What are the factors that create a positive dental experience for children?

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2019

An independent scholarly project presented in partial fulfilment of the requirements for the degree of Master of Health Science at the Eastern Institute of Technology Hawke's Bay, New Zealand

I declare that the work presented in this thesis, is, to the best of my knowledge and belief, original and my own work, except as acknowledged in the text and reference pages.

Signed Date ..12 December 2019……

Acknowledgements

I would like to acknowledge with gratitude, the support and love of my family – my husband Jason, parents, Larry and Sue, my children Lachlan, Hadley and Charles. They all kept me motivated, and this research would not have been possible without them.

To all my friends and colleagues at the Hawke's Bay District Health Board who in one way or another showed their moral support, thank you. Lastly, I would like to thank the EIT Masters Lecturers for their guidance during the past three years. With a deep sense of gratitude, I acknowledge the encouragement and guidance received from Dr Kathryn MacCallum, Associate Professor, Eastern Institute of Technology, Hawke's Bay.

1.1 Abstract

***Objective*:** To conduct a systematic literature review on the current literature concerning the factors that create a positive experience and are equally effective in reducing dental anxiety for children visiting the dental clinic. The focus was on evaluating what techniques and strategies influence a positive experience for our children.

Method: The study reviewed international peer-reviewed research articles published between 2000 and 2019 in English, which focused on identifying interventions for children older than five years of age, for children visiting a dental clinic. The outcome of this analysis identified factors and techniques which have been adopted and evaluated to have a positive influence on a child's dental experience during routine dental treatment. Studies were retrieved from the PubMed library.

Results: The study identifies key factors that influence the dental experience for children, namely multimedia, colour, parental presence/absence, noise in the dental operatory and animal-assisted therapy**.** The search yielded one hundred and eighty-three studies, of which eleven were considered eligible based on a comprehensive evaluation of these studies based on specific inclusion/exclusion criteria. The included studies produced a mix of techniques and strategies that have been shown to influence the dental experience for children. The role of non-pharmacological interventions and their application to dental treatment has provided varying results in seeking what determines a positive dental experience for children. Five studies were significantly associated with a positive experience. A range of pre-treatment interventions such as animal-assisted therapy and anxiety level evaluation survey were found to have a significant effect on the child's dental experience, however, parental presence/absence technique was not found superior to improving child dental anxiety to other non-pharmacological behaviour management techniques in the dental operatory.

Conclusion: The studies identified a wide range of different interventions resulting in varying outcomes. However, this systematic review highlights and identifies, that there was relatively little application of innovative and new approaches utilising digital technology. Other than audio visual eyewear, there were no other examples of digital or mobile technology used to create a positive experience. This lack of innovation was somewhat surprising and it highlights a significant opportunity for future exploration.

Keywords: children, dental clinic, positive experience, reducing dental anxiety

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AAT: anxiety assessment tool · 19

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GA: general anaesthetic · 8

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NPI: non-pharmacological interventions · 9

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PICOS: population, interventions, comparators, outcomes and study design · 14
PRISMA: Preferred Reporting Items for Systematic Review and Meta-Analyses · 14

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RCT: randomised control trials · 13

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SLR: systematic literature review · 9

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TSD: tell-show-do · 10

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WHO: World Health Organisation · 8

Chapter 2 - Introduction

Importance of Oral Health

The World Health Organisation (WHO) defines oral health as an integral part of a person's general health, wellbeing and quality of life, as the effects of oral diseases goes beyond the oral cavity, being linked to other major chronic diseases such as obesity, cardiac disease and respiratory infections (WHO, 2019). Oral health is a major health issue for all populations and has an impact on all systems of the body. Dental caries, also known as tooth decay, is a common infectious disease where acid-producing bacteria (mutans streptococci) live in the mouth. The causation of tooth decay involves a complex process between biological, social and economic factors, with disadvantaged children and those with a lower social economic status the most vulnerable (Health Promotion Agency, 2015).

In 2006, the Ministry of Health published the Good Oral Health for All, for Life, this report was not only a vision statement but a strategic document presenting action areas for policy work (Ministry of Health, 2006). The report would state that New Zealand has reached a turning point for oral health care with the government investing to strengthened, community-based oral health service. The strategy sets out to ensure oral health services are accessible and responsive to the needs of children.

Tooth decay is the most common preventable disease among children, impacting on a child's ability to learn, their health and quality of life. As a result, it is one of the leading causes of preventable hospital admissions in New Zealand (Whyman, Mahoney, Stanley, & Morrison, 2012). Future work of government will require a genuine response to improve oral health for all populations including Māori and Pacific populations. This is significant, as research shows indigenous children have worse oral health than non-indigenous children (Jamieson et al., 2016).

Alarmingly, hospital admissions for children being treated under general anaesthetic (GA) for tooth decay have increased nationally by 60% since 2004 (Moffat, Foster Page, & Thomson, 2017). The reality is children are undergoing unnecessary surgeries to have rotten teeth removed. The challenge for health professionals is not only the models of care which underpin service delivery, but the recently coined 'neoliberal diet' which consists of sugary drinks and food high in sugar, salt, and fat (Bach & Manton, 2014). The link between sugary drinks and tooth decay is well-researched with evidence in the literature stating an established relationship

between frequency of carbohydrate drink intake and caries activity (Mishra, & Mishra. 2011). Poor oral health is preventable however, prevention must start early with information and education emphasised at any opportunity.

A study by Roguski, Gregory, and McLaren (2015) reported that the success of a positive oral health experience is closely linked to the effective engagement of the dentist and dental staff. The study further identified the importance of the dentist's training and how interpersonal behaviour impacts on the child having a positive experience. Subsequently, participants in the focus groups reported that a positive dental experience impacted on their future engagement with a dentist.

The research related parent's memories of their experience visiting the dentist as a child, for which a dental clinic would be nicknamed the "Murder House". Dallas, Li, Kruse, and McBride-Henry (2015) further reported this common phrase is still widely used today and continues to be reported in much of the research. Similarly, the finding by Bernstein, Kleinknecht, and Alexander (1979) reported these early negative memories could be influenced by the dentist's; behaviour, pain, physical discomfort, anxiety and impact behaviour long into their adulthood.

