

Using video analysis to illuminate professional – patient interaction of clinical interventions

ABSTRACT

Evidence-based practice in physiotherapy should include reasoning as well as definition of practice knowledge and manual skills. The aim of this study was to explore how patients and physiotherapist interact in a situation of motor learning. Six patients with the diagnosis subacromial impingement were video-filmed during 11 treatment sessions with the same physiotherapist. The aim of the treatment was to improve their initial pattern of movement in arm elevation. The films were analysed with content analysis and the results are presented in three content areas: The context, Interaction, and Professional skills. Further development of methodology including computer aids for transcriptions will make digital video analysis an interesting research method for physiotherapists.

Keywords: Coaction; collaboration; digital video; interaction; motor learning; physiotherapy research

INTRODUCTION

The focus of this study was on a situation of motor learning; how we teach and learn, and how this learning can be studied. It was also a study on interaction between physiotherapist and patient, as this is always the basis in physiotherapy treatment, irrespective of the outcome of the process.

Many patients visit the physiotherapist with a painful shoulder, and an increasingly common diagnosis among them is the subacromial impingement syndrome. This is a specific diagnosis, but the clinical presentation can be confusing (Bigliani and Levine, 1997). It presents as pain when lifting the arm, forwards or outwards. The process of pouring from a pot can be very painful because of the squeezing of soft tissue that occurs in the shoulder in this syndrome. Subacromial impingement is a biomechanical phenomenon. The first task in physiotherapy training is to make the muscles of the rotator cuff function together in a precisely coordinated way, to stabilise the humeral head, to enable lifting of the arm without causing impingement. Kelly et al. (2005) found statistically significant differences in shoulder muscle firing patterns between symptomatic and asymptomatic cuff tear patients during internal rotation, carrying and elevation tasks. Böhmer et al. (1998) described a comprehensive treatment programme for these patients. The aim of the programme is to unload mechanical stress and reactivate the supraspinatus muscle to improve the initial movement pattern in abduction. Unloading of the weight of the arm, relaxation and manually guided movements are essential elements of the “Supervised exercises programme”. (figure 1). Touch is used as therapy in a learning situation. The purpose of our study was to explore how this is done in physiotherapy practice.

In earlier times, Hislop (1975) said that physiotherapy as a science was “weak in lack of precision of its intervention procedures” Although progress has been made since then, it is still difficult to give specific answers to the what, where, when and how much, so another purpose of this study was to develop a suitable research method to answer these questions.

Questions asked in the study:

- How is the treatment situation organized?
- How do patient and physiotherapist interact in this situation of motor learning?
- What does the physiotherapist do to help the patient restore a normal pattern of movement in arm elevation?

METHOD

Study design

An exploratory study on interaction in physiotherapy was carried out with digital video recording and a video editing program. An ethnographic approach and qualitative content analysis were used to study all ongoing events in this particular situation of motor learning. This provided a method for drawing inductive inferences out of clinical practice that is not logically conclusive, but has a certain probability of being correct (Krippendorff, 2004). To proceed from particulars to generalizations and vice versa is a fundamental difficulty in physiotherapy research since all humans are individuals and we react according to our own personal history. We all have common fundamental traits, however, and share experiences that make it possible to predict responses and study human behaviour which makes clinical science possible. Content analysis focuses on human communication and offers practical applicability in research into clinical practice.

One very good reason for using video recording is that interaction is a complex process and it is not possible for an observer to capture and document this complexity simply by observing it in real life (Martin, 2004). We found only a few examples of video studies in the field. In 1990, Ek published a thesis based on a micro-ethnographic case study. Ek thoroughly described the verbal communication that took place between the physiotherapist and patient during treatments according to principles of conversation analysis that had been developed to understand how and why conversations are or become organized the way that they do. There were two participants that sent, received and interpreted messages, and this made the treatment a coaction. The patient was diagnosed with a frozen shoulder and the treatment that the patient received was observed by the researcher and recorded with a video camera. Thornquist (2001) video-recorded first encounters between patients and physiotherapists to investigate diagnostics as a selective, interpretative and interactive process in an ethnographic study. Magnusson (2003) studied blind people’s non-verbal communication using video studies and interviews. Martin (2004) published her thesis about learning as a changing of patients’ understanding and participation in treatments. The latter was a video study and the author described learning as a coaction that was bound to a particular situation and context. These authors each developed their own transcription model to combine verbal information with visible information in data analysis. None of them was applicable in our case, since we were not interested in analysing conversation in detail but more as messages, and how these were related to actions and hand movements. We therefore developed our own model for digital video analysis.

