

Title Page

Title: An exploration of the extent and nature of reconceptualisation of pain following pain neurophysiology education: a qualitative study of experiences of people with chronic musculoskeletal pain.

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ABSTRACT

Objective: Pain Neurophysiology Education (PNE), a method of pain education, purports to work by helping patients reconceptualise their pain, shifting from a tissue injury model towards a biopsychosocial understanding related to neural sensitivity. Better understanding of pain reconceptualisation following PNE is needed to improve the delivery of this educational approach to enhance its effectiveness. This study aimed to investigate the extent and nature of reconceptualisation following PNE.

Methods: In a qualitative design, based on Interpretive Phenomenological Analysis, thematic analysis was carried out on individual interviews with 7 adults before and three weeks after receiving PNE at a pain clinic.

Results: Three themes emerged describing variable degrees of reconceptualisation; prior beliefs as facilitators and barriers to reconceptualisation; and the influence of reconceptualisation on clinical benefits of PNE.

Conclusion: The results lend support to claims that reconceptualisation is an important mechanism in PNE and justify further investigation of this phenomenon.

Practical Implications: When delivering PNE to patients with chronic pain helping patients to reconceptualise their pain may be key to enhancing the clinical benefits of the intervention. Understanding prior beliefs may be an important step in facilitating reconceptualisation.

Highlights

Pain neurophysiology education (PNE) aims to help patients reconceptualise their pain

This study found varying degrees of reconceptualisation following PNE

Prior beliefs acted as both barriers and facilitators to reconceptualisation

The degree of reconceptualisation influenced the clinical benefit of PNE

1. Introduction

A common problem in pain management is lack of understanding of chronic pain and how it affects people. Pain Neurophysiology Education (PNE) also known as “Explain pain” is a widely used form of patient education, with a distinct emphasis on explaining the neurophysiology involved in order to change patients’ core beliefs about their chronic pain [1, 2, 3]. PNE is based upon Butler and Moseley’s manual “Explain Pain” [1]. PNE is delivered by a trained health professional to individual patients or groups of patients. The educational materials and language use layman terms combined with attractive and engaging freehand drawings and metaphors to assist in communicating complex neurophysiological ideas, which are counterintuitive to traditional ways of viewing pain. PNE can be delivered in isolation but more often it is used as starting point or component of a broader pain management approach. Emerging evidence suggests that PNE can be effective for pain and function - physical, psychological and social [3,4,5,6,7,8,9]. While most studies have focused on changes in these outcomes, less attention has been paid to exploring the mechanisms by which PNE works. This is important because its putative mechanism of effect is a key factor in defining PNE as distinct from other methods of education.

This proposed mechanism is reconceptualisation, defined as the acquisition of a new, less threatening understanding about the nature of one’s pain [3,8,10]. Reconceptualisation is a process of becoming aware that pain is not proportional to tissue injury; pain is influenced by psychological and social factors; the longer pain persists the weaker its association with tissue health; and pain is a subconscious warning of danger of tissue damage, regardless of whether the danger is real or not [10].

Claims of reconceptualisation following PNE have been made on the basis of quantitative studies showing improved scores in questionnaires about pain physiology [11,12,13] and pain-related fear [4,7]. However, these are partial or indirect measures of reconceptualisation. Qualitative investigation enables exploration of reconceptualisation in more depth [14,15,16,17].

We have previously observed reconceptualisation to be partial and patchy rather than complete; perceived relevance of the information was important for the patient, and reconceptualisation was more apparent when participants talked about pain in general rather than their own pain [18]. In that study, participants were only interviewed *after* PNE, thus restricting the ability to assess change; and the interview questions drew responses that were more about pain in general rather than the participants' own pain. Therefore, we set out to further assess reconceptualisation with specific reference to the participants' own pain, using interviews before and after PNE.

The aim of this study was to investigate the degree and nature of people's reconceptualisation of their own chronic pain following PNE.