Therefore, developing an early positive experience is vital to ensure that children continue to return to the dental clinic. Obviously, a positive dental experience cannot always be guaranteed, however developing an environment that can foster this will hopefully support children to develop a positive attitude to the dentist and encourage their return. The environment goes beyond the actual dental activity, but rather a more encompassing view of the whole experience. Based on the findings of Wright and Kupietzky (2014) it can be argued that techniques and strategies used in the practice of child dentistry for behaviour management are also one of the cornerstones of paediatric dentistry. It will require clinical applications that go beyond dental treatment and prevention but towards the application of non-pharmacological interventions (NPI) strategies which prepare the relationship between the child and dentist.

To explore what constitutes a positive dental experience, the research undertakes a systematic literature review (SLR). This review focuses on identifying techniques and strategies which has shown to have made a positive impact on the experience of children. The study draws out key themes that have been adopted in modern dentistry practice, in particular, the study will focus on NPI, widely recognised as the science-based and non-invasive interventions on human health. There are several designations of NPI, such as behavioural interventions, complementary therapies, medical devices to name a few (Ninot, 2013).

The information presented will provide the wider components which impact on a positive dental experience for children, firstly the techniques that minimise dental anxiety, and secondly, behaviour management strategies to improve cooperation during routine dental treatment. It is important that potential motivators and barriers are explored, thus identifying the enablers which create a positive dental experience. The review will draw on evidence-based techniques and strategies identified within the literature and in particular, explore what modern approaches are being adopted in dental clinics to improve the experience for children and minimise anxiety.

2.1 Dental Anxiety and Behaviour

Dental anxiety is defined by subjective or objective fear in a dental setting. Subjective fear is based on feelings and attitudes that have been suggested to the child by others about dentistry, or the child's personal experience. In comparison, objective fear is the response felt because of a prior experience. In the context of the research, dental fear is referred to as the known danger which involves the 'fight or flight' response, on the other hand, dental anxiety is a reaction to the unknown danger (Minja & Kahabuka, 2019). Both terms are relevant in the application of this SLR to under the role of NPI in child dentistry.

Further, dental anxiety is an expected reaction by children undergoing dental treatment due to environmental factors such as the sights, sounds, and sensations of the dental operatory. Additionally, children have a tendency to overpredict the discomfort they may experience during treatment (Hoge, Howard, Wallace, & Allen, 2012). Understanding what works to reduce anxiety is important if a child's behaviour can't be managed, as it is difficult, if not impossible for a dentist to carry out the dental treatment.

It is widely accepted in paediatric dentistry that dental anxiety experienced by children creates a barrier for successful treatment. Considering this, Alsarheed (2011) reported children who have a positive interaction with their dentist are less likely to develop dental anxiety. Therefore, a positive experience from an early age will mean children are more likely to visit the dentist as an adult, resulting in better dental health (Alsarheed, 2011). For that reason, dental professionals need to consider the factors that influence a patient's perceptions, preferences, and fears in order to provide them with quality care in a manner that is comforting and reduces anxiety.

There is mounting research in the area of NPI for patient management, like communicative management techniques such as voice control, Tell-Show-Do (TSD), positive reinforcement, distraction, and non-verbal communication to reduce dental anxiety (Wright & Kupietzky, 2014).

2.2 Innovations for new Behaviour Management and Strategies

Commonly, NPI are used by dentists, with these techniques and strategies having evolved over generations. However, there is little understanding of how modern innovations (such as digital technology) have been integrated into modern dental practice in this context. And yet, little research has been conducted with regards to innovative approaches to support behaviour management during dental treatment. It can be argued that a visionary response is required to meet the needs of the tech-savvy populations who undergo routine dental treatment.

Alternatively, formal pharmacological interventions such as sedation, nitrous oxide, and GA are mostly used for complex dental procedures or behavioural management for children with high levels of anxiety (Anthonappa, Ashley, Bonetti, Lombardo, & Riley, 2017). Encouragingly, it was reported by Law and Blain (2003) and widely supported, that hand-over-mouth, physical restraint, and even voice control are losing societal acceptance.

It is not surprising, surveys conducted with dental professionals found that uncooperative behaviour amongst children is one of the most perturbing problems facing their clinical practice. It needs to be seen that dentists should not only be looking to the evidence and the use of traditional NPI but to also explore innovative approaches.

Notwithstanding, traditional methods have their place, it is vital to explore new interventions that respond to the needs of specific patient groups. With the rise of the digital age, young people are heavy users of tablets, smartphones, and laptops with one in three users worldwide (International Telecommunications Union, 2018). Furthermore, the data showed 830 million young people are online worldwide, of which 320 million, or 39%, live in China and India alone. Digital devices are prevalent in all areas of modern life, however, it is uncertain how digitalisation and rapid adoption of technology have impacted dental practices in minimising anxiety. As innovation is the process of bringing together new ideas, it needs to be considered how new approaches can be applied to routine dental treatment for children.

The direction and goal of the study follows a systematic approach to collect evidence-based data. Therefore, a systematic literature review will explore the research question **'what are the**

factors that create a positive dental experience and equally to explore factors that reduce dental anxiety for children visiting the dental clinic'. Central themes will identify the factors which influence a positive dental experience for children. At the same time, the review will explore a sub-question, to consider the adoption of innovative approaches using digital tools to current practice to support a positive dental experience.

The research will adopt a qualitative analysis of recent articles from 2000 to 2019 that outline a variety of approaches undertaken to manage anxiety. In addition, this study will evaluate how these approaches can minimise dental anxiety and how the use of digital technology can be adopted to contribute to a positive dental experience. The study will consider the techniques and strategies and how they have evolved over the last 19 years and if technology has played a role in the interventions taken to manage the anxiety of children in dental care.

Studies dated from 2000 have been chosen, as the changes in technology have seen environments change. This is reflected in the older and less favourable hand-over-mouth method no longer widely used in paediatric dentistry. Recent shifts and the rise of digital technology provides new opportunities to build supportive environments. Technology is continually changing and with it brings exciting opportunities to explore digital distractions also known as contingent distractions such as; digital eyewear, Smart televisions, and iPads. The decision may depend more on what digital platforms to introduce for tech-savvy patients, rather than the feasibility.

Classic NPI are widely researched but this study explores how the latest approaches with a particular interest in how they have evolved over time and incorporated new technology. Not one review draws all the factors together, therefore studies explore these interventions in isolation. It is evident that the complexity of dental anxiety will require several remedies. This study will draw together the different approaches used in a range of studies to provide a more complete picture of the different approaches undertaken that are proven to impact experiences. The dentist and dental staff can contribute and accommodate these techniques as they are able to play a pivotal role in the dental experience for children.

