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ORIGINAL ARTICLE

A grounded theory study on Swedish 10 to 16-year-olds' perceptions of pain in conjunction with orthodontically indicated tooth extraction

Henrik Berlin[a], Ulrika Hallberg[a], Karin Ridell[a], Danijela Toft[b] and Gunilla Klingberg[a]

[a]Department of Pediatric Dentistry, Faculty of Odontology, Malmö University, Malmö, Sweden; [b]Colosseum Smile Dental Group, Malmö, Sweden

ABSTRACT

Objective: Children frequently experience pain and/or discomfort during dental treatment. Still, pain research in dentistry has mainly been performed on adults using quantitative methods while research on the child's perspective is scarce. This study aims to explore and describe children's experiences and/or thoughts regarding pain in conjunction with tooth extraction.

Material and methods: Interviews were carried out with twelve Swedish 10–16-year-olds who had recently undergone tooth extractions due to orthodontic reasons. Interviews were transcribed verbatim and analysed according to grounded theory.

Results: A core category was identified and named 'handling the unavoidable unknown'. The informants recalled experiences of pain and discomfort during extractions. However, instead of focussing on pain, they described an urge for more information about the procedure and what to expect in terms of pain and/or discomfort, during and/or after treatment. They stated that the levels of pain/discomfort were manageable, while the lack of information negatively affected their coping abilities, causing feelings of unease.

Conclusions: To improve patients' ability to deal with pain in conjunction with dental extraction, the dental team should ensure better and individually tailored information about the treatment. Thus, the use of psychological techniques is a cornerstone in pain management and must be reflected in clinical guidelines.

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Introduction

Pain is defined as 'An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage' [1]. Due to pain's subjective nature [1], it can be difficult to measure pain objectively and patient-centered self-report instruments are therefore advocated [2]. Despite the emphasis on pain being subjective much of the performed research in dentistry has used quantitative methods. This is important for collecting and generalising objective knowledge. The most important aspect might however be lost using quantitative methods, namely the subjective perspective of the individuals participating in the study. The child's experience and understanding of how she/he feels should position the child as an expert, which we sometimes forget [3].

Most studies on the prevalence of dental pain have used different rating scales or questionnaires to measure pain. There are reports of pain being relatively common among children receiving dental treatment, with some procedures perceived as being more painful than others and approximately one-third of children experience pain and/or discomfort in conjunction with dental treatment [4]. For example, pain after tooth extraction has been reported to occur in about one-third of the children undergoing such treatment [5,6].

Grounded theory (GT) is a qualitative research method originating from sociological research developed in the 1960s by Glaser & Strauss [7]. The method is characterised by a systematic approach to gathering and analysis of data and so-called constant comparisons where all new data and all steps in the analyses are compared with all other parts of data and analyses [8]. Generally, quantitative research methods with a priori formulated hypotheses come with a risk that the important perspectives of the involved or affected individuals in the study are not being identified or even lost. Qualitative methods have a special role here and GT is often a suitable method to evolve new knowledge that can be used to formulate hypotheses that may be further investigated in subsequent quantitative research [9].

The aim of this study was to explore and describe, using grounded theory, children's experiences, and thoughts of pain in conjunction with tooth extraction performed on orthodontic indications, and the subsequent postoperative period. Knowledge about these concepts could serve as a basis for future studies, which is a prerequisite to being able

CONTACT Henrik Berlin henrik.berlin@mau.se Faculty of Odontology, Department of Pediatric Dentistry, Malmö University, Malmö, SE-205 06, Sweden

to formulate guidelines on pain management for dental personnel treating children and adolescents when there is a risk of pain.

Material and methods

Study group and procedure

Eligible participants were identified during their visits to any of the orthodontic clinics in Malmö, Sweden. The orthodontist gave written and verbal information (age-appropriate) to potential candidates and their legal guardians. After the children assented to participate, the legal guardians signed an informed consent form. All informants who were invited accepted participation. Inclusion criteria were healthy individuals aged 10–16 requiring extraction of premolars prior to orthodontic treatment. The study group was strategically selected in terms of sex, age, and residence (type of housing; to mirror socioeconomic background). Informants were included to cover experiences of having one tooth as well as two teeth extracted, but also recently initiated orthodontic treatment. The exclusion criterion was if the patient or legal guardian could not understand Swedish. The Swedish Ethical Review Authority approved the study (# 2019-00121, (2018/1029)), and the study was registered on https://ClinicalTrials.gov (NCT04064853).