Data collection and procedure

Participants

In empirical studies data are gathered from everyday clinical practice. In the present study, a common question was posed among physiotherapists working with shoulder rehabilitation in order to find someone who would meet the study criteria. Initial contacts led to an experienced colleague, with well documented knowledge in this area, who was asked to participate in the study. Patients were referred to the clinic in question with the diagnosis subacromial impingement stages II or III by orthopaedic physicians. All these patients were prescribed physical therapy according to the "Supervised exercises programme". The selection of patients took place during a two-month period and no names or civic registration numbers were registered. Ethical aspects were considered by the hospital board and regional ethics committee in Oslo. Six consecutive patients were selected from the waiting list and were filmed during two separate treatments. One case that did not complete the study, since the case was closed before the second filming occasion, produced 11 video tapes. The group consisted of two women and four men. Their median age was 51 years, ranging from 40 to 56 years.

Data collection was carried out using a digital video camera. Background information was collected using field notes, questionnaires filled out by the physiotherapist and, if needed, direct questions to the physiotherapist for additional information and deeper understanding during analysis according to the principles of "thick descriptions" (Geertz 1973).

The treatment situation

The aim of the "Supervised exercises programme" is correction of the neuromuscular activity pattern, reduction of mechanical subacromial stress, stimulation of the collagen tissue and simple advice to prevent relapse. The whole program takes an hour to perform and consists of different tasks, but our interest was in the initial part of the treatment session. It is done with the patient in a supine position with the arm in a sling fixed to the ceiling to eliminate the forces of gravity. The physiotherapist is seated on a stool beside the bench on the affected side, using her hands to guide the patient's swinging arm towards a normal pattern of movement (figure 1). The physiotherapist controls the movements around the gleno-humeral joint with his or her hands while the arm is swinging constantly in and out from the body. Carr and Shepherd (1987) called this technique "manual guidance" and divided it into two types. Passive movement can be used here in order to give the patient the idea of the wanted movement, often along with verbal communication. Spatial and temporal constraint, or physical restriction, is exercised by the therapist allowing the patient to concentrate on certain aspects of muscle activation, mainly with non-verbal conversation – with the therapist's hands. It is a situation of teaching and learning, for both parties. The longest treatment was 14 minutes and 55 seconds and the shortest was 6 minutes and 07 seconds.

Data analysis: The process of analysing a rather large collection of video recordings includes several steps and analytic dimensions. When analysing video tape the representation of data must make clear what the participants are saying, as well as what they are doing, and several things happen simultaneously. The films were transcribed according to qualitative descriptive research principles, staying close to data and to the surface of words and events (Sandelowski 2000). "The transcript is both an analytical tool and a way of representing interaction", (Martin 2004, p.80) and at some level interpretation is inevitable. Communication always has a meaning that is relative to the perspectives of the sender and the receiver of the message, and also to the spectator. It can be divided into different types – for example, exchange of

information, reasoning, questioning, conversation or small talk. To achieve reliable results, parts of the films were shown to the physiotherapist to avoid misinterpretation of expressions or words, and to make clear her intentions in situations that were not clear to the researcher.

Decisions were made on how to divide the material into meaning-carrying entities; that is words, sentences or paragraphs containing aspects related to each other through their content and context (Graneheim & Lundman, 2004). The label of a meaning unit is usually called a code. The codes were then put together in accordance with the content they expressed and sorted into categories. The three study questions could be called domains, or content areas (Graneheim & Lundman, 2004), and the final analysis could be described as though viewing the material through three different pairs of spectacles to identify the specific topics that we were interested in.