2. Methods

2.1 Design

This was a qualitative study based on Interpretative Phenomenology Analysis (IPA). Given the aims of the study, IPA was deemed appropriate as it seeks to understand how a person makes sense of their experience ("*the lived experience*") of a particular phenomenon [19,20]. Participants underwent semi-structured interviews before and after PNE and the transcripts were analysed thematically within an IPA framework. The inductive nature of IPA allowed a

focus on participants' understanding of their pain, in relation to reconceptualisation as defined by Moseley (2007) (see introduction), but was sufficiently flexible to facilitate the emergence and identification of unanticipated topics and themes [20]. IPA recognises that an understanding of participants' experiences is only possible through the analytical lens of the investigator and thus, our findings should not be regarded as fact but rather plausible interpretation that is logically and transparently grounded in the participants' transcripts and can be viewed as a co-construction between the researcher and the participant [21,22].

This study was approved by the East Midlands – Nottingham 2 National Research Ethics Service Committee (REC reference: 13/EM/0369). Written informed consent was obtained before enrolment.

2.2 Setting, recruitment and participants

The setting was a single pain clinic in the NHS. Purposive sampling was used to recruit men and women with a spread of ages (≥ 18 years), with chronic musculoskeletal pain who had been referred for PNE. The study excluded people whose first language was not English; people who were, at any point, a patient of the interviewer (RK). The study aimed to recruit 12 participants which is in keeping with IPA studies where about 10 participants is the norm [19,20,21]. Data collection was from September 2013 to August 2014.

2.3 Procedures

Participants were scheduled to take part in two face-to-face semi-structured interviews held in a private area of the pain clinic. One researcher conducted all interviews (RK) and no-one else was present. The first interview was one week before PNE, with the second three weeks after. This gap was chosen to allow participants to digest the information from PNE, and it matched

the follow-up time used in the highest quality RCT available to date [7]. In the first interview, the questions focused on what participants felt was causing their pain and how psychosocial factors interacted with their pain (supplementary material A). In the second interview, participants were asked the same questions, plus questions about changes in their beliefs about their pain. The interviewer took care to specifically ask participants to talk about *their* pain and how the PNE session related to *their* pain, to encourage them to talk about their own specific experiences rather than pain in general. The interviews were audio-recorded and transcribed verbatim by an independent agency.

The PNE session was a 2-hour didactic group-lecture based upon the manual “Explain Pain”, delivered within routine pain management by an experienced senior physiotherapist (VR).

2.4 Analysis

Initial analysis was carried out by one researcher (RK). Following the guidelines of Osborn and Smith [22], transcripts were read and re-read to get an overall impression of participants’ perceptions. Notes were made of potential themes and key statements were identified and coded. Groups of statements were grouped together and categorised. From this, emergent themes were tentatively identified. The themes were then discussed at length and further refined by all members of the research team to produce a coherent account of the meaning and essence of the participants’ experiences grounded in their own words.

To enhance credibility, the extent to which findings were compatible with the participants’ accounts [23], a second author (CR) read the transcripts to ensure that the themes were logical and rooted in the data. Participants were telephoned to ensure that the interpretations by the researcher were a valid reflection of what they said [22]. To enhance the dependability of the

data and reduce the risk of excluding minority views, all voices and viewpoints were recognised, analysed and interpreted. The study is reported using the consolidated criteria for reporting qualitative research (COREQ) [24] and is consistent with qualitative methodological recommendations [25,26].

2.5 Reflexivity

Three of the authors are trained in PNE and have experience of delivering PNE clinically (CR, VR, & RK): two currently do this routinely within the NHS (VR & RK). Each researcher considers that PNE is a useful intervention for patients with persistent pain.

3. Results

Eleven people consented to participate. One withdrew before the first interview without giving a reason. Two withdrew before the second, one giving no reason and the other stating that she was in too much pain to participate. With another participant, the second interview was void as the audio-recorder failed. The characteristics of the seven remaining participants (5 women, 2 men) who provided data for analysis are presented in Table 1.

The interviews lasted for a mean of 32 minutes (range 15-58 minutes). Three themes emerged: variable degrees of reconceptualisation; prior beliefs as facilitators and barriers to reconceptualisation; and the influence of reconceptualisation on clinical benefits of PNE.