In summary, the review aims to examine positive interventions for which children are responsive and engaged in their dental care. Thus, accumulating all facets of the journey, from the front door, waiting room, and dental operatory.

Chapter 3 - Methods

3.1 Data Sources and Data Extraction

In this study, the focus has been placed on peer-reviewed research articles that identify influencing factors that impact a positive dental experience for children. These factors will be identified and are presented by critically appraising and synthesising results from eleven primary research studies and one SLR. The key focus will examine a range of techniques and strategies described in the literature. The analysis and summarising of the findings will be presented into key themes.

Accordingly, published literature generated from the SLR provides evidence from randomised control trials (RCT), non-RCT and observational studies. Thus, translating the evidence to factors that influence and promote a positive dental experience delivered by dentists, dental therapists, and dental support staff to children over five years of age.

This SLR uses a systematic and reproducible approach to clearly formulate the research question, with methods used to identify, select and critically appraise all relevant research. It is research in its own right and by its nature, as it is able to address much broader questions than those from single empirical studies (Siddaway, 2014).

3.2 Study Design

Research provided from SLRs has become increasingly important in health care and is considered one of the most reliable types of study as SLRs present at the top of the evidence table, addressing the many dimensions of an intervention (Gopalakrishnan & Ganeshkumar, 2013). Furthermore, the review aims to systematically and exhaustively examine the literature, providing an objective summary of evidence helping to reduce implicit researcher bias.

This research has applied the five PICOS components (explained in 3.3.1) essential in forming the research question, “what are the factors that create a positive dental experience for children and equally to explore factors that reduce dental anxiety for children visiting the dental clinic”. Subsequently, the method helps construct the research question and allows for the correct definition of which information (evidence) is needed to solve the question being researched (Santos, Pimenta, & Nobre, 2007). This process enables search terms to be identified to maximise the recovery of evidence, focus on the scope and avoid unnecessary research.

3.3 Search Strategy

The SLR process undertaken in this review was based on the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) checklist criteria to manage the search and analysis of this study (Moher, Liberati, Tetzlaff, & Altman, 2009). All academic publications were recorded including a detailed summary of authors, publication date and clear description of research methods and questions, including study subjects and outcomes.

The search of the literature found a variety of RCTs, quasi-experimental and observational studies. Notably, a quality assessment tool such as a Cochrane Quality Assessment for SLR has not been applied due to timeline restrictions. However, only reputable journals were included which contained peer-reviewed articles there is an assumption of quality. All studies have been assessed from the PubMed database, a publicly available search interface for other databases such as MEDLINE, making it the premier source for biomedical literature and one of the most widely accessible resources in the world, as a result, medical librarians and researchers depend on this database as a trustworthy sources of quality literature (Williamson & Minter, 2019). Furthermore, the PRISMA and guidelines have been applied to support the study methods.

The process for assessing the risk of bias has been within the systematic review process itself. Additionally, this review was conducted by the author (the research student). Support and guidance were provided by the lead supervisor from the Eastern Institute of Technology (EIT) for which this research was undertaken as part of a Master's Qualification in Health Science. Only full-text publications were included from PubMed, which includes all MEDLINE and non-MEDLINE titles available through the EIT student database. In addition, four studies were sourced by the EIT librarian, of which only two were included in the review (based on later screening). Systematic reviews offer a rigorous and transparent form of research, the approach minimises bias, additionally, it ensures future replicability

Importantly, the focus of the studies extracted would centre on the environment (dental operatory) where possible. It needs to be acknowledged that some trials were conducted in non-clinical environments, considered as a neutral setting such as the participant's classroom. Most of the studies involved a hospital dental clinic and general dental clinics, with two being completed in a school classroom.

3.3.1 Selection Criteria and Process

Study characteristics are shown in the flow diagram **Figure 1 Inclusion and Exclusion Criteria** which explains the selection process for the studies included in the review. Applicability and validity of studies have also been identified, focusing on the PICOS framework; population, interventions, comparators, outcomes, and study design. Studies have not been limited to a particular research design, therefore, studies conducted by both RCT or non-randomised control trials have been included for children visiting a dental professional and the interventions used to create a positive outcome for the child. However, the focus has been on selecting verified, evidence-based studies. In addition, only studies published in English and full text were included in the review.

The search terms used have been presented in **Table 1: Search Terms** which identify participants receiving dental treatment between the age of five years and 14 years of age were considered within the studies. Some studies in the search criteria included children younger than five years of age. The decision to include these studies was on the merit of quality, eligibility and suitability criteria. Trials comparing techniques and strategies for children with complex dental needs would be excluded from the review.

Initially, search results yielded 183 studies from PubMed based on firstly the selection criteria and search terms used. The first selection process included a screening of published titles to remove any duplicates. As a result, two studies were identified as duplications and removed. Secondly, abstracts were read for the remaining 181 articles and screened for suitability. This resulted in the exclusion of 159 studies as they did not fit the search criteria, for which 22 studies would meet the criteria for the screening and eligibility of full articles.

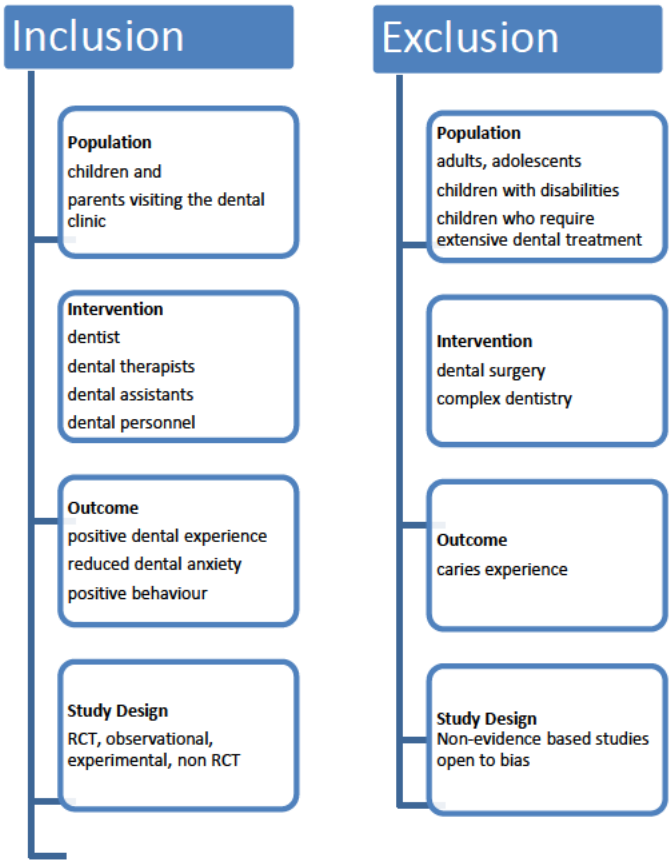

Figure 1: Inclusion and Exclusion Criteria

The PICOS search terms, when applied to the PubMed database in July 2019, identified studies which included children, dental visits, and positive dental experience. Studies have been excluded if they do not include or report the specific outcomes to provide an unbiased selection of studies.