Stage one: The videos were downloaded to a computer to make possible a detailed description of what actually took place during each treatment. The video editing program Adobe Premiere™ was then installed. The videos required 25.7 GB of space and the combined duration of the eleven video sequences was circa 2 hours. Every video frame had a time stamp which simplified the process of browsing the video images, and made it easy to review a video sequence and find a particular video frame. The video could also be shown in slow motion or fast forwarded. Therefore, one could clearly see how the physiotherapist's hands moved or did not move, and the latter was often the case.

Stage two: The events that took place second by second in each video sequence were meticulously written down on paper. Everything that took place was drawn on graph paper using a time axis with a mark for each 30 seconds since one square was 5 cm long (2 min-250-3min etc), like a film synopsis. Then every aspect of each scene was noted: the dialogue was written down word for word; silence and hand movements were marked; vocal expressions were noted as expressed. These drawings functioned as visual aids that provided an overview of the situation and course of events. Some drawings were made in a computer program AUTO-CAD™ (fig 2).

Stage three: The meaning units were coded according to principles of content analysis and given a moniker. We made minimized copies of the timeline drawings to be able to experiment with the use of symbols, colours and groupings. The goal was to visualize coherent entities, their occurrence and mutual relationship. Behaviourist Magnusson's transcription model, which she called the "note score model", inspired this stage (2003; p.242). She put monikers on different types of non-verbal conversation and wrote them down in sequences as they occurred. We wanted to have a visual illustration built on simultaneity, so we constructed a three-dimensional diagram with symbols or text in squares on different layers of transparent film. The films were placed over the time line (figure 2). Every square that contained text was given a caption that summarized the contents. Metaphors, paralinguistic expressions like laughs, coughs, hums and other "sounds" as well as when the physiotherapist's hands moved, were marked with symbols along the time axis. All captions and symbols then stood out through the transparent film. These were then written down on paper and later grouped into categories.

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Stage four: Special focus was given to the dialogue and a final categorisation was made. Every treatment had a general structure and an individual feel. In order to study this phenomenon, the contents of the dialogue and other communication must be studied. The word communication is used here to mean influence and exchange of information. One

decisive problem was how meaning-carrying entities should be differentiated in the text. According to the perspective that was chosen for analysis in this study, it was natural to allow silence of 10 seconds or more to decide where one dialogue ended and another one started. A dialogue entity must also have similar contents, so that a context is formed, in order to be a meaning-carrying entity. Therefore in a few cases there were periods of silence that were longer than 10 seconds that were included in a dialogue. Taking into account the specific contexts in which they occur, it becomes clear what it is that the persons express both verbally and non-verbally. The analysis was limited to those categories that were believed to most accurately deal with the questions at issue and the context controlled the distribution. In the first phase 8 categories arose, but due to the fact that these categories were sometimes hard to differentiate by meaning and contents, they were reduced to four.

RESULTS

The results are presented below in three sections, based on the following aspects:

- the content areas of the study: how the treatment situation was organised
- how patient and physiotherapist interacted in this situation of motor learning
- what the physiotherapist did to help the patient restore a normal pattern of movement.

The three content areas are: the context, the interaction, and the professional skill. Also, attention is drawn to the importance of the positioning of the arm in the sling as a precondition for a good result. The constant swinging of the arm is also thought to have a regenerating effect on the tissue of the cuff muscle tendons, which is likely to affect the outcome of the treatment; however, this issue was not addressed in this study, and will therefore not be discussed further here.

Examples from the 11 videos are used in this compilation. Every patient was given a moniker. The first and second video occasions were named with a letter followed by the number 1 or 2. The following designations were used: A, B, C, D, E and F. To simplify this text, the physiotherapist has simply been called “she” while the patients consisted of both males and females.

