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Laser in caries treatment – patients' experiences and opinions

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Abstract: *Objectives:* The aim of this study was to obtain a deeper understanding of patient's experiences and perspectives after dental caries treatment with Er:YAG laser technology. *Methods:* Twelve patients aged 15–30 years who had undergone at least one laser caries excavation agreed to participate in an interview study. All the interviews were tape recorded and transcribed by a transcription agency. The transcribed texts were analysed using manifest and latent qualitative content analysis. *Results:* The categories in this study were identified as choosing laser, understanding laser, encouraging dental care and my oral health. The motivation for laser treatment was described as dental fear in general, specific fear of needles or discomfort with the drill. The informants described the dentist's role as initiators of treatment and willing or unwilling facilitators. Laser treatment was described as safer and more carefully considered treatment. They felt generally safe with laser and were able to relax during the treatment. All interviewees described a positive impression of the laser, and words like 'up to date' and 'future-oriented' were used to describe laser. Laser treatment was considered less painful. *Conclusions:* The results indicate that patients find laser a feasible and convenient treatment option.

Key words: dental caries; Er:YAG lasers; interview; qualitative research

Introduction

The incidence of dental caries has decreased in recent decades in Sweden and other Western countries (1, 2) but is still a disease that affects the majority of the population (3). Caries disease is treated by influencing the factors that cause the disease, diet and bacteria and by strengthening the factors that protect the teeth (4). Fluoride treatment is the most effective way to prevent both new caries lesions and enamel lesions from further progressing (5–7).

In cases with larger caries lesions, damaged enamel and dentine have to be removed and the tooth restored. The use of rotating instruments (conventional drilling) is the most common method for removing caries. The method is well known to dental professionals, is efficient and fast and teeth treated with this technique have a good prognosis (8, 9). However, there are also disadvantages with the method: risk of overpreparation, even sound dentine is easily removed, the pulp could be adversely affected by vibrations, and heat from the bur and drilling is painful (10). These negative consequences have been the main reasons for seeking alternative ways to remove caries. Examples of such methods are air-abrasion, sono-abrasion, chemo-mechanical methods (11, 12) and lasers (13).

On the late 1980s, the Erbium:YAG laser was introduced (14). The combination of water with a pulsed laser beam did not give significant

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pulp temperature changes (15). It has been shown that Er:YAG laser ablated carious dentine effectively with minimal thermal damage to the surrounding intact dentine and removed infected and softened carious dentine to the same extent as the bur treatment (13, 16). However, a longer treatment time was required for the laser technique (13, 16). Treatment with laser seems to be preferable from a patient perspective because 80% of adult subjects rated conventional preparation as more uncomfortable and 82% indicated that they would prefer the Er:YAG laser preparation for future caries treatment (17). It has also been found to be favourable for children. In a study by Liu *et al.*, (18) 82% of the children felt no pain at all with laser preparation and 92% of the children preferred laser for future caries therapy.

Previous studies have used questionnaires to describe patients' experience of treatment with Er:YAG laser. Research in dentistry has predominantly been quantitative in nature (19). So far, there is no study that has used qualitative method and in-depth interviews to examine patients' experiences and feelings after they have undergone caries excavation with laser. Because the knowledge of patients' opinion about laser treatment still is limited (20), an interview study could contribute to reducing the gap in knowledge. Therefore, the aim of this study was to obtain, explore and interpret a deeper understanding of patients' experiences and perspectives after they have experienced dental caries treatment with Er:YAG laser technology.

Material and method

The study was approved by the ethics committee at the Faculty of Medicine, Uppsala University. Informed consent was obtained from all informants before start of the study. For informant younger than 18 years, consent was also obtained from their legal guardians.

Study population

A total of 12 patients aged 15–30 years who had undergone at least one caries excavation with laser were invited to participate in an interview study. The patients were selected strategically with the purpose of obtaining variation in the data. Thus, subjects of both sexes, of different ages and with varying experience of dental care were chosen. The patients had been treated at one of three dental clinics within the Public Dental Service in Uppsala County, where one therapist at each clinic used laser technique.

Interviews

Patients were interviewed two weeks or later after treatment with laser. The first interview was performed by a dentist (PG) and the remaining eleven interviews by a dental hygienist (EH), both experienced in qualitative studies. The interviewers used a semi-structured interview guide with questions about the informant's background, experience of dental care, dental health, the experiences associated with laser treatment

and thoughts about the future. The questions allowed the interviewers to address the topics in the guide in a relaxed conversational style. As the informants expressed new views during the interviews, the interview guide was adapted to these new perspectives. All the interviews were tape recorded and transcribed by a transcription agency. The interviews were performed in Swedish, transcribed in Swedish, and the analysis was conducted with the Swedish text as a basis. A professional translator translated the quotations used in this article from Swedish into English.