Interviews were scheduled at least one week, but no longer than three weeks after tooth extraction. The interviewer was not involved in the informants' dental treatments. Twelve informants, aged 10–16 years, all living in the southern parts of Sweden were included (five girls (mean age 13.0 years) and seven boys (mean age 14.6 years)). Eleven interviews were performed initially. After the first five open interviews, informants were identified strategically to ensure that all aspects of the background were included and to obtain a heterogenous group and to maximise the variations of experiences in the studied group [6]. Previous experiences with dental treatments varied; however, the informants had generally good dental health and few experiences with local anaesthesia. After the categories had emerged and been formulated, three informants were re-interviewed for verification purposes, and a twelfth new informant was included for validation of the results.

Method

Classical grounded theory, first described by Glaser & Strauss [7], was used in this study and describes the phenomenon under study as the main concern for the informants that have to be solved. Its ontological position is close to positivism due to its adoption that a 'real reality' can be discovered and described without any influence from the 'objective' researcher [8]. In classical grounded theory, to be able to solve the main concern, informants use different strategies that are described in different categories. The basic principles of the grounded theory include theoretical sampling and hierarchical analysis, constant comparisons, theoretical sensitivity, and saturation [10–13].

Qualitative interviews

Data were collected from April 2019 to April 2021. So-called open interviews lasting 30–45 min were conducted in a conversational style with each informant by the main author of this article (HB, a paediatric dentist, trained in conducting qualitative interviews). All interviews were taped. The first eleven interviews were carried out either in a quiet room at the dental clinic or at the informant's home. Owing to Covid-19 regulations, the twelfth confirming interview and the three verification interviews were performed *via* telephone or Zoom. No differences in the settings other than that were introduced. These interviews were conducted from November 2020 to April 2021.

An interview guide was used, and it concerned topics such as *general thoughts about dental visits, thoughts specifically around tooth extraction, being at the dentist's office,* and *experiences from the post-operative period*. Based on these themes, the interviewer asked relevant follow-up and probing questions and the informants could also raise questions of relevance to themselves [11–13]. Data collection and analysis were conducted simultaneously [7,8,10,14] and continued until new interviews did not provide additional information – until saturation was reached [11–13].

Analyses of data

The process of analysis has previously been described in detail [11–13] why a shorter description is provided here. All interviews were transcribed verbatim by HB and analysed by HB, GK (both paediatric dentists) and UH (sociologist experienced in research in the field of odontology) in parallel, using a hierarchical coding process, i.e. open, and focussed (selective) coding, and continued until saturation was achieved [10]. Memos and notes covering ideas, preliminary assumptions, and theoretical reflections, were continuously written in order to keep track of the analysis [10]. Analyses and preliminary findings were constantly discussed between HB and GK, as well as with UH as an external partner. Finally, a core category was identified describing a psychosocial process and this was central to the data and could be related to other relevant dimensions/categories grounded in the data.

The interview transcripts were re-contextualized in the final stage to certify that raw data supported the categories, in other words, that the categories were grounded in the data. The unit of analysis in a grounded theory study concerns events and actions in the data rather than the separate individuals per se [14] and the content and quality of the data are therefore of more interest than the number of informants.

Results

All the participants expressed some level of worrying prior to their tooth extraction. Despite that, no one hesitated to carry on with the planned treatment. Instead, they all reported using different coping strategies to handle the situation.

Core category

The main concern (core category) for the children were ***handling the unavoidable unknown***. Despite the uncertainty about the treatment procedure, and what that could lead to in terms of pain/unpleasantness during the treatment and postoperatively, the participants were 'jumping into the unknown' (solving the main concern) and went through with the treatment. The children were all well aware that the treatment was unavoidable. They went through the whole procedure with many aspects of it being unknown, nor did they have any knowledge of what to expect after the treatment in terms of pain or unpleasantness. Despite the uncertainty surrounding the whole procedure of tooth extraction, the children chose to go through with the treatment. The children reported varying degrees of unease before the treatment. The onset of worrying differed, but in general, it debuted shortly before treatment, often the evening before. In order for the children to deal with the unknown, they used different types of coping strategies, which are described in the five conceptual categories that were generated in the data analysis (*clinging to what I can trust, clinging onto earlier experience, striving to be in control, longing to get it over with,* and *looking forward to a treat*) (Table 1). This was seen regardless of age, sex, or other background variables.