1. The context: The organisation of the treatment situation

Everything that was said and done was noted and plotted along a timeline that came to constitute a learning occasion. The following division of time disposition could be seen: *start/preparation phase; motor memory training; possible interruptions; continued motor memory training; completion.*

The patient is lying on her back with her arm hanging in a sling attached to the ceiling to eliminate the effects of gravity. The physiotherapist is seated on a stool at the side of the bench, close to the affected arm. When the arm and the sling are in the right position the physiotherapist lays both of her hands over the patient’s shoulder: the fingertips of the left hand are over the deep pectoralis major muscle and the fingers of the right hand are somewhat higher up and further out, so that she feels the movements of the humeral head against the glenoid cavity. She uses her right wrist to swing the patient’s arm outward like a pendulum.

During this procedure the physiotherapist explains the point of the exercise and gives instructions to the patient. She seeks the patient's affirmation that the arm is hanging comfortably and can pendulate without pain. In all films she adds a light weight cuff into the sling to make relaxation easier by the sensation of weight. Much focus is given to obtain an optimal starting position. When the preparations are done and the starting point is deemed good, then the actual learning process begins. This process goes on as the arm continuously pendulates in and out under the guidance of the physiotherapist's hands for circa 10-15 minutes. In the videos the shortest sequence was 6 minutes, 7 seconds long and the longest was 14 minutes, 55 seconds long. The physiotherapist controls movements around the humeral head the entire time. Interruptions can take place, and they most often deal with a resetting of the starting point because the swing radius needs to be adjusted and the patient needs more room to swing his arm. After such an interruption the learning process must be restarted to some extent. In some cases the patient's attention has been disturbed by outside factors. All the videos end with the physiotherapist stopping the swinging of the arm with a firm grip. She removes the weight cuff and removes the arm from the sling. She then moves back to her starting position on the stool.

2. Interaction

The following four categories were deemed as most important to reflect interaction in this motor skills learning situation:

Verbal and non-verbal communication

1. *Dialogue* – a primarily verbal exchange where both parties participate. This sometimes includes a mumbled or muttered answer from one party and even silence, but the verbal communication continues with a content-rich context.
2. *Other vocal expressions* that are not expected to be answered:
 - *Word/instruction*: verbal instruction from the physiotherapist intended to be understood intellectually.
 - *Word/image*: metaphors and/or imagery that the physiotherapist uses to give the patient the experience of the characteristics of a movement.
 - *Up!* Short request, encouragement or confirmation from the physiotherapist that the movement is correct. For example: "like that!", "there you go!", "good job!"
 - *Paralinguistic expressions*: vocal expressions to amplify an instruction. For example, a sigh, a long exhalation or laugh, all of which can express different things. These can be used by both parties.
3. *Silence* Has meaning for both communication and learning; an occasion for both to contemplate and deliberate about what is taking place. It can simplify consolidation of explicit knowledge.
4. *Situations of "hands on – hands off"*. How the physiotherapist guides the movement of the arm with her hands and when the patient is allowed to swing her arm freely without guidance.

Both physiotherapist and patients are generally very dependent on verbal and spoken language for communication and learning, even for the learning of motor skills. Therefore the term "dialogue" is used to describe those elements in the treatment situation that include verbal exchange between parties, even if laughter, movement of hands or some silence has

also taken place. Explicit – spoken – expressions are easiest for us to interpret, but it is only when compared to implicit – unspoken or non-verbal expressions – that our manner of expression is complete. This information is, however, difficult to transfer from video film to text. Thus “dialogue” is explained as its own category of verbal communication.

The physiotherapist explains what she is doing and plans to do and why, as well as instructs the patient regarding relaxation and movement without pain. She wants the patient’s affirmation before continuing; verbal or non-verbal. Non-verbal affirmation can be noticed in movement or muscular strain. The physiotherapist may see this or feel it with her hands. Sometimes she confirms with a smile to herself, which is seen on the film and can be marked in a diagram but is difficult to relate in text. She asks: “Is this good?”. She uses expressions like “try yourself and see if it hurts or not”; “Let your arm fall through the bench”; “I do not feel anything so let me know if you do”; “Let your arm drag along the sheet ”...”so that you do not need to control your arm”. When patient D asks which muscle is to work, the physiotherapist answers “the muscles on your back side” and points with her left hand under the shoulder. Communication assumes mutual meaning – we must talk about the same thing.

