT. Based on this study, it can be concluded that RSMT is technically feasible and induces changes in clinical outcomes. However, further improvements to technical functioning and research into the clinical effectiveness are needed before this treatment can go into real deployment.

Key words: *myofeedback treatment, neck–shoulder pain, remote supervision, women, sEMG*

Introduction

The prevalence of work-related neck–shoulder pain among computer workers is high, particularly in females.[1] Various traditional modalities for treatment exist for this group of patients, varying from one ergonomic consult, workplace adaptations, to very intensive physiotherapy. This variability also causes high variety in costs. Despite these various interventions, neck–shoulder complaints persist in a majority of computer workers. The development and introduction of new interventions is therefore desirable.

A new intervention addressing neck–shoulder pain is myofeedback treatment (MT). MT uses a system enabling continuous recording of upper trapezius muscle activation patterns (sEMG data) by means of dry surface electrodes that are incorporated in a garment that can be worn under the clothes in normal daily life. The garment is connected to a signal processing and feedback unit that vibrates and creates a soft sound in case of insufficient muscle relaxation. MT has shown to be beneficial in reducing pain intensity and disability in neck–shoulder complaints.[2,3]

An inefficient property of the current MT is the fact that the therapist has to manually download the sEMG data from the system, making weekly in-person counseling visits with patients necessary. For this reason, MT was further developed into a remotely supervised myofeedback treatment (RSMT) in which sEMG data are remotely accessible. This way, weekly in-person visits can be replaced by remote e-counseling sessions.

RSMT is hypothesized to positively affect multiple aspects of healthcare simultaneously. First, the *quality* of care might be improved. Because training can be provided by an ambulatory method, it is applied with high intensity in the subject's own environment, which facilitates the generalization of learning into a variety of work tasks and activities of daily living. Second, since the data are available on a server at any time and anywhere, myofeedback therapists are highly flexible in the preparation and conduction of counseling sessions. Consequently, the *accessibility* of care might be improved because the geographical area in which subjects can be treated is unlimited. Third, *costs* might be saved because remote counseling is less time-consuming as a result of reduced travel times for the patient.

Appropriate evaluation of RSMT, however, is challenging because effect outcomes are dependent on the (im)maturity of the technology. Technical failure in immature applications is likely to occur and could affect the true clinical effectiveness and accessibility of the service.[4,5] DeChant et al. (1996) proposed a framework for telemedicine evaluation in which the type of assessment is tailored to the development life cycle of the technology.[5] This so-called staged approach differentiates between telemedicine evaluation at application (stages 1 and 2) and global levels (stages 3 and 4). In each stage the effect of the intervention on endpoints within the following domains is studied: *quality, accessibility,* and *costs* of care. A stage 1–2 evaluation, which should be considered the starting point of evaluation, aims at proving the technical efficacy and evaluating the primary objectives of the service in domains of access, quality, or cost and is performed in the present study. In stage 3–4, when the technology has proven to be mature enough to meet its objectives, the goal is to integrate all three endpoints into a global assessment of the technology on a healthcare delivery level.

Because some parts of the equipment applied in RSMT were still in the prototype phase, the endpoints of evaluation were narrowly defined on an application level.[5] The objective of the present study was to examine RSMT on technical efficacy for clinical use, including accessibility of data and overall satisfaction, the changes in clinical outcome on pain intensity and disability, and the patients willingness to pay (WTP) for RSMT.

Methods

STUDY DESIGN AND SUBJECTS

Subjects were recruited by means of local contact persons, and by publication in a national newspaper. The myofeedback therapist approached candidates by telephone to inform them about the treatment in more detail. Volunteers received a screening questionnaire that was an adapted version of the Nordic Questionnaire[6] and was used to check the inclusion and exclusion criteria described elsewhere.[7,8] Subjects to be included had to report at least 30 days of complaints in their neck–shoulder region during the past 12 months. The study was approved by the Medical Ethics Committee of the Roessingh rehabilitation centre. All participants gave their informed consent prior to participation in RSMT.