Table 1: Search Terms

Databases	Search terms used	PubMed Search String
PubMed	Child*, dental visit, dental clinic*, positive dental experience, dental anxiety *MeSH term	Search ((((((child? oral health care) AND dental check) OR dental clinic) AND anxiety) OR positive dental experience) AND ("2000/01/01"[PDat] : "3000/12/31"[PDat]) AND child[MeSH:noexp])) NOT caries experience Filters: Abstract; Publication date from 2000/01/01 to current; Child: 6-12 years

PRISMA guidelines have been applied and used to articulate the objectives and formulate the research question using PICOS which are presented below in **Figure 2**. The PICOS method frames

the research question by formulating (P) the population, (I) the interventions, (C) the comparator, (O) the outcomes, (S) the study design) to identify relevant and precise questions.

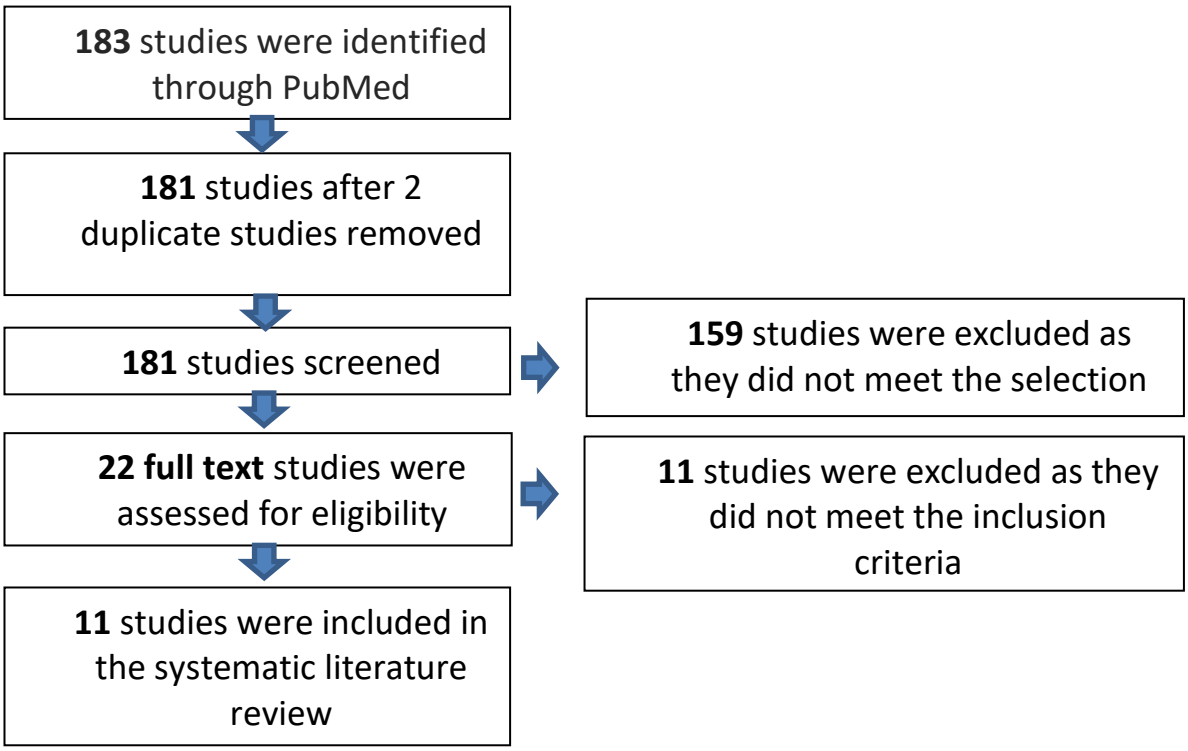

Figure 2: Flow diagram based on the PRISMA guidelines

Exclusion Criteria

Based on the search terms 159 studies were further evaluated and excluded if they targeted the following; i) children with medical conditions or disabilities, ii) children required to undergo dental treatment under GA, iii) treatment which required specialist rehabilitative dental treatment and complex intervention that involved several components. These factors place children in surgical settings and children would be considered highly anxious, further aligning to the research objectives to understanding how to create a better experience for children undergoing routine dental care.

Furthermore, studies were excluded if they included participants of adolescent age and adults. The search parameters for participants age would be targeted to studies which included children over five years of age, however, some eligible studies have included children as young as three. The decision to include these studies was based on study suitability.

3.4 Synthesis of Results

Published studies between 2000 to 2019 were examined if they focused primarily on children over five years of age and did not require complex dental treatment. The majority of 183 studies screened, would explore dental anxiety levels against dental procedures or the health condition of the children, such as a disability or those who are medically compromised. Studies available in the electronic PubMed database were included by using the controlled vocabulary index to find journal articles, including the use of MeSH terms (Medical Subject Headings).

The research findings and conclusions from the set of studies draw on factors that influence a positive dental experience for children. The review provides a narrative synthesis of how the interventions work, such as why and for whom. In short, the synthesis from the variations used in the trials will enable investigation into the similarities and differences in the interventions.

3.5 Ethical Approval

A low-risk research application was completed and submitted to the EIT Research Committee for project approval on the 6th June 2019. The process would determine the risk of the research to ascertain physical or psychological harm to participants. As a result, the research would not require ethical approval by the NZ Health and Disability Ethics Committee

Chapter 4- Results

4.1 Study Selection

Based on the search results publications ranged from 2009 to 2019, with full citation of the eleven studies listed in **Table 2 Included Studies in the Systematic Literature Review.** Of these, the studies settings varied between dental clinics (n=5), schools (n=2), waiting room (n=1), and hospital clinic (n=3). In total, 2208 participants were included in the eleven studies, this includes the systematic literature review which yielded 397 participants across 31 studies. The main inclusion criteria involved children over five years of age, however, some studies included children as young as three years of age, with the eldest study participants being 17 years of age. On average most participants ranged between 6-10 years of age.