The different physical therapy treatments all follow the same pattern, but that which most clearly separates them from one another is the duration and the phase before completion. In the case of C2 above, the swinging of the arm continues with relative silence with short words of reinforcement in the category of request or encouragement to the end of the session when the physiotherapist stops the movement of the arm. Case B2 is concluded after long periods of silence. Sometimes the session is ended when the patient starts using an incorrect pattern. In case C1 the physiotherapist asks at the end: “Do you feel the ball of the shoulder rising and the movement starting to become obstructed?” “Yes”. The movement is then stopped. The physiotherapist means that the humeral head has moved to the front part of the glenoid cavity, and it is no longer centred. Therefore she discontinues the therapy. Case D2 is interrupted and concluded after confusion arises. The physiotherapist judges that the movement is good and when answering a direct question afterwards regarding why she chose to restart after 13 minutes, the physiotherapist answered that she wanted to give the patient an opportunity to achieve a larger movement. However, the patient did not understand what happened and what was expected of her, and after a short time the physiotherapist stated that “we can quit for now” and stopped the movement. This situation can be viewed as an incident of “*non-learning*”.

3. Professional skill: Physiotherapy tools for correction of movement

Verbal instructions and vocal expressions

Verbal expressions have aspects of *what* and *how* movements should be performed. Metaphors, pictorial language or imagery are used to illustrate verbal instructions. The adjustment of force in relation to the assignment is controlled automatically by the cerebellum. The paralinguistic expressions are also there to clarify or amplify an image or request. It is not that easy to relax on command. Instead, the patient may need to be led to an *experience* of relaxation with a deep exhalation or a sigh. Words and images evoke different conceptual processes as words are abstract and generic and bring different associations, while images are concrete and specific and suggest more strongly the meaning (Fletcher & Tobias, 2005). Due to the fact that all individuals are different, it may be wise to contemplate whether or not the patient in question is responsive to imagery or more intellectual instructions. Not everyone has made a “snow angel” and in that case the image says nothing. This instruction is often used in the video films except in case A2. In that case a correct description of how the movement is made is given instead: “Swing out! Hold one second before pulling back”. Just

enough time is given to consciously adjust from the outward to the inward movement of the arm in a lying position.

Phases of "hands-on and hands-off": tactile stimulation and exchange of information

The hands of the physiotherapist are constantly guiding the movement of the arm, hence giving the proper stimuli to the nervous system. The continuous movements of "hands-on/hands-off" provide a continuous flow of information to the brain. The finger tips have a high density of receptors and thus provide the physiotherapist with detailed information about the ongoing movements around the gleno-humeral joint. She gives information to the patient, verbally and with her hands, in order to obtain "agility of movement" (Böhmer 1998). The patient is made aware of the obstacles, mostly muscular restraint, that prevent a free swinging of the arm without effort and pain. In D2 the physiotherapist's left hand "knocks" every now and then on the patient's pectoralis or trapezius muscle as a reminder that the tension is too high. Martin called this "an attention giving device" since the problem area is not visible for the patient (2004, p.39). The patient is rarely allowed full freedom of movement in the studied cases and when it does happen it is as a rule for a very short period of time. We see here how the implicit learning of this particular motor skill is built up slowly, over time, and tightly connected to the specific stimulus conditions, as explained by Kandel (2000).

Relaxation: mental reduction of muscular tone

The entire time the patient is encouraged to "be as lazy as possible", to reduce muscular strain. According to the informant it is very important that relaxation can be achieved, so that the correct movement is trained; "so that we get it on the right track", as she explains for B. The majority of the contents of the physiotherapist's verbal communication deals with relaxing the patient, making him or her feel secure, and with getting the patient to experience the difference between tensed and relaxed as well as being aware of how much force is used. Imagery and paralinguistic expressions amplify the impressions of the plain instructions. The patient is encouraged to think about "how much force do you need to use to pull your arm to your side?"