> *'Well, then again was good informing a bit earlier that it could feel like this and, yeah – if they had examples of individuals that like, had felt it was difficult, and so they could have brought that up and like tell – oh, it's no big deal or like this is how it's supposed to feel. Just so you know a bit more because I have never done this before so I didn't know how I would feel or how it would feel … a little …. uhh … I didn't really know anything about it so that's why I took everything they said very literally. So, if I felt any discomfort or anything that hurt then I should raise my hand and that's what I did. But uhh … like perhaps be more … tell more.'* (ID8)

Conceptual categories

Clinging to what I can trust was based on children clinging to things the dentist had said before, such as the description of tooth extraction and what could be expected during and after the procedure in terms of pain or other types of sensations. One example is that there could be a sensation of pressure in the tissue during the injection of local anaesthetics. Clinging onto concrete information and what seemed plausible was turned into a strategy for coping with treatment and pain.

> *'They went through each step before they did it. She said "now we're doing the anesthetics', 'we … ' – so they said exactly where I would … where they would do the injection too. And they told me the whole time during the process what they did and told me, and listened carefully if I were to tell if I wanted to abort/stop, and I did that too when … I clapped my hands, so I got more anesthetics and stuff.'* (ID1)

The participants requested an adequate amount of relevant information in order to reduce levels of worrying, but not make them frightened/scared.

Table 1. Core category, conceptual categories, properties, and examples of meaning units regarding 'handling the unavoidable unknown'.

Core category	Conceptual categories	Properties	Examples of meaning units (*in vitro* codes)
Handling the unavoidable unknown	Clinging to what I can trust	Information is crucial in order to reduce patients' anxiety levels.	Had received information on how it could feel during and after injection, and also afterwards. (ID6) Wishing for more information beforehand on how it could feel. Especially since no previous experience from invasive treatments at all. (ID8) Got information during treatment, step by step. (ID10)
	Clinging onto earlier experience	It is important to ask children about previous experiences so that information can be adjusted individually.	Earlier experience of tooth extraction led to less anxiousness this time. (ID4) Less nervous prior to second extraction since the procedure was familiar, and what to expect from the postoperative period. (ID8) Less nervous prior to second visit. Knew what was going to happen. (ID9) Less nervous prior to second treatment. Pain also passed more quickly. (ID10)
	Striving to be in control	Give the child a possibility to take control of what is doable in the dental setting.	Got the possibility to choose if one or two teeth would be extracted at the same appointment. (ID2) Got information about stop-hand. (ID3) Was asked if it was ok to take out one more tooth, after the first had been extracted. (ID7) Feeling a bit worried that the dentist is going to do something wrong. (ID8) Was thinking about taking pain killers. But then it did not feel necessary. (ID11)
	Longing to get it over with	With proper handling, the child is often strong enough to handle some pain/unpleasantness.	Wasn't so bad, that I felt like pausing/stopping the treatment. (ID1) It did not hurt that much … (ID2) I take it as it comes. (ID5)
	Looking forward to a treat	Identify motivators for the child; why treatment [and possible pain/discomfort] is worth it.	Is fine with having more teeth extracted. It leads to more attention from mother. (ID1) Feels motivated to have braces. Is looking forward to it. (ID5) Got a lot of praise after the treatment. (ID6)

'I thought it was good that they did not tell, because otherwise I would have been even more nervous if they had told me it would hurt.' (ID5)

Clinging onto earlier experience emerged as the children used their own previous experiences to cope with treatment and pain. Some of them had undergone this type of treatment before, which gave them confidence in the treatment they underwent in conjunction with the present study. Those children with experiences of less psychologically challenging earlier treatments felt more at ease and could find motivation from those experiences in the present treatment. In contrast, those with more challenging experiences were in need of more calming information to cope with treatment.

'I've had the syringe before. So that was nothing dangerous. I hardly felt it. Didn't really notice that they did it. So that was nice.' (ID2)

Informants interviewed after having two premolars extracted in conjunction with this study felt less distress before the second extraction compared to the first.

'The first time I hadn't felt like that before so that was more jittery. To know what it feels like… but the second time I knew kind of what it feels like and then it was a bit easier.' (ID2)

Striving to be in control is a result of children finding ways to be in control of the situation, which makes them cope with treatment. Instructing the child to raise their hand to stop the treatment immediately, gives the child a feeling of being in control of the situation. The treatment continues only as long as the child wants/gives permission.