The table classifies the articles according to the author, country, age of children involved, setting, method, and the number of participants included in the study. The studies were a mixture of RCT, non-RCT, observational and one SLR. Most of the studies were conducted by dentists and performed across a number of countries; India (n=4), United Kingdom (n=2), the USA (n=2), Middle East (n=1), Europe (n=2).

Table 2: Included Studies in the Systematic Literature Review

1. Birardi, V., & Pasini, F. (2011). Study about the effects of dental noises on the emotional experiences of children aged 6 to 10 years. A pilot study. *European journal of paediatric dentistry: official journal of European Academy of Paediatric Dentistry, 12*, 236-238.
2. Boka, V., Arapostathis, K., Charitoudis, G., Veerkamp, J., van Loveren, C., & Kotsanos, N. (2017). A study of parental presence/absence technique for child dental behaviour management. *Eur Arch Paediatr Dent, 18*(6), 405-409. doi: 10.1007/s40368-017-0313-9
3. Hoge, M. A., Howard, M. R., Wallace, D. P., & Allen, K. D. (2012). Use of video eyewear to manage distress in children during restorative dental treatment. *Pediatric dentistry, 34*(5), 378-382.
4. Kuscu, O., Caglar, E., Kayabasoglu, N., & Sandalli, N. (2009). Preferences of dentist's attire in a group of Istanbul school children related with dental anxiety. *European Archives of Paediatric Dentistry, 10*(1), 38-41.
5. Mishra, G., Thakur, S., Singhal, P., Ghosh, S. N., Chauhan, D., & Jayam, C. (2016). Assessment of child behavior in dental operatory in relation to sociodemographic factors, general anxiety, body mass index and role of multi-media distraction. *Journal of Indian Society of Pedodontics and Preventive Dentistry, 34*(2), 159.

6. Muppa, R., Bhupatiraju, P., Duddu, M., Penumatsa, N. V., Dandempally, A., & Panthula, P. (2013). Comparison of anxiety levels associated with noise in the dental clinic among children of age group 6-15 years. *Noise and Health, 15*(64), 190.
7. Nammalwar, R. B., & Rangeeth, P. (2018). A bite out of anxiety: Evaluation of animal-assisted activity on anxiety in children attending a pediatric dental outpatient unit. *Journal of Indian Society of Pedodontics and Preventive Dentistry, 36*(2), 181.
8. Pati, D., & Nanda, U. (2011). Influence of positive distractions on children in two clinic waiting areas. *HERD: Health Environments Research & Design Journal, 4*(3), 124-140.
9. Umamaheshwari, N., Asokan, S., & Kumaran, T. S. (2013). Child friendly colors in a pediatric dental practice. Journal of Indian Society of Pedodontics and Preventive Dentistry, 31(4), 225.
10. Yee, R., Jones, L., & Hosey, M. (2017). What the child "SAID" to the dentist: A UK randomized controlled trial. Child: care, health, and development, 43(6), 926-932.
11. Zhou, Y., Cameron, E., Forbes, G., & Humphris, G. (2011). A systematic review of the effect of dental staff behaviour on child dental patient anxiety and behaviour. Patient Education and Counselling, 85(1), 4-13. doi: https://doi.org/10.1016/j.pec.2010.08.002

4.2 Study Characteristics

Further analysis of included articles identified the specific techniques and strategies that create a positive dental experience for children who present at the dental clinic for routine dental care. The rating for the studies has been ranked by; (0) which summarises studies with inconclusive outcomes, (-) which represents a neutral response towards the interventions by participants (neither positive nor negative), and positive outcomes feature the (+) rating, which indicates interventions have had a successful result, with a varying degree.

Table 3 Study Characteristics of included studies provides a further analysis of key factors that influence the dental experience for children, namely multimedia, colour, parental presence/absence, noise in the dental operatory and Anxiety Assessment Tools (AAT)**.** The table highlights the common interventions and techniques from mostly primary studies (n=10) and one SLR.

The analysis showed the most common intervention was contingent distractions techniques, a method designed for children who are not cooperating in the dental clinic or a child who presents with dental anxiety. Methods would include the use of audio-visual distractors (n=6) and Smart television (n=1). Three studies using pre-treatment anxiety methods; AAT, parental presence/absence, and the anxiety tool eSAID (electronic scale for anxiety and information for dentists), all of these studies were published in 2017 and 2018.

The provision of dental care treatment was provided by mostly dentists in general dental clinics. Based on these key factors, three themes were acknowledged namely pre-treatment, dental personnel, and contingent distractions. The following chapter will discuss each theme in detail.

Table 3: Study Characteristics of included studies

Reference	Country	Factors	Intervention	Method	Outcomes/Results	Setting	Positive Experience
(Mishra et al., 2016)	India	Multimedia	Dental behaviour, social demographic factors, and the role of multimedia as a distraction.	One group, children and parents.	Child behaviour in the dental operatory – however gender, socioeconomic factors, general anxiety, BMI and multimedia does not show any significant association with the child's behaviour. The study gave little detail on what and how the multimedia was used in the study.	Hospital clinic	0

(Nammalwar & Rangeeth, 2018)	India	Animal-assisted therapy	Comparative anxiety control trial using animals to benefit child behaviour in waiting/operatory areas.	One group of children.	A first of its kind study showed pet therapy was a promising method of reducing dental anxiety in children. Challenge for implementation such as trained dogs, and health care which requires stringent infection control standards.	Dental clinic	+
(Umamaheshwari, Asokan, & Kumaran, 2013)	India	Colour	Colour therapy to impact a positive experience associated colour and emotions.	Two groups by age range	Participants identified yellow (cheerful) as the preferred colour which could enhance a positive dental attitude and experience for children, closely followed by the colour blue (calming).	Hospital clinic	0

(Muppa et al., 2013)	India	Noise	Examine anxiety levels associated with noise in dental clinics.	Two groups by age range, a survey on feelings towards dental noise.	The result showed noise produced in the dental clinic is anxiety-provoking and significantly contributes to the avoidance of the dental clinic, children self-report audio-visual distraction would better support experience.	Dental clinic	0
(Boka et al., 2017)	Greece	Parental presence	Effects on the parental presence on a child's behaviour in a dental setting.	Two parents' groups, controlled and experimental, parents present/absent in operatory.	Results showed no advantage of parental presence however, children reported a more positive experience in the presence of their parents.	Dental clinic	0
(Pati & Nanda, 2011)	USA	Smart TV	Five distraction conditions randomly used in the waiting room.	Two children's waiting rooms, dental and cardiac using visual-auditory distractions	Positive distraction in waiting rooms is significant to improve the waiting room experience, thus reducing anxiety pre-dental treatment and a calmer behaviour.	Waiting room	+