Table 1: Participant characteristics

Patient ID	Location of pain	Duration of pain
B	Lower back and legs	26 years
C	Lower back	20 years
E	Lower back and leg pain	11 years
F	Lower back and right thigh pain	2 years
G	Thoracic spine and throat	5 years
J	Complex Regional Pain Syndrome	2 years
K	Neck and shoulder pain	2 years

3.1 Theme 1: Varying degrees of reconceptualisation.

There were varying degrees of reconceptualisation after PNE. The object of analysis was participants' use/or lack of use of language consistent with awareness that pain is not proportional to the presence or degree of injury and awareness that chronic pain has a psychosocial dimension (Moseley 2007). We interpreted greater use of such language after PNE compared to before PNE as indicative of reconceptualisation whilst a maintenance of biomedical based language after PNE which was consistent with their view before PNE was indicative of a lack of reconceptualisation. Participants B and J, after PNE, displayed clear evidence of reconceptualisation, talking about the cause and nature of their pain in terms of hypersensitivity and a disconnect between pain and tissue damage.

Basically I've got a build-up of chemicals around the nerves in the damaged area, I can't remember exactly, I think its cortisone, I can't remember? but basically what it's doing it's exciting the nerve but at the same time it's clinging to the gates on the bottom of your nerves so it's not allowing them to shut properly, so my brain's reacting by saying what the hell's

going on. So therefore it's creating more gates, creating more braches of nerves, to try to understand all of the information. And if I've understood it alright this is basically hyper exiting it more so they're in a constant state of excitement... It was just really interesting because like I say it was something that I was vaguely aware of but not in that much detail [Participant J Post-PNE]

Well again it's [the pain] the over-sensitivity [Participant B Post-PNE]

After PNE, B and J discussed how their mood or stress affect their pain, showing an increased understanding of the psychosocial dimensions that they talked briefly about before PNE.

Oh God yes. It [negative emotions] sends it [my pain], it doesn't send it through the roof, but it does increase. (Participant J Post-PNE)

If I am mentally worried about something it will set it off....It's [PNE] confirmed it [the stress – pain link] ... so I understand it. (Participant B Post-PNE)

Participant C's reconceptualisation was more partial. Before PNE, she described her pain as being caused by an old injury. Afterwards, she described the cause of her pain in terms of deconditioning. This indicates a move towards an appreciation that pain and tissue damage are not proportional.

I think now it's [pain] because I'm so stiff because I haven't moved my joints for that long I want to move them. they're saying to me we want to move if you know what I mean, they've stayed still for that long and I haven't used them for that long, I'm becoming so stiff. My knees,

my arms, everything is all starting to stiffen. And I'm suffering more by not doing them.

[Participant C Post-PNE]

The other four participants, however, showed no evidence of reconceptualisation. Participants E, F, G and K clearly saw their pain as directly linked with tissue damage. Neither was there evidence of and shift in understanding of the psychosocial dimensions of their pain.

It's degenerative and it's not going to get, you know, I'm not going to get younger or anything.

[Participant E Post-PNE]

I don't think on a day-to-day basis it affects my psychological health in any particular way.

(Participant K Post-PNE)

3.2 Theme 2: prior beliefs as facilitators of and barriers to reconceptualisation.

Accounts before PNE show a marked contrast in beliefs about pain between those with signs of reconceptualisation and those without. In the former, while their accounts before PNE were dominated by descriptions of tissue damage, we also observed some language consistent with reconceptualisation.

it's basically a short circuit in my brain. Basically I, my legs always sending pain signals to my brain when there's actually, there is pain there but it's nothing that's going to get any worse...the pain is a bit... overprotective with me and I'm just getting lots and lots of weird signals which my brain's just like. [Participant J PRE PNE]

In the latter, their accounts before and after PNE were rooted in beliefs alien to reconceptualisation.

I do think it's [the cause of my pain is] wear and tear. [Participant F, Post-PNE]

Two of these latter participants, E and K, displayed prior beliefs that were very resistant to change. Participant E described a history of problems with physical approaches to dealing with her pain. After PNE she was very positive about the session and reported that this was the second time she had received PNE. Despite this, she showed no evidence of reconceptualisation.

Very much clearer... My understanding. I think when I went through it the first time I came out a bit bamboozled with it all. But having bought the book [Explain Pain, 2003] as well and read some of it, I think that really helps. But it solidifies sort of where I was going or trying to go. [Participant E Post-PNE]

The final sentence in the quote shows that her positive feelings towards the education was an interpretation that it had actually confirmed her existing beliefs.