'The first time I did but just because… but the second time it went well. I wouldn't have needed it the first time either. But it was just to feel comfortable.' (ID3)

Being able to decide for themselves if and/or when to take oral analgesics after arriving home (to reduce or prevent pain), convinces the children that they have control over the situation which helps them to cope with subsequent pain. Regardless of whether they took oral analgesics or not, this possibility to choose gave the children a sense of self-control.

'My mother suggested it but I didn't feel the need.' (ID3)

Longing to get it over with arose during the interviews as a category of relevance since the children often mentioned that they wanted to get the treatment over with. The wish to some extent made the children more likely to cope with pain and discomfort. It was a way to save themselves from postponing the treatment, thereby prolonging the worries and apprehension. They knew that the extractions were something they had to handle to be able to get further in their treatment plan since they knew that this would lead to straight teeth.

'No, so – I felt more than in the upper jaw but it didn't hurt that much or I felt it wasn't that uncomfortable that I had to tell.' (ID4)

Looking forward to a treat emerged through informants' describing positive outcomes in the future that they were eager to reach. It could be a variety of events such as spending a day with mum, choosing what movie to watch the evening of the tooth extraction, watching some Netflix shows, or longing to get their braces. With this in mind, the informants were more motivated to endure the treatment, even when there was a little pain and/or discomfort.

'That's okay too. Because then you get more attention from mum once you get home.' (ID5)

Discussion

The main finding in this qualitative study was that despite a great deal of uncertainty in terms of what to expect of pain during and after tooth extraction, the children went through with the procedure. By using different types of coping strategies, they *handled the unavoidable unknown*, which emerged as the core category. Although children and adolescents have different experiences from previous dental treatments, there are similar traits. These are described in the five *conceptual categories*, representing different ways of coping with tooth extractions.

In general, the pain in conjunction with tooth extraction seems to be manageable. The informants were motivated to go through with the treatment despite some pain and discomfort. Instead, their stories focussed on the importance of the dentist not forgetting the basis of non-pharmacologic pain treatment, namely accurate and individually tailored information about treatment as well as possible pain and discomfort both during extractions and postoperatively. For example, it may be beneficial if more detailed information about tooth extraction, including the postoperative period, was provided preferably both by the orthodontist and the dentist responsible for the extractions. Today many children and adolescents have limited experience with invasive dental treatments, due to good oral health. Therefore, tooth extraction prior to orthodontic treatment might be a totally novel experience, perhaps the very first invasive treatment, encounter with local anaesthesia, and possible dental pain. Pain memory or recall bias could of course affect the informants' descriptions. However, previous studies have reported that children's memories of pain intensity were accurate and showed a very little decline over one week [15], and since most of the interviews in this study took place one to one and a half weeks after the extractions the risk of getting altered results due to recall bias has to be considered minimal.

The strength of the present study is that the same person performed all interviews and transcriptions. By this measure, a deepened acquaintance and close knowledge of the data was achieved. Also, having a multidisciplinary team reading the transcripts and participating in analyses is a strength as it warranted different views of the information, and led to picking up nuances in the participants' stories that otherwise might have been missed [16,17]. Re-interviewing of three earlier informants plus the inclusion of a new twelfth informant was conducted following a verification strategy called 'member checking' and is another strength. The goal is not to make a data check, rather it is a way to perform analysis at a more abstract, and higher position in the process, to make a validation of concepts and their components. This leads to the completion of data collection and is also

ensuring commitment to the data and the analysis being made [18,19]. From interviews of the 12 informants and 3 re-interviews, we could clearly see that saturation was reached for each category, thanks to all interviews being lengthy and rich in information.

Qualitative methods, including GT, cannot be used to investigate differences related to e.g. age, sex, or other background factors since the study design does not allow this. Still, we observed that the informants described their experiences and thoughts similarly, and the conceptual categories were identified in all interviews. This shows that by theoretical and strategical sampling, and re-interviewing for verifying purposes, we ensured saturation, which is an important quality marker.