Ethical aspects

The informants were given the opportunity to cancel their participation without having to give specific reasons. Neither of the interviewers was involved in the treatment of the informants. The location of the interviews was chosen by the informants, and it took place at a neutral place such as a library or an office. This meant that the informants could more easily talk about their experiences of treatment and the interviewer had an opportunity to get a more correct view of the informants' feelings and experiences.

Analysis

The transcribed text was analysed using manifest and latent qualitative content analysis according to Graneheim and Lundman (21). They state that both manifest and latent content analysis deal with interpretation, but the interpretations vary in depth and level of abstraction. The *units of analysis* were 12 whole interviews, each of which lasted 20–30 min. The units were large enough to be considered a whole and small enough to be possible to bear in mind as a context for the *meaning unit* during the analysis process. All authors independently read through each interview several times to obtain an overall understanding. Two authors (RS and PG) continued the analysis by further condensing the meaning units to form codes, which can be described as labels for the meaning units with the aim of disclosing new and different aspects. The codes were then sorted into subcategories (threads of meanings) and clustered into categories. Trustworthiness of the study was expected to be achieved by evaluating the process of sampling and analysing data. Credibility was reached by choosing interviewees who have own experience of the studied phenomena, including enough participants and presenting deviating cases. Structured recording of data and using direct quotations strengthen the dependability. Transferability describes the extent to which the results could be transferred to another groups and was achieved by a careful description of the studied context and analysing process. In addition, the comparisons with other studies increase the transferability.

Results

Of the twelve individuals interviewed, 7 were female and 5 male, all between 15 and 30 years of age (median 20.5 years).

All had experienced caries treatment with laser, and 10 of them had also experienced caries treatment with conventional drilling. The categories in this study were identified as choosing laser, understanding laser, encouraging dental care and my oral health. Subcategories were found in all categories (Table 1).

Choosing laser

The subcategories in this area were initiative, dental fear as a motivating factor and experience of drilling as a motivating factor.

Initiative

The initiative to the laser treatment was often described as having been taken by the dentist.

The dentist was the one who asked me if I found getting fillings unpleasant ... then she suggested laser and I thought it was a good idea (Interview 5).

Other participants stated that they asked for laser treatment themselves.

I read about laser in the paper ... and it sounded great. So when I went to my regular dentist and they said I had cavities that needed filling, I said I wanted laser... but they wouldn't let me. They said it wasn't good and wasn't an option ... but I nagged and was really firm and said I didn't want ordinary fillings ... so in the end they sent me here (Interview 1).

The informants described the dentists' role as initiators for treatment and willing or unwilling facilitators.

Dental fear as a motivating factor

The motivating factors for laser treatment were described as dental fear in general, specific fear of needles or discomfort with the drill.

I'm scared to death of the dentist ... I had lots of cavities as a child, and I don't go to the dentist unless I really have to (Interview 9).

Table 1. Subcategories and categories identified during the analysis process

Subcategories	Categories
Initiative	Choosing laser
Dental fear as a motivating factor	
Experience of the drill as a motivating factor	
Concrete description	Understanding of laser
Attitude	
Feeling	
Response and participation	Encouraging dental care
Laser in the future	
Fresh and good looking	My oral health
Healthy	
Own responsibility	

Some informants expressed fear for drilling although they had never experienced drilling.

I had never had a filling before ... they told me I had a cavity and I started thinking about drilling and all that. Then she mentioned that that maybe we could do it with laser. And what I thought was just that laser sounded good (Interview 3).

Experience of the drilling as a motivating factor

Several participants had negative previous experiences of drilling. Their descriptions were sometimes detailed, showing exactly what was difficult. Others just had a diffuse, uncomfortable feeling.

It's the sound that like goes right into my head. The metallic sound. And then there's the big drill that sounds a little lower and the sharper drill that sounds higher. I don't know which I hate more. They're equally awful (Interview 12).

Some informants also expressed a fear that something terrible might happen. In contrast to several descriptions of fear of drilling, other informants had the opinion that drilling was neither good nor bad.

I don't have many fillings. But I didn't have any memory of the drilling being bad (Interview 8).

Understanding laser

The subcategories in this area were concrete description, attitude and feeling.

Concrete description

The description of laser was precise and covered many details such as sound, smell, taste, treatment time, pain, aesthetics, protection and security. During treatment, a burnt, strong and strange smell was experienced. One informant felt a strange taste during treatment. The sound was described as a ticking, rattling sound like popcorn. Many of the informants were not disturbed by the sound, while others described it as scary and noisy.