The suspension: physical reduction of muscular tone

The resting position of the shoulder was found to be important for regaining normal muscle length and low muscle tone by relaxation. The suspension eliminates the impact of gravity. No force is needed to lift the arm and it can swing with a minimum of effort. Low muscle tone is desirable to prevent co-activation from other muscles than the rotator cuff in order to facilitate adequate recruitment order of motor neurons in the correct pattern of movement. The importance of the line that the sling was hung on being elastic became apparent once the movement became larger. In order for the swinging of the arm to be able to take place according to the physiological conditions the line must be pliant. Otherwise the movement could be rigid and incorrect and even cause pain in the outermost positions.

DISCUSSION

The aim of this study was to find out how patient and physiotherapist interact and co-operate in a situation of motor learning. Ek (1990) came to the conclusion that "treatment situations need to be conceptualised as jointly co-produced by the patient and therapist moment by moment in real time, and as occasions where knowledge is created". This became very clear when we analysed the video sequences. We found the words "interaction" and "communication", which are commonly used to express this particular dimension of the

physiotherapy process, to be inadequate. The words “co-operation”, “co-production” and “co-action” are acceptable, but to coact also means to compel, and it is compulsory to collaborate in this process. The two participants must both be active and work together; otherwise they won’t reach the goal. Therefore, we introduce in this article the concept “coactive collaboration” to describe this mutual effort made by physiotherapist and patient to reduce the patient’s symptoms. It is accomplished in interaction and based on verbal and non-verbal communication including physical contact; in this study in phases of “hands- on and hands-off”. From our films the contrast case D2, described as “non-learning”, illustrates what occurs when “coactive collaboration” does not take place.

Data consists of the recordings of naturally occurring interactions, and means of verbal and non-verbal communication are equally important for the participants in a situation of motor learning. Although each session follows the same pattern there is an individual feel that make them differ from one another. Messages are produced by someone to have meaning for someone else and who the participants are makes the difference. The challenge is for the physiotherapist to find the “wavelength” of each patient to make him or her follow her lead. This comes more or less natural to different people. Skilled health care workers often use what is called their “tacit knowledge” (Polany, 1966); they do things they are not always aware of. Repeated viewings of video films, systematic documentation and “unmotivated looking” (Martin, 2004) reveal some of these “things” so they can be pronounced and expressed in research and in education. An example from this study was the importance of the cord being pliant, a fact that had not been discussed earlier among colleagues. When watching the films this became clear to the physiotherapist and she could also express why she had chosen this cord.

In empirical studies digital video recording and a video editing programme for personal computers make it possible to study the interrelatedness of elements in simultaneous courses, such as physiotherapy treatment sessions. The video sequences can be seen many times and be analysed with different qualitative research methods. The difficulties lie within processing the large volumes of data. Further development including computer aids for transcriptions will make digital video analysis an interesting research method for physiotherapists.

CONCLUSIONS

The method described can be used for concept development or model building in physiotherapy theory, emerging from clinical practice and experience. The what, where, when and how questions can be addressed with the use of video analysis, by investigating how experienced clinicians act in specific treatment situations, and how treatment and interaction are interrelated. Having the “same kind” of patient in contextually comparable encounters with one physiotherapist, we can study differences and similarities in the interactive process that takes place; the co-active collaboration that hopefully leads to successful outcomes. Recorded material could also be seen as “raw” data sources that other researchers or clinicians can have access to, in order to develop physiotherapy practice and professional knowledge.

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Figure 1. The arm comfortably placed in a sling.