INTERVENTION

RSMT was provided by two myofeedback therapists who collaborated during the study to ensure that they would provide the RSMT as identically as possible. A technician who specialized in RSMT assisted the myofeedback therapists in case of technical problems.

The RSMT infrastructure consists of a Body Area Network (BAN), a wireless communication platform, and a back-end server (*Fig. 1*). The BAN is composed of a garment, the processing and feedback unit, and a PDA (Qteq9090, HTC Corporation, Taipei, Taiwan) on which subjects could view their muscle activation and relaxation patterns for both sides of the trapezius muscle.

Subjects received 4 weeks of RSMT during which they noted their activities and pain intensity in a diary. Weekly counseling sessions of approximately 30 minutes with the myofeedback therapist took place. Workers were taught about personal work style in relation to muscle tension and techniques to manage stressors at work and at home that may affect their musculoskeletal health. At the beginning and end of the treatment, an *in vivo* session between the professional and patient took place. The intermediate sessions were conducted remotely (*by telephone*).[9] Measurements were taken at the baseline (T0), immediately after 4 weeks of RSMT (T1), and at 1-month follow-up (T2).

TECHNICAL EFFICACY FOR CLINICAL USE

The evaluation of the technical efficacy consisted of logging technical failures of the system, the number of hours of sEMG data that was available at the server, and the manual actions of the patients on the PDA. For clinical use, a minimum of 8 hours of data per patient per week is required to be available at the server for the therapist to be able to provide relevant counseling. The data should consist of datablocks of at least 15 minutes' duration because this is considered an acceptable time span for activities to be analyzed and interpreted.

USER SATISFACTION

Since no standardized and validated satisfaction measures are available, a questionnaire was developed based on the Technology Acceptance Model[10] that comprised Likert-type items (1—totally disagree, 7—totally agree) to assess the subjects' opinion on the perceived usefulness and ease-of-use of the myofeedback system and the remote counseling sessions in RSMT. In the current study, the measurement at T1 is used as an indicator of satisfaction as well as the difference between the user's expectations (T0) and experiences (T1).

CLINICAL EFFECTIVENESS

Subjects were asked to rate the averaged pain experienced and the level of disability during the preceding week (at T0, T1, and T2). Pain intensity in the neck, shoulder (left and right), and upper back was scored on a 10-point scale, ranging from 0 (no pain) to 10 (worst pain ever experienced). The level of self-reported disability was assessed with the Neck Disability Index (NDI),[11,12] which is a 10-item self-reporting instrument with a numerical rating scale (5-point).

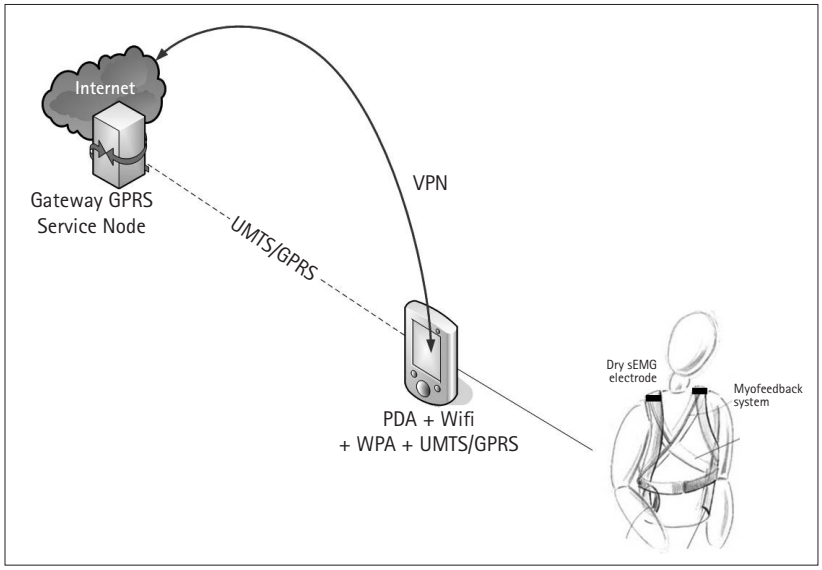

Fig. 1. Schematic overview of remotely supervised myofeedback treatment (RSMT). GPRS, general packet radio service; UMTS, universal mobile telecommunication system; VPN, virtual private network; WPA, wifi-protected access; sEMG, dry surface electrodes electromyography; NDI, neck disability index.