Well, it is a bit noisy, it kind of shoots right through you, I can't really explain it, but it isn't the kind of thing that scares you, really (Interview 2).

Some informants thought that the laser treatment took less time.

I guess it doesn't take as much preparation ... my feeling is that laser is quicker. It's simpler. Kind of a simpler alternative (Interview 6).

Those who felt that the treatment took a long time thought it was worth it. One thought that the reason for the longer time was that the dentist was working slowly. Some participants experienced the laser treatment as painless, while others explained that the laser treatment hurt sometimes, depending on the chosen energy level or depth of the cavity.

I didn't feel a thing and it was a good experience (Interview 6).

One thing was that it hurt quite a bit, but I think that depended on the level they used, I don't know what it's called, but they could change the frequency or whatever..... (Interview 5).

The informants said that protective goggles gave a sense of security and it felt fair, given that everyone wore goggles.

Attitude

A positive attitude to laser technology was expressed, especially by those who had tried drilling in the past. Laser treatment was considered to be taken more seriously by the dentists, and all parts of treatment were better thought out, and the technique was more precise. The positive attitude to laser was based on laser as a new technology.

I like new technology ... I'm really in favour of new technology, they wouldn't have used laser unless it was better (Interview 8).

I think they somehow take laser treatment more seriously than regular treatment ... I really felt like they had thought it all through ... in a way it also felt more accurate (Interview 5).

Feeling

The participants described a positive feeling about the laser treatment, and they felt safe and able to relax during the treatment. Another informant expressed the feeling that the filling made with laser was significantly more appealing aesthetically compared with a filling made by conventional drilling.

I was thinking, like, God how good, why how come I didn't know about this earlier ... the next time if there is a next time it will definitely be laser. The results looked a lot better, it took no time at all, and I didn't feel a thing (Interview 7).

Most informants declared that they were willing to invest more money or time to get laser treatment.

Encouraging dental care

The subcategories in this area were response and participation and laser in the future.

Response and participation

To obtain information about treatment and to have an influence as a patient during treatment were of great importance and had incredibly positive impacts on the overall experience of treatment. Most informants expressed that it felt good to get information during laser treatment.

I felt secure and calm and they were, like, pedagogical. What I thought was that the people in the room looked after me a lot better ... than other dentists. They told me what they were doing, and what tools they were using... (Interview 12).

The treatment was perceived more positively when the informants were praised. It was important that the dentist gave a sympathetic impression and cared about the patient.

I thought it was nice, maybe less because I was interested in what was going on than because I noticed that she cared about me knowing what was going on... that she actually communicated and wanted me to find the whole situation pleasant (Interview 4).

Patients' participation in treatment affected the experience of treatment. One informant with dental fear described the laser treatment as pleasant because she could influence the treatment.

Anyway, it was easy, we could have a break whenever I wanted ... if I just raised my hand they gave me a chance to catch my breath (Interview 2).

Laser in the future

The informants seemed to have a strong belief in laser as a future technology and said that they would choose laser if they had to repair their teeth in the future.

In the future I hope I won't have to have any fillings ... but if I do, I'll choose laser again (Interview 6).

My oral health

The subcategories in this area were fresh and good looking, healthy and own responsibility.

Fresh and good looking

Most informants felt that teeth affect one's look greatly. It was very important for self-esteem to have fresh breath and good looking teeth.

Teeth are much more in focus It's important to have white teeth to look nice (Interview 9).

One informant thought that teeth were important for the first impression, making a comparison between teeth and shoes.

Teeth are a bit like shoes, when you meet someone for the first time you usually take a peek at their shoes (Interview 2).

Healthy

It was important to have healthy teeth and not to have oral disease. The informants were aware that one's oral health affected one's general health. They described the links between oral hygiene, nutrition and dental health. Some were afraid of losing teeth because their family members had lost teeth due to oral disease.

Teeth are so important, good teeth are a real sign of how your health is and what your life is like otherwise (Interview 12).

One informant's opinion differed from others; he did not think teeth were so important.

If you get a cavity you have to have it filled, but otherwise teeth aren't that important (Interview 6).

Own responsibility

The informants seemed to be aware that they themselves could influence their oral health. They were well aware of the need to use fluoride toothpaste, flossing and mouthwash to keep one's teeth healthy. Some believed that people became more careful and responsible about their oral hygiene after having dental caries and with increasing age.

I think I can have a good deal of influence on my oral health ... if I floss and how I brush my teeth ... there are lots of things I can affect (Interview 5).