(Kuscu, Caglar, Kayabasoglu, & Sandalli, 2009)	Turkey	Attire	Examine if dental professionals' attire is appropriate for anxious children.	Two groups at two schools, survey on various attire.	Children preferred the formal attire of dentists, however, if children were highly anxious about the treatment, they preferred the 'child-friendly' attire.	School	+
(Birardi & Pasini, 2011)	Italy	Noise	Dental noise as a reaction increases dental anxiety.	One sample group, listening to recorded dental drills in a neutral setting.	The noise of the dental environment did not impact on the participant's anxiety level however, the report recommends the transformation of TSD to include tell-show-do-**listen,** include a listening moment.	School	+
(Zhou, Cameron, Forbes, & Humphris, 2011)	UK	Dental staff behaviour	Effects of dental staff behaviour on the anxiety and behaviour of child dental patients.	SLR of studies on the effects of dental staff behaviours that reduce dental anxiety.	Findings reported 31 publications on the effects of dental staff behaviour on the anxiety and behaviour of child dental patients.	Dental Clinic	-

(Hoge et al., 2012)	USA	Visual eyewear	Evaluate the effectiveness of visual eyewear in reducing disruptive child behaviour.	Two groups of children, experimental and controlled using eyewear during treatment.	Children wearing eyewear demonstrated less disruptive behaviour, including reduced appointment length.	Dental clinic	+
(Yee, Jones, & Hosey, 2017)	UK	eSAID	Examine whether eSAID benefited children and they were more satisfied with their dental visit.	Two groups of children, experimental and controlled in survey pre-treatment.	Results showed no effect on the benefit, satisfaction, and cooperation of the children however, the report found that it had an impact on pre-treatment anxiety. Children self-reported they liked that they could ask questions during treatment.	Hospital clinic	0

(+) significant improvement in the measured outcome of the interventions
(0) insignificant improvement in the measured outcomes between the intervention and the participants
(-) no measure/outcome reported

Chapter 5 - Synthesised Findings

This section presents a further analysis of the findings by using a thematic analysis to identify techniques and strategies which are underpinned in three key themes; pre-treatment interventions, dental environment, and contingent distractions or escape **(see Table 4: Techniques and strategies for a positive dental experience for children)**. Further, the studies offer a range of methods with interesting findings in the studies which use NPI approaches which can be considered the future for clinicians. All these methods required no special training or equipment.

Dentists have used a variety of NPI over the decades. This is evident in the results, as only a small portion of the techniques and interventions are used simultaneously by dentists. Further to this Coles et al. (2017) reported a growing consensus that when evaluating the impacts of interventions, the important questions such as "what works, for whom, and in what circumstances" was a key strategy in paediatric dentistry.

Published articles included in the review found a range of interventions that can impact on a child's dental experience. Studies considered dental anxiety levels and what strategies can be introduced to help children overcome fear, whether it is subjective or objective. Some of the themes identify techniques used from the first contact in the waiting room to the dental operatory, revealing the characteristics which have the ability to reduce anxiety, thus an agreeable experience for children.

Importantly, the research which resulted in a positive outcome for the child's dental visit is linked to pre-treatment questions or dental anxiety assessments, such as the use of questionnaires to determine the source of the child's anxiety. This would enable the dentist to decide on the appropriate treatment plan for the child. In addition, negative outcomes could be triggered by encounters with dental personnel before they reach the dental chair.

The management for first entry into the dental office is an essential first step and is a key factor in creating a positive dental experience for children. The next section will provide an in-depth discussion of these themes alongside the articles which they are covered.

Table 4: Techniques and strategies for a positive dental experience for children

Non-pharmacological Themes	Birardi and Pasini (2011)	Boka et al. (2017)	Hoge et al. (2012)	Kuscu et al. (2009)	Mishra et al. (2016)	Muppa et al. (2013)	Nammalwar and Rangeeth (2018)	Pati and Nanda (2011)	Umamaheshwari et al. (2013)	Yee et al. (2017)	Zhou et al. (2011)
Pre-treatment interventions		√ parents					√ Animal Therapy			√ eSAID	
Dental environment aspects	√ noise levels			√ attire		√ noise levels			√ colour		√ staff
Contingent distractions			√ visual eyewear		√ multi media			√ Smart TV			

5.1 Pre-treatment Interventions

The following interventions need to be considered as first response techniques in managing child behaviour and understanding a child's dental anxiety before children enter the dental operatory. As reported in a Sri Lankan based study by Andaleeb (2001) which highlighted patient satisfaction as an important measure of service quality in healthcare. Study findings identified that the patient's perceptions of the healthcare they receive are largely ignored by healthcare providers.

Anxiety Assessment Tools

One factor that seems to make a significant impact is the dentist's pre-treatment knowledge of the patient's anxiety. When applied, techniques that use questionnaires to assess anxiety levels were seen to impact on clinical decisions, it would appear that it is an important non-pharmacological tool for dentists (Yee et al., 2017).

Similarly, the passive technique, eSAID reported in the study by Yee et al. (2017) would allow children to tell the dentist about their feelings. This supportive method enables the dentist to provide better support to the child, in turn assisting with coping preferences. The finding provides limited evidence for eSAID as a single tool to create a positive experience, though the results showed it did impact on a child's pre-treatment anxiety. However, the approach provided little change in the child's behaviour or impact on the child's satisfaction or cooperation during treatment.

Furthermore, Yee et al. (2017) reported rich data from the qualitative study, as participants wanted to know if the procedure would be painful, they wanted to talk about their experience, some wanted to know if they were healing or if their dental disease was 'cured'. This further endorses the finding discussed further in this sector by Birardi and Pasini (2011) that techniques such as TSD need to consider 'listen' as a gap in this method.

Animal Assisted Therapy

Many healthcare facilities, including hospitals and eldercare facilities, have introduced animal-assisted therapy (AAT) to improve the health of patients or residents. However, this successful type of therapy comes with challenges such as infection control, patient allergies, fear of animals, bites, and the risk of zoonotic disease transmission. The study by Nammalwar and Rangeeth (2018) showed success in the use of AAT, however, the study identified the lack of trained dogs in healthcare settings and a lack of staff qualified to deliver the intervention were significant challenges.