WILLINGNESS TO PAY (WTP)

A payment card technique was used to assess the WTP for receiving the 4-week RSMT as described in the patient information brochure. Subjects had to score the amount of money they were willing to pay on a voluntary basis as well as the maximum amount RSMT was worth. The amount on the payment card ranged from 0 to >250 euros. Subjects were told that the RSMT had to be paid from personal funds rather than by a third party such as a health insurance company. WTP was assessed prior to the onset of RSMT (T0).

ANALYSIS

The total duration (in hours) of sEMG data available at the server was automatically collected between consecutive counseling sessions and the percentage of useful datablocks (>15 minutes' duration) was extracted.

Regarding user satisfaction, the median satisfaction scores after RSMT (T1) and difference (Δ) scores between T0 and T1 were calculated. A negative Δ median score is defined as disappointment, whereas a positive median Δ score is defined as satisfaction.

On a group level, the overall effect of RSMT over time (i.e., the three measures [T0, T1, and T2], on pain intensity in three body regions (neck, shoulder(s), and upper back) and neck pain disability was analyzed using a dependent nonparametric test for repeated measures (Friedman). Differences in pain intensity and disability scores before (T0) and after RSMT (T1) were compared using a Wilcoxon paired nonparametric test.

For the pain intensity in the neck region and disability level, an additional evaluation investigated the percentage of subjects with a clinically relevant improvement between T0 and T1, and T0 and T2. A change of 5 points on a maximum sum score of 50 (10%) is considered to be clinically meaningful for the NDI.[13] Likewise, a clinically relevant change of ≥10% of the maximum sum score of 10 (i.e., a change of 1 point) was used as a clinically relevant difference in pain intensity.[7] SPSS 11.5 (SPSS Inc., Chicago, IL) was used for statistical testing. Alpha was set at 0.05 for statistical significance.

Results

Eighteen (n = 18) subjects were approached for participation. Two subjects were excluded because of too-short duration of complaints. Of the remaining 16 subjects, 5 refrained from participation because of a self-reported reduction in neck–shoulder complaints since inclusion, lack of time, or family circumstances. During RSMT, one subject dropped out because of technical inconveniences with the BAN (connectivity problems). In total, 10

subjects completed the RSMT. The mean age was 38.1 years (range 22–51), mean height was 172.2 cm (range 164–187), and mean weight was 68.4 kg (range 59–84). On average, they worked 36.1 hours per week (range 25–40). The mean pain duration was 78.4 months (range 10–300).

One of the 10 subjects reported complaints in the neck only, 2 reported complaints in neck and shoulder, and 7 reported complaints in the neck, shoulder, and upper back.

TECHNICAL EFFICACY FOR CLINICAL USE

The median amount of hours of sEMG data, which are available data, lay between 9.2 and 15.4 hours per week (*Table 1*).

In 97.6% of the total amount of data available at the server (695 hours), data blocks were larger than 15 minutes (total 678 hours in current study). In 31 of 40 remote counseling sessions (78%), sufficient (sEMG > 8 hours per week) data were available at the secured server.

The technical problems encountered during the study period predominantly concerned the BAN, especially the Bluetooth connection between the processing unit and the PDA. In 21.5% (range 7–44) of the n = 555 manual startups (about three times a week per person), the BAN stopped functioning for reasons other than a manual stop such as power shortages, lockup of software, and loss of connectivity. Subjects complained about the relatively short battery life of the PDA (about 4 hours at maximum) and the processing and feedback unit (about 8 hours at maximum).

USER SATISFACTION

The items presented in *Table 2* will be discussed consecutively. Subjects were least satisfied about the technical functioning of the myofeedback system (median = 3.5 at T1). However, they were highly satisfied with the limited effort it took to use the myofeedback system during treatment (median = 6.0 at T1). Subjects were able to follow the instruction remotely (median = 6.5 at T1). According to the subjects, the remote consultation saved time (median = 6.5 at T1). They were satisfied about the usefulness of the myofeedback system in reducing their neck–shoulder pain (median = 7.0 at T1). In addition, after RSMT the remote counseling sessions were thought (median = 6.0 at T1) to be more effective than they anticipated at T0.