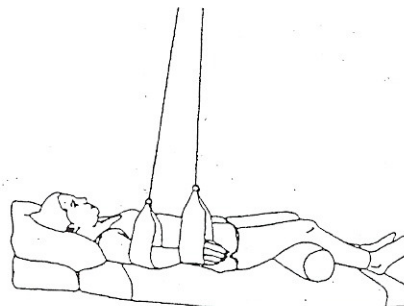
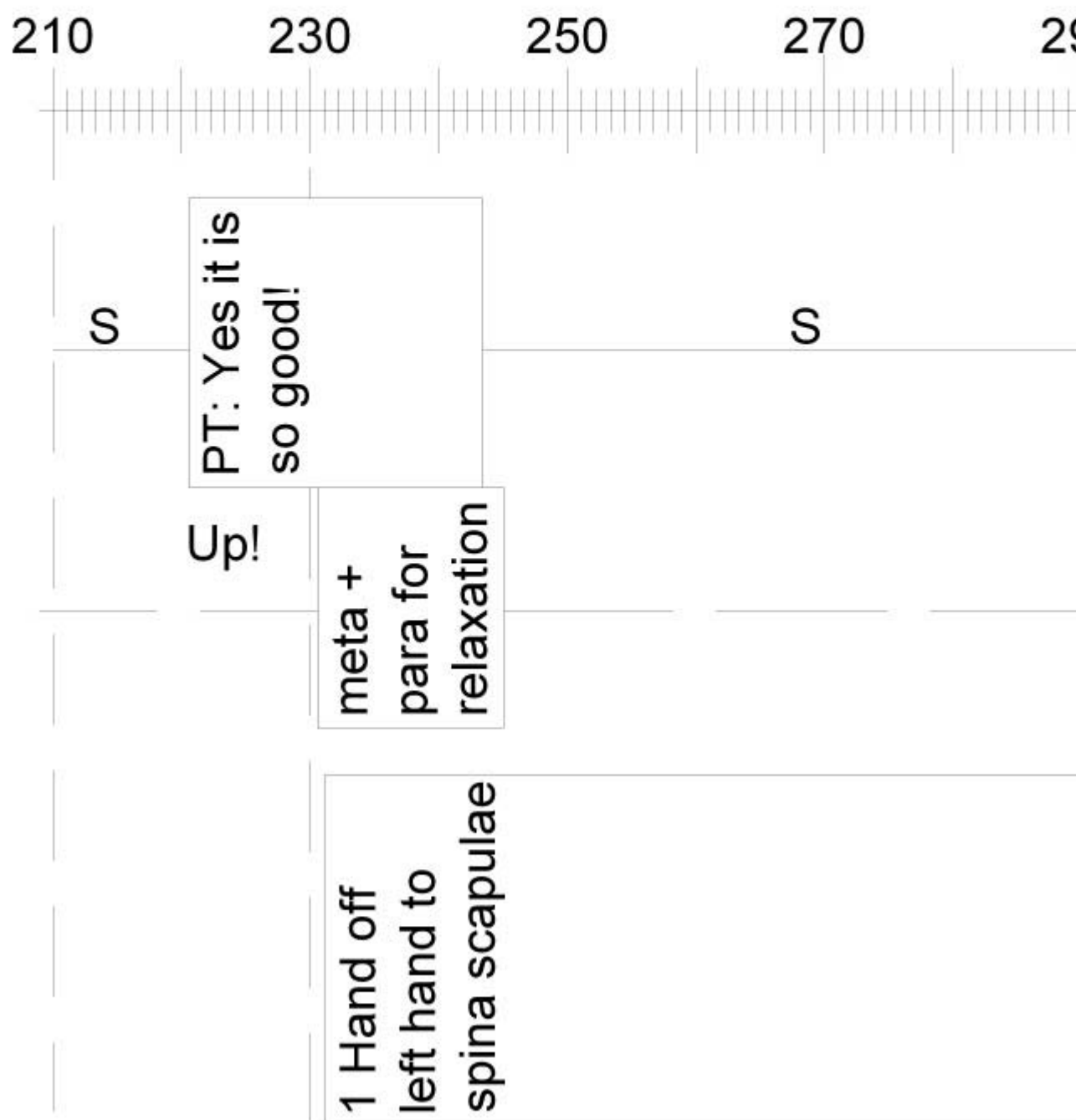


Figure 1. The arm comfortably placed in a sling.



S = silence, PT = physiotherapist, para = parallel