Authors, Nammalwar and Rangeeth (2018) adopted the applied science of AAT in a study with 20 children in a dental care facility in Chennai. This known technique of using animals to support human problems was the first of its kind to be conducted in a dental clinic. Interestingly, this biophilia hypothesis is based on the premise of human attachment, and human interest in animals is strongly linked to human survival (Cole & Gawlinski, 2000). In short, a number of studies show AAT has promising results in reducing stress hormones and increasing endorphin levels within healthcare settings (Odendaal & Meintjes, 2003).

Parental Presence/Absence

Poor child behaviour is largely expected by dentists in paediatric dentistry as reported by Boka et al. (2017) as it is largely associated with the fear of the dental treatment and the apprehension of

the child. Interestingly, the study would report parental presence/absence (PPA) in the dental operatory showed no advantage over other basic, NPI such as hand-over-the mouth technique.

The PPA method was reviewed by The American Academy of Paediatric Dentistry in 2015, it reported that the use of parental presence continues to be endorsed by dentists and parents, noting its success in paediatric dentistry if applied in an empathetic way. However, studies have suggested that PPA is better suited for younger children who are experiencing their first contact with the dentist.

Furthermore, dentists stated a preference in treating children when parents are absent, they explained that children were more compliant and cooperative. In contrast, research suggests that there is a growing trend for parents to be present during routine dental treatment, particularly for younger children (Boka et al., 2017).

5.2 Dental Environment

The treatment triangle known in paediatric dentistry features three key components; the dentist, dental staff and dental environment, such as the waiting room. As explained by Wright and Kupietzky (2014) in their book written in two parts to support and guide paediatric dentists, which provides information to better understand children's behaviour, techniques and methods to promote cooperative behaviour of children in the dental operatory. The book noted that young paediatric dentist and new graduates do not consider the importance of these key components, in particular the office environment.

The patient experience, and consequently satisfaction is an important outcome for health professionals. One of the approaches is the effect of attire on the patient experience. Additionally, it has been shown to influence how patients perceive the care and how willing they are to trust the health care provider (Petrilli et al., 2018)

Attire

Children who have been exposed to a poor dental experience, or similarly, a surgical procedure involving the professional clothing worn by a dentist, may transfer the experience or fear from one situation to another (Wright & Kupietzky, 2014). Minimising the stressors for children will influence both the child and the dentist.

Kuscu et al. (2009) noted there are many variables that influence a child's dental anxiety but highlight that the dental professional's attire significantly contributes to a positive experience. It would also acknowledge that dentists who considered their selection of attire would be a reflection of their empathy as a dentist. Dental attire has the ability to evoke different feelings from children according to the appearance of staff in the dental operatory.

Child-friendly attire like coloured attire and popular cartoon characters are more appealing to children, especially for the uncooperative, this would be more so for anxious dental patients. These findings confirmed the connection between dental attire and dentally anxious children. The study would question 827 children as to their preference of dental attire and if they considered it important in their dental experience (Kuscu et al., 2009).

Furthermore, the study would dispel the view that children were fearful of white coats. The results showed that children preferred the formal attire (45.6%) such as lab coats over other formal attire worn by a dentist (Kuscu et al., 2009). However, if children were highly anxious about the treatment the child-friendly attire was considered more appropriate since it enhanced the first communication with the dental operator.

Dental Staff Behaviour

Zhou et al. (2011) reported the behaviour of dental staff would have the ability to encourage the cooperation of anxious children. They found that it was a common theme across the majority of the studies they included in the SLR (n=31). Furthermore, the study reported that communication strategies such as permissive, personal and empathic styles, adopted by dentists significantly impacted on a child's anxiety. Empathic communication approaches were favoured by participants, resulting in reduced anxiety and bringing about a better mood in the child (Zhou et al., 2011).

The study reported in general that reducing the child's anxiety not only required empathic communication but appropriate physical contact such as patting the child's upper arm or shoulder, explanation and positive reinforcement. Furthermore, it reported the dentist's clinical behaviour affects a child's dental anxiety, understanding what techniques and strategies support the child will impact on their behaviour, resulting in treatment success.

Management of Dental Anxiety

Dental anxiety in children was found to be the third most common reason that children did not attend dental appointments and visiting the dentist would rank as the most commonly feared situation (Dallas et al., 2015). This is important and considered a key aspect in the study by Muppa et al. (2013) which studied the effect of noise in the dental clinic and to explore whether dental anxiety is aroused by dental equipment.

Notably, 38% of the participants in the study reported noise heard from the waiting room made them anxious. Similarly, Hoge et al. (2012) reported much of the stress exhibited by children is created by the unusual and sometimes unpleasant sights and sounds in the dental operatory. Results may present bias as the research was conducted in a school setting that does not capture and mirror the stimuli of a dental operatory. Therefore, the setting in which the research was conducted could impact study results as the participants would be considered more relaxed in familiar surroundings amongst their peers.

Birardi and Pasini (2011) reported that dental noise caused an anxious reaction from the study groups. The findings showed dental stimuli created a negative sensation or emotion in most of the participants. Another essential point of the study was to explore the TSD method, a widely accepted technique used in children's dentistry. The TSD method involves verbal explanations of dental procedures, in phrases appropriate to the developmental level of the child. The study concluded that the effects of dental noise would have an emotional impact on a child's experience. Authors Birardi and Pasini (2011) recommend the method should include 'listen' as dentists would be able to demonstrate the noise of the drill. Interestingly, children in the study would self-report and recommend audio-visual distraction as a tool to reduce dental anxiety.

5.3 Contingent Distractions

Behavioural scientists refer to contingent distractions in two parts; contingent distraction and contingent escape. Both are designed to support and calm a child who is not cooperative in the dental chair (Kuhn & Allen, 1994). Traditional methods have seen dentists use distractors such as audio systems with earphones, television and videotapes, with the advantage that children can select their favourite program or music.

Evolving methods like age-appropriate apps are now more readily available in the digital age with hand-held music players, video games digital eyewear and multimedia screens (Wright &

Kupietzky, 2014). However, only three examples were found in this SLR using contingent distractions for the management of child behaviour during routine dental treatment.

Smart Televisions

Waiting is an integral part of the healthcare experience with the amount of time patients wait varying. Research shows there is common agreement that the experience is long, uneventful and stressful (Pati & Nanda, 2011). Modifying and designing how patients spend their waiting time will require consideration to create a more positive healthcare experience. Importantly, the dental waiting room can influence the perception of quality care and those that provide healthcare.