Table 1. Amount of (sEMG) (Hours) per Week at the Server (Median score) (n = 10)

HOURS SEMG PER WEEK AVAILABLE AT SERVER FOR MYOFEEDBACK THERAPIST		
RSMT	MEDIAN	RANGE
Week 1	14.6	0.3–55.1
Week 2	15.4	4.6–64.6
Week 3	14.0	2.6–40.2
Week 4	9.2	0.0–36.7

sEMG, dry surface electrodes electromyography; RSMT, remotely supervised myofeedback treatment.

CLINICAL EFFECTIVENESS

Figure 2 shows box plots of the pain intensity scores for the neck, shoulder(s), and upper back at T0, T1, and T2 at a group level. At T0, the highest median pain intensity score was found for the neck (6.0). A tendency for overall effect for RSMT on pain intensity in the neck over the three measures (T0, T1, T2) was found (χ^2 = 4.8, p = 0.09). However, a remarkable decrease in the median level

Table 2. Median Satisfaction Scores After RSMT (T1) and Difference Between Experiences and Expectations Δ (T1–T0) (n = 10)

ITEMS QUESTIONNAIRE (TAM COMPONENTS)	MEDIAN (RANGE) T1	MEDIAN DIFFERENCE (RANGE) Δ (T1–T0)
PERCEIVED EASE OF USE		
The myofeedback system functions without any (technical) failures	3.5 (5)	- 1.0 (4)
Using the myofeedback takes little effort	6.0 (6)	- 0.5 (9)
Instructions and advice of my therapists during remote consultations can be followed as easily and well as if *in vivo*	6.5 (3)	0.5 (4)
Remote consultations are less time-consuming compared to *in vivo* consultations	6.5 (3)	0 (3)
PERCEIVED USEFULNESS		
With the help of the myofeedback system, the pain in my neck–shoulder region is reduced	5.0 (5)	0 (5)
Remote counseling sessions are as effective as *in vivo* counseling would have been	6.0 (3)	4.5 (2)

RSMT, remotely supervised myofeedback treatment; TAM, Technology Acceptance Model.

of pain was reported at T1 for the neck and shoulder(s) compared to baseline (T0); from 6.0 to 2.5 for the neck; and from 4.5 to 3.0 for the shoulder(s). The decrease was significant for the neck (p = 0.015) and close to significant for the shoulder(s) (p = 0.057). Pain intensity scores of the upper back did not change significantly (p = 0.611).

At the individual level, 8 of 10 subjects reported a clinically relevant decrease in pain intensity in the neck (T1). Compared to baseline (T0), one subject reported an equal amount of pain intensity and one subject deteriorated on pain intensity after RSMT (T1). At follow-up (T2), the clinically relevant positive effect remained in five of these eight (63%) subjects compared to baseline (T0). Of the two subjects who did not report a decrease in pain intensity after RSMT (T1), one deteriorated further at follow-up (T2) and one had pain intensity equal to what she reported at baseline (T0). *Figure 3* shows the disability scores before RSMT (T0), after RSMT (T1), and at follow-up (T2).

Based on the median NDI score of 13.5 at the onset of RSMT (T0), subjects were classified to be mildly disabled (NDI score 5–14).[13]

On a group level, no overall effect of RSMT on disability over the three measures was found (p = 0.12, χ^2 = 4.2). Nevertheless, after 4 weeks of RSMT (T1), subjects reported significantly lower levels of disability scores (median 8.0) compared to baseline (T0) (median 13.5) (p = 0.021).

Eight of 10 subjects reported a decrease in disability after RSMT (T1) compared to baseline (T0), and 2 of 10 subjects reported higher levels of disability at T1. The improvement after RMST (T1) was clinically relevant in four of these eight subjects (50%). At follow-up (T2), five of these eight subjects still reported a decrease in disability level (which was clinically relevant in three of eight subjects, 38%). Of the two subjects who reported elevated levels of disability after RSMT (T1), both reported decreased levels of disability at follow-up (T2) compared to baseline (T0).