Wanting more information emerged as a central part for the informants in this study as an aid to cope with the tooth extractions since the information given appropriately makes the procedure understandable, leading to lower levels of fear and nervousness. The amount of information was described as sufficient; still, informants were concerned during and after treatment, showing a continuous need for information, which must be age-appropriate, and come at the right time. Within dental care, the 'tell-show-do' procedure is commonly practiced, exposing the child gradually to procedures, which will aid future cooperation with dental treatment. Problems in a dental scenario are most likely to be prevented if time and awareness are devoted and combined with an empathetic attitude to the patient's needs and preferences [20,21]. With this comes the patient's right not to know. Some children said in their interviews that they did not want too much information as it would lead to more worrying. In such cases, it is crucial to be aware that it is not only verbal communication that matters. Non-verbal communication also aids children in visiting the dentist [22].

Previous experiences from dental visits are used by the child as a model to predict future treatments [23]. In this study, the informants seemed to have had positive to neutral experiences and the first visit seemed to have a positive conditioning effect on the second visit. This is an important finding, especially as the research method used children's own verbalised experiences as the source of data and this is supported by findings from previous studies [5,24,25]. Thus, pain-free dental treatments serve as conditioning processes similar to the theory of latent inhibition [26–28].

The participants repeatedly mentioned *being in control of the situation* as an important coping strategy. An example is a use of raising the hand as a stop signal [22]. Some informants said they had tested this, even though they really did not have to. Doing so can be interpreted as them not feeling totally secure in the situation, but when they noticed that the stop hand worked, they had better control and felt safer in the situation.

The fourth and fifth category, *longing to get it done with*, and *looking forward to a treat*, are both showing that motivation can make the child accept the treatment although sometimes painful/unpleasant. Motivation can have a different origin. For example, Davies and Buchanan [20] reported that children preferred getting the treatment over and done with, compared to having a pause which would prolong the treatment, while van Meurs et al. [29] found that many children used a strategy called 'I tell myself I have to do this because it is good for my teeth'. Both were identified in the present study.

None of the informants indicated during their interviews that their main concern was dental fear, rather the focus was on coping strategies. Since the informants in this present study are to be considered as well-motivated patients with no dental fear, this underlines the importance of every patient receiving age-appropriate information to deal with the treatment ahead of them. This is especially important because it is not always known beforehand if the patient in the dental chair is suffering from dental fear or not. Therefore, it is important to give correct and age-appropriate information, also to prevent and/or reduce levels of uneasiness. And if the presence of dental fear is established, then information is even more crucial as part of the treatment.

Would the result of this study be the same if the participants came from other clinics, if the extraction was performed on other indications than orthodontic treatment, or if any other treatment had been performed? No other studies have been found to answer these questions. It can be assumed that patients selected for orthodontic treatment are often highly motivated patients, which could affect their view on tooth extractions in a positive way. Teeth that are extracted for orthodontic reasons are often also free from any pathology, hence, free from symptoms, which could affect the outcome of the postoperative pain. But to answer these questions above, more research is much needed in a general dentistry context, where a wider array of treatments is presented.

There was in general a very low demand for pharmaceutical aid to cope with pain. Instead, prevention of pain seems to be the main theme based on data in this study. When formulating guidelines, the focus should lie on psychological/non-pharmacological care.

Conclusions

Children describe experiencing discomfort during and after dental extractions; however, they also explain that they can cope with it – they are *handling the unavoidable unknown*. Children want to be well informed about the whole treatment: what to expect before, during, and after the treatment, in this case, tooth extractions. It is important that information is individually tailored, and given at the right time, to reduce and/or avoid uneasiness prior to the first treatment.

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Author contributions

HB and GK conceived the ideas; KR and DT participated in planning the study and recruiting participants; HB performed all interviews; HB, GK and UH analysed the data; HB led the writing, and all authors participated in finalising the manuscript.

Disclosure statement

The authors declare no conflict of interest. The authors alone are responsible for the content and writing of the paper.

Clinical trials registry

The protocol for this study was registered on ClinicalTrials.gov (NCT04064853), August 22, 2019, available at https://clinicaltrials.gov/ct2/show/NCT04064853?term=berlin&cntry=SE&draw=2&rank=1.

Complying with ethics of experimentation

Written informed consent for study participation was obtained from the legal guardian. All children received age-appropriate information and assented to participate. The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. The Swedish Ethical Review Authority, Sweden [# 2019-00121, [2018/1029]] approved the study.

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ORCID

Henrik Berlin http://orcid.org/0000-0003-3362-3362

Data availability statement

The datasets generated and/or analysed during the current study are not publicly available due to information that could breach patient's confidentiality but are available from the corresponding author upon reasonable request.

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