Taking care of your teeth by flossing and using mouthwash, I think, is something that comes with age. When I was younger I didn't think my teeth were so important (Interview 7).

Discussion

This study allowed twelve people to share their views on caries treatment with laser. All twelve expressed a positive impression of the laser, and words like 'up to date' and 'future-oriented' were used to describe laser. The informants considered laser treatment as less painful and safer than conventional drilling. The results indicate that patients find laser a feasible and convenient treatment option. The informants often said that it was the therapist who had initiated the laser treatment and suggested it as an alternative to drilling. Few informants stated that they took the initiative to laser treatment themselves. They saw the dentist as either supportive or reluctant.

Because little was known about patients' view of laser treatment, a qualitative method was used in this study. Neither of the interviewers was involved in the treatment of the informants. This means that informants were able to talk honestly and openly about the treatment. Informants were interviewed two weeks or later after treatment with laser to obtain a fair description of the treatment. It is known that informants describe treatment more positively immediately after the treatment is completed compared with their opinion a few weeks later (22).

In several interviews, it appeared that the dentist suggested laser treatment because of patient's anxiety about the drilling or their previous negative experience of drilling. One may ask whether the results would have been different if more patients with no anxiety or negative experiences of drilling had been interviewed after trying the laser method. It should be mentioned that the aim of the study was not to recruit patients with negative experiences of drilling, but it was found that most of the patients who actively chose the laser actually had negative past experiences of drilling. Vibration from the drill,

drill sound, touch of metal and the need for local anaesthesia associated with drilling were the main negative features of the drilling method mentioned in this study. Other studies have shown that patients reported noise and vibration of drill as especially fear provoking (23) and that masking drill noise during dental treatment reduced dental fear and stress (24). Most of the informants in our study were not disturbed by the laser sound, although it was described by some as scary and noisy.

Some informants stated that they had never tried drilling, but had still developed dental fear. These informants may have acquired their dental fear by hearing stories from relatives or friends and were sure that drilling was an unpleasant and painful method in spite of the fact that they had never experienced the method previously. This is in line with studies showing that dental fear can come either through direct exposure to a negative experience, associated with dental treatment, or indirectly through exposure to information from others who have had negative dental experiences (25).

The informants expressed a very positive attitude to the laser. Similar results have previously been reported when patients through questionnaires were allowed to express their opinion (17, 18). In this study, the patients could give a more profound and nuanced description because the interview situation was less guided. The informants interpreted everything that could be a negative characteristic about laser to a positive, while for drilling, the situation was the opposite. Laser was a new opportunity, a new, successful start, and the positive experience strengthened the informant's self-esteem. Success in attaining relevant goals increases self-esteem, whereas failure can decrease it (26). Several informants in this study felt that they were well informed during the treatment and the dentists gave a sympathetic impression and cared about them. Patients' trust in the dentist is essential to making the patient accept and go through with the treatment (27). Having influence as a patient and obtaining information during treatment were of great importance and had an incredibly positive impact on the overall experience of treatment. Our results are in line with other studies that showed that patients would often like to have been talked to more and wanted to be encouraged during dental treatment (28). Knowledge about dental treatment and a respectful approach from the dental staff gave the patients a feeling of security during treatment (29).

The informants in this study felt it was important to have good oral hygiene and fresh looking teeth. The results are in line with other studies showing that brushing with fluoride toothpaste daily is important for the population in Sweden (30). Avoiding oral diseases was a driving force for the implementation of oral hygiene, but even more important was the sense of feeling refreshed and having a good breath.

Previous studies have shown that significantly longer treatment time is required for laser treatment (13, 17, 18). Surprisingly, most informants in this study experienced laser treatment faster than conventional drilling. Those who felt that the laser treatment took more time said that it was worth it or explained that the time was longer because the dentist was slow, not a result of the laser method itself. The duration of laser treatment

appeared to be no problem at all. Our study indicates that laser is not a painless method. Pain is as much a cognitive and emotional construct as a physiological experience. Patients who expect the treatment to be painful, patients with dental anxiety and who feel that they have little control over the treatment report more often that they experience pain associated with treatment (31). Several informants described the shooting pains associated with the laser treatment. The informants' positive attitude to the laser treatment resulted in attempts to explain why it still hurt during laser treatment. Some informants described the depth of the cavity and the dentist's choice of high pulse energies as possible causes of pain. One informant avoided using the word pain as she described laser treatment and used the words shooting pains instead.

It didn't hurt, it just gave me a terrible rushing feeling (Interview 3).

The results of our study indicate that patients find laser a feasible and convenient treatment option. One explanation for the extensive acceptance of laser treatment in this study could be that the informants had great confidence in both the method and dentist.

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