WILLINGNESS TO PAY

From *Table 3*, it becomes clear that subjects are willing to contribute a maximum of 200 euros for a 4-week period of RSMT. On a group level, the median amount of voluntary WTP is 75 euros.

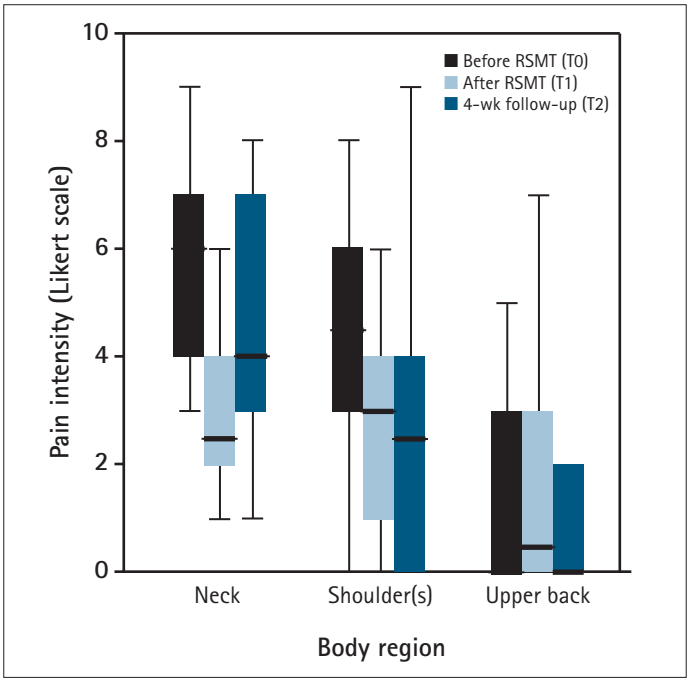

Fig. 2. Box plots of pain intensity scores for neck, shoulder(s), and upper back before remotely supervised myofeedback treatment (T0), directly after remotely supervised myofeedback treatment (RSMT) (T1) and at 4 weeks follow-up (T2) (n = 10).

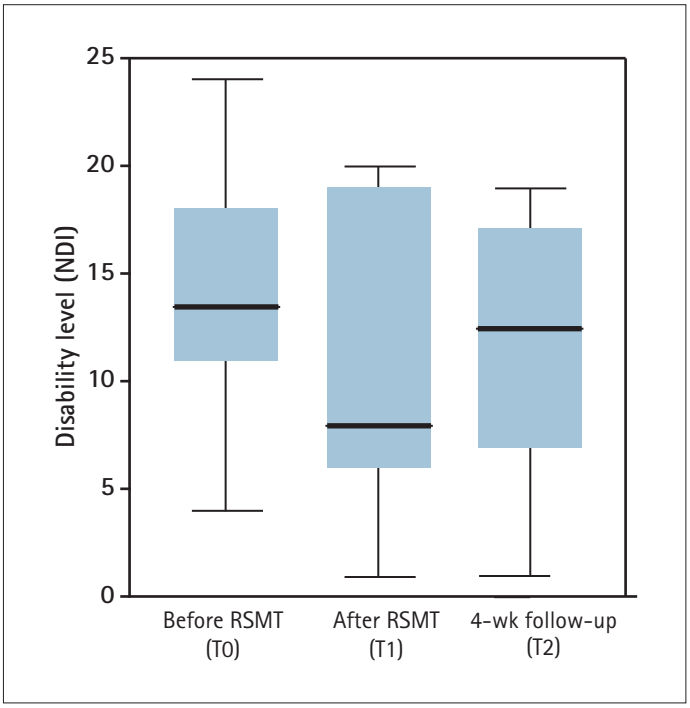

Fig. 3. Box plots of disability level before remotely supervised myofeedback treatment (RSMT) (T0), after RSMT (T1), and 4 weeks follow-up (T2) (n = 10). NDI, neck disability index.