Participant K actively resisted letting go of her prior beliefs. She seemed able to understand the concepts in PNE but was unwilling or unready to apply them to her pain.

You have your signals going, your brain is assessing what's going on and essentially the pain response may not be proportionate to the underlying whatever. And I suppose I understand that but whether it's that I'm not willing to accept it or whether it's that I can't bear to accept it...I just, I can't believe that there's not something [structural] there. Something must have happened, there must be a reason. [Participant K Post-PNE]

3.3 Theme 3: the influence of reconceptualisation on clinical benefit

Another theme described how reconceptualisation was associated with greater reported clinical benefit from PNE. In this case, clinical benefit is operationally defined as patient-reported improvement within the domains of pain, function and psychosocial wellbeing, as opposed to changes in knowledge or understanding.

Participant B demonstrated the most obvious reconceptualisation following PNE and spoke most clearly about the benefits of PNE to her, which, in this case, were primarily in the area of psychosocial wellbeing. She felt that the education had provided her with validation of her experience by explaining for the first time how pain could have persisted for so long. We interpreted this as clinical benefit because previous lack of validation had been causing her distress. She felt it had made her more aware of the role of stress in her pain experience, helping her to accept her condition more and carry on with her life despite the pain.

it also reassured me that I wasn't going barmy...it [PNE] explained that I'm not. What I am experiencing is real and it explained why, without something necessarily being wrong... things like the sensitivity is a kind of new thing that no one had offered before [Participant B Post-PNE]

I'm hoping to be able to watch out for it [stress] in the future, if I see it come along then I've got to try to make sure that I can relax and not take things too seriously in order to look after my own health in order to cope. [Participant B Post-PNE]

It [a cure] isn't quite so important anymore, it doesn't rule your life... Accept that it's there but move on. [Participant B Post-PNE]

Participant J, who also showed clear signs of reconceptualisation, talked about an increased awareness that negative mood affected his pain, and how he used this to better manage his condition.

In some ways I have been finding it a little bit easier because I have been trying to, once I start getting negative thoughts I just try to think about something else. A few breathing exercises that I've been taught, just to calm myself down. [Participant JJ] And were you doing those previously? [Interviewer] A little bit but not as much. but now that... I'm more aware of what's going on I've been using them more and basically just when I start feeling like that I try and jump into something to try and occupy my mind. Once my mind's occupied it sort of like ebbs away. [Participant J Post-PNE]

Participant C, in whom a lesser degree of reconceptualisation was observed, also reported benefits. He talked about decreased fear-avoidant behaviour and related that to the message from PNE that pain is disproportionate to tissue damage.

But each day I'm doing little bit by bit more and like pushing myself where before I wouldn't. But I don't know whether it's because like the medication I'm on because I've had them all upped... Do you know what I mean? And I feel better in myself for trying and pushing myself...Because they explained to you that it's not going to damage you...Do you know what I mean? and you have a fear that if you do this it's going to damage you and if you do that it's going to damage you but it [PNE] explains that it won't because you get to the peak before

you'd even damage yourself. And that's what I've come to understand. [Participant C Post-PNE]

In contrast, the participants who demonstrated no reconceptualisation after PNE discussed few, if any, benefits. Two participants briefly reported what may have been better pacing of activity [E, K] and another [F] vaguely mentioned feeling reassured by the session. One participant [G] flatly stated that the education was of no benefit to him.

...it just didn't do nowt [nothing] and I explained at the end I thought it was a waste of time [Participant G] ...So were there any parts of the talk that you found kind of useful. [Interviewer] No not at all, no. [Participant G Post-PNE]

This may have been related to the uniqueness of his condition in that his primary problem alongside spinal pain was throat pain and belching. He felt that the material in the sessions was far removed from his experience making PNE less relevant to him.

For me personally I didn't think it was any good for the symptoms that I have... I said how can you help people with physio on their throat and what I was suffering? And the two ladies that were doing the session basically couldn't answer my question. So I said well I wouldn't want to come back to this... I was sort of lost with the session... Just wasn't for me... I was belching and gurgling and everything and it wasn't covered about that, it didn't help me at all... it was for more for people with different parts of the body pain and not the one I have. [Participant G Post-PNE]

Other data: The remaining data was grouped in a theme around issues of delivery of pain education that were not specifically linked with reconceptualisation.