Discussion

The present study evaluated the technical feasibility and clinical changes after remotely supervised myofeedback treatment (RSMT). Effect evaluation is a critical issue in telemedicine research,[4,14] and designing a comprehensive evaluation protocol is still challenging. Inappropriate evaluation might have adverse consequences (i.e., obstruct the development and implementation of telemedicine interventions). A valuable framework for comprehensive evaluation of telemedicine systems is offered by a staged approach,[5] which differentiates evaluation at application and global levels while taking into account the (im)maturity of the technology. Because it is a theoretical framework, it does not offer practical guidance. In our perspective, the present study provides a practical illustration of an evaluation that is conducted within the first two stages of this approach. In line with the iterative character of the staged approach, small study samples can be used to optimize certain aspects of the technology within a reasonably short time span.[5] With small sample sizes, valuable user input can be obtained in a short period of time and these results can be used for technology improvement that fits very well with the end-users' requirements. Because the technical feasibility was a strong focus in this study in which we worked with a prototype treatment, we believe the sample size used for this was adequate.

With regard to the technical feasibility, the results of our study show that in a majority of RSMT sessions a sufficient amount of (sEMG) data was collected, and wirelessly transmitted to and accessible at a remote location for counseling purposes. Subjects were satisfied with the ease of use (efficacy to follow instructions of therapist) and the usefulness (advice and time-saving character) of remote counseling. Nevertheless, subjects were less satisfied about the technical functioning (i.e., stability of the BAN component—Bluetooth connection, power consumption, and ease of using the myofeedback equipment). Preceding further evaluation, the equipment needs be improved according to the end-users' recommendations resulting from this evaluation.

Table 3. Willingness to Pay (WTP) for 4-Week Period of RSMT (n = 10)

SUBJECT	SOCIOECONOMIC STATUS		WTP 4-WEEK RSMT (EURO)	
	INCOME PER MONTH	HOUSEHOLD SIZE	VOLUNTARY	MAXIMUM
1	3,500–4,000	2	200	200
2	2,500–3,000	2	50	100
3	500–1,000	1	0	0
4	2,500–3,000	4	0	0
5	2,500–3,000	2	100	140
6	>4,000	3	200	200
7	3,500–3,000	1	20	20
8	>4,000	2	200	200
9	>4,000	1	100	200
10	2,000–2,500	2	50	200

RSMT, remotely supervised myofeedback treatment.

The clinical results suggest a beneficial effect of RSMT on perceived pain intensity and disability in a substantial number of subjects. Eighty percent of the subjects reported a clinically relevant reduction in pain intensity immediately after RSMT. Accordingly, 80% of the subjects reported lower disability levels, although the decrease in disability was clinically relevant in 50% of the subjects. At 1-month follow-up, these effects diminished but a clinical relevant reduction in pain intensity and disability was maintained in about half of the sample (38–63%). Compared to studies on *in vivo* MT showing a clinically relevant improvement in pain intensity and disability in 30–50% of the subjects,[2,3] our results might support the hypothesis that RSMT is equally or slightly more effective. There are possible explanations for this positive result. One concerns providing subjects with more detailed information on their performance. As a result of technological advancements in RSMT, subjects can view their muscle activation and relaxation patterns for both the left and right side of the trapezius muscle on the visual display of the PDA. Along with "knowledge of results" (e.g., the sound and vibration), this so-called knowledge of performance is considered to be important in motor skill learning and could have played a strong motivating role.[15] Furthermore, because subjects are aware that the therapist is able to view their data on the server, treatment compliance could have been increased in RSMT. Because of the small sample size included and the uncontrolled nature of the present study, the clinical findings need to be interpreted with caution.

Subjects were willing to spend a maximum of 200 euro for RSMT; however, the subjects included in the present study had a relatively high socioeconomic status, which might have affected their WTP and so the results might not be generalizable. Thus, more research is needed to examine to what extent this WTP is typical for RSMT or generalizable to effective neck–shoulder pain treatment in general.