4. Discussion and Conclusion

4.1 Discussion

In this qualitative study of seven adults with chronic pain, we investigated participants' reconceptualisation of their chronic pain following PNE. The themes described variable degrees of reconceptualisation, including none; people's beliefs about their pain before PNE as barriers to or facilitators of reconceptualisation; and the influence of reconceptualisation on clinical benefits of PNE.

Themes from our previous qualitative study of PNE [18] also emerged in this one. In both studies we found evidence of reconceptualisation in some participants but not others; and in those who did show evidence of reconceptualisation, it was variable in degree and nature. In our previous study, we concluded that some people may be more likely to reconceptualise their beliefs about pain in general than when relating to their own experience. Therefore, in the current study, we specifically encouraged people to talk about their own pain experience. Those participants who demonstrated reconceptualisation did so clearly in the context of their own pain. Participant G's narrative, shows the importance of relevance, an issue raised in our previous study [18].

A new theme that emerged was prior beliefs as facilitators of or barriers to reconceptualisation. Changing beliefs requires not only the acceptance of new information and experiences but also the breaking down of existing beliefs) [27,28]. Posner et al. [28] outline four steps to accommodate a new scientific concept: the individual must be dissatisfied with their current

beliefs; the new concept must make sense to the person; it must be plausible; and the person must believe that it can actually help them.

This model could help to explain why Participants B, C and J showed evidence of reconceptualisation after PNE: their budding awareness of reconceptualisation before PNE would facilitate the passage through the four steps.

Participant E's lack of reconceptualisation is noteworthy for her point that the PNE reinforced her belief that her pain was directly linked with tissue damage, which is counter to the messages put forward in the session. Within the context of the model, it would appear that she had not got past step one. Somewhere within the session, a misinterpretation of the information must have confirmed her prior beliefs.

A strength of this work is the collection of data before and after the PNE session, which facilitated investigation of change in beliefs. The sample was limited to white British people living in the North East of England. Additionally, while our delivery of PNE is within the range of methods reported in the literature [8], other formats may influence people's experiences. Thus, caution should be taken in transferring the results to other patient groups and delivery styles. The interviewer was a physiotherapist working in the pain clinic where the participants received PNE. This may have resulted in more socially desirable responses, though none of the participants received PNE from the interviewer. It is possible that some participants merely repeated the concepts and ideas provided during PNE in the subsequent interview rather than demonstrating true reconceptualisation about their pain. However, due the semi-structured nature of the interviews, the researcher was able to probe understanding and how the participant contextualised this understanding to their pain. While there was evidence of partial

reconceptualisation and the co-existence of incongruent reconceptualisation and medical model beliefs, there was no obvious indication of participants regurgitating the information provided in PNE in a purely superficial manner. As a qualitative piece of work, the findings should be seen as illustrative rather than representative of the population. While the themes presented provide a comprehensive description of the data we collected, we did not continue to recruit to search for more. This is in keeping with IPA methodology [30]. Thus, there may be more issues in this field that have not emerged.

4.2 Conclusions

Our findings provide support to claims that the concept of reconceptualisation is an important mechanism and they provide useful insights for the work needed to investigate this further.

4.3 Practical implications and future research

Those with positive signs of reconceptualisation show an understanding before PNE that “hurt does not equal harm”, which may be an important facilitator to change. They may form a category of patients who are ready to reconceptualise. Clinically, there may be merit in screening patients’ understanding of their pain prior to PNE to identify unready patients and prime them with basic PNE messages beforehand to aim to facilitate change within the PNE session. The finding that reconceptualisation was partial after the single PNE session adds weight to the potential of follow up education to help continue the process [31]. Further investigation is warranted to explore the readiness of patients to take on board the messages of PNE. The findings would justify a grounded theory study to develop a detailed understanding of reconceptualisation, or a framework analysis to rigorously explore how the model described by Posner et al [28] can add to our understanding. Further illustrative studies, like the current study, would enhance and expand understanding of the construct of reconceptualisation. This

would be useful to inform the development of new measurement tools or explore the validity of the Neurophysiology Pain Quiz as such a measure [32].

Conflict of interest

The authors have no conflicts of interest to declare

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