In conclusion, RSMT was technically feasible, subjects were satisfied about the remote counseling sessions, and the clinical changes tended to be equally or slightly better compared to myofeedback when provided in person. In further evaluation of RSMT, a more global assessment of the RSMT is recommended in which the overall impact on healthcare

is examined by integrating the domains of interest (i.e., quality, access, and costs) by means of high-quality research designs. Therefore, it is recommended to include a larger sample size based on power analysis, and a valid control group. In addition, the satisfaction of myofeedback therapists toward RSMT need to be addressed because this was not done in the present study and is considered to influence future adoption of RSMT when implemented in routine healthcare. Maximum WTP will be important in (future) cost–benefit analyses.[16]

Acknowledgment

Special thanks go to Gerlienke Voerman and the myofeedback therapists from The Roessingh Rehabilitation Centre for sharing their knowledge and experience regarding myofeedback. This study was supported by a grant from SenterNovem provided to the ExO-Zorg project (project number TSIT1014). SenterNovem is an agency of the Dutch Ministry of Economic Affairs.

REFERENCES

1. Blatter BM, Houtman I, van den Bossche S, Kraan K, van den Heuvel S. Health damage and costs due to RSI and psychosocial workload in the Netherlands. (Report on demand of the Dutch Ministry of Social Affairs and Employment) **2005**; Available at www.arbogenoten.nl (Last accessed July **2008**).
2. Hermens HJ, Hutten MMR. Muscle activation in chronic pain: Its treatment using a new approach of myofeedback. *Int J Indust Ergon* **2002**;30:325–36.
3. Voerman GE, Sandsjö L, Vollenbroek-Hutten MM, Larsman P, Kadefors R, Hermens HJ. Effects of ambulant myofeedback training and ergonomic counseling in female computer workers with work-related neck-shoulder complaints: A randomized controlled trial. *J Occup Rehabil* **2007**;17:137–152.
4. Bashshur RL. On the definition and evaluation of telemedicine. *Telemed J* **1995**;1:19–30.
5. DeChant HK, Walid WG, Mun SK, Hayes WS, Schulman KA. Health systems evaluation of telemedicine: A staged approach. *Telemed J* **1996**;2:303–312.
6. Kuorinka I, Jonsson B, Kilbom A, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon* **1987**;18:233–237.
7. Voerman GE, Vollenbroek-Hutten MM, Hermens HJ. Changes in pain, disability, and muscle activation patterns in chronic whiplash patients after ambulant myofeedback training. *Clin J Pain* **2006**;22:656–663.
8. Hermens HJ, Hutten MMR. Muscle activation in chronic pain: Its treatment using a new approach of myofeedback. *Int J Indust Ergon* **2002**;30:325–336.
9. Huis in 't Veld MHA, Voerman GE, Hermens HJ, Vollenbroek-Hutten MMR. The receptiveness towards remotely supported myofeedback treatment. *Telemed E Health* **2007**;13:293–302.
10. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quart* **1989**;13:318–340.
11. Hains F, Waalen J, Mior S. Psychometric properties of the neck disability index. *J Manipulative Physiol Ther* **1998**;21:75–80.
12. Vernon H, Mior S. The Neck Disability Index: A study of reliability and validity. *J Manipulative Physiol Ther* **1991**;14:409–415.
13. Stratford PW, Riddle DL, Binkley JM, Spadony G, Westaway MD, Padfield B. Using the Neck Disability Index to make decisions concerning individual patients. *Physiother Can* **1999**;51:107–112.
14. Dansky HK, Thompson D, Sanner T. A framework for evaluating eHealth research. *Eval Program Planning* **2006**;29:397–404.
15. Schmidt RA, Lee TD. *Motor control and learning: A behavioural emphasis*. San Francisco: *Human Kinetics*, **1999**.
16. Foreit JR, Foreit KG. The reliability and validity of willingness to pay surveys for reproductive health pricing decisions in developing countries. *Health Policy* **2003**;63:37–47.

Address reprint requests to:
Rianne M.H.A. Huis in 't Veld, Ph.D.
Roessingh Research and Development
Roessinghbleekweg 33b
7522 AH Enschede
The Netherlands

E-mail: r.huisintveld@rrd.nl

Received: September 17, 2007
Accepted: November 26, 2007