As reported by Pati and Nanda (2011) the attractiveness of the waiting room is shown to be significantly associated with higher perceived quality of care, less anxious patients and an increase in the interaction with staff. Subsequently, the data analysis of two types of waiting rooms (paediatric dental and cardiology) showed that the introduction of distractions via Smart television was associated with calmer behaviour. The study reported less fine and gross movements, suggesting the distractions had a calming effect on children in the waiting room. In conclusion, the overall benefits of using visual-auditory distraction on Smart televisions in the waiting room proved to be a positive factor.

Colour for Dental Anxiety

Colour is considered to be one of the most immediate methods of conveying messages and meanings. Ulrich et al. (1991) would report colour choice stimulates and works synergistically with all of the senses. Likewise, the study by Umamaheshwari et al. (2013) reported that the colour used in the dental clinic impacted a child's mood. This is amply supported in the findings by Pruyn and Smidts (1998) that the adverse effect of waiting can be appeased by creating an attractive waiting room environment, rather than shortening the objective waiting time.

This finding needs to be considered relevant for anxious or restless children as they wait to be seen by the dentist. While Pruyn and Smidts (1998) suggest the waiting area plays a key role in the overall health experience for the patients, the key would be the details of the attractiveness and use of colour.

The review by Pati and Nanda (2011) quoted research by Ulrich et al. (1991) which he defined a positive experience as the "environmental feature that elicits positive feelings and holds attention without taxing or stressing the individual, thereby blocking worrisome thought". The results showed that children value and favour colour in a dental environment and preferred colours which they felt were best suited to the surrounding in the dental clinic. Interestingly, 44% of the participants in the study (n=132) identified yellow as the preferred colour to enhance a positive dental attitude and experience, closely followed by the colour blue.

Digital Eyewear

The unpleasant distress exhibited by children during dental treatment is created by the unusual and sometimes unpleasant sights, sounds and sensations of the dental operatory. Research conducted in a dental clinic by Hoge et al. (2012) reported a significant difference in the children from a randomised group who wore digital eyewear glasses compared to the experimental group who wore regular sunglasses. The use of digital eyewear refers to a lightweight, goggle-like set of glasses than connects to media providing private viewing. The effect of digital eyewear works to distract (contingent escape) children by engaging them in salient visual or auditory activities.

Results showed children in the control group were 22% more disruptive, whilst children in the experimental group using digital eyewear were disruptive only 14% of the time. Children in the experimental group would report more satisfaction with their eyewear than those in the control group who were wearing the regular sunglasses. Hoge et al. (2012) reported that digital eyewear is widely available and relatively inexpensive. Therefore, considering the cost and improved productivity the intervention has economic benefits for the dentist.

In another study, Mishra et al. (2016) assessed the effects of socio-demographic factors, general anxiety, body mass index, and the role of multimedia distraction on child behaviour. They found the relationship between children visiting the dental clinic with high anxiety could be the lack of dental health education. Resulting in the compliance and the child's attitude towards the dental clinic and staff. The overall conclusion was there is no significant association of age and treatment procedure rendered on child behaviour in the dental operatory.

In addition, the report would state that multimedia did not show any significant association with child behaviour in the dental clinic. However, the study did not provide clear detail of the exact role of multimedia in the study design. Further, the study was limited in the type of participants

used in the trial, as they were not a random sample of patients, rather patients reporting for the first time.

To sum up, NPI undoubtedly have their place in the dental office, for which they are applied or modified will be the challenge for dentists. This is important as millennials are fast entering their parenthood years with both parent and child exposed to the digital age. Millennials were the first generation to grow up with the Internet and mobile phones, their defining characteristics has been their affinity with the digital world, undoubtedly setting them apart.

This review has identified the gaps in innovative approaches in the dental operatory. It will require further research to understand the new techniques and strategies which can be applied to create a positive dental experience with the use of technology.

Chapter 6- Discussion

It was theorised by Rosenthal and Jacobson (1968) in their book Pygmalion in the Classroom where the Pygmalion effect or the Rosenthal effect is the phenomenon whereby others' expectations of a target person affect the target person's performance. For example, if teachers expected an improved performance from a child then positive expectations will influence a positive and enhanced performance.

On this basis, the theory shows attitude or expectation from dental personnel can affect the outcome of an appointment as children respond to the type of behaviour expected of them. This is important as the patient journey from the front door will impact on the experience. Lee and Lee (2014) reported that children are more likely to participate in activities that are adaptive, both for them and those around them.

The aetiology of dental anxiety in children is multifactorial and difficult to manage with no monotherapy for the management of patients with dental anxiety (Appukuttan, 2016). With the proper evaluation of the patient and determining the source of anxiety, it can enable the dentist to decide an appropriate intervention to create a positive dental experience. These environmental factors are prevalent and show positive responses from participants in the study. Even though the study involved adults the techniques and strategies show similarities to methods used in paediatric dentistry.

6.1 Effectiveness of Pre-treatment Interventions

Children's dental treatment should be individualised with the consideration of the dentist's experience, expertise, child's understanding, age and the child's level of anxiety and cooperation (Appukuttan, 2016). In question, tools such as eSAID have been identified as an underutilised method for anxiety management in the dental office (Yee et al., 2017). This low cost and effective approach have seen results in reducing dental anxiety as it builds rapport with the child and fosters the dentist and patient relationship. One possibility could be the integration of eSAID onto a digital device such as an iPad.

Another pre-treatment intervention that showed a significant impact in paediatric dentistry was the use of ATT. Without doubt, this complementary type of therapy involving animals as a form of treatment is increasing in popularity to improve the health of humans, with positive results in health outcomes. These outcomes include patients who have seen blood pressure reduced,

improved mood and a delay in the onset of dementia (Linder, Siebens, Mueller, Gibbs, & Freeman, 2017). It will be important to consider how such a positive method could be achieved through digital eyewear, as the physical application of bringing animals into clinical environments has a number of challenges.

6.2 Effects of the Dental Environment

To begin with, dental personnel need to be considered as an extension of the dentist, as frontline staff such as receptionists use of communicative behaviour and methods is an essential step in engaging with patients. Regardless of anxiety levels, this process is invaluable when dealing with children, dental auxiliary staff need to be employed not only on their skills and knowledge but more importantly on their positive attitude, passion to work with children and families.

Anxiety can be triggered by even the most innocuous situations such as the waiting room layout and playtime activities, thus it is essential that every aspect of the dental practice is appropriate. The reception, waiting room, and play areas need to be considered as the store-front window, as the initial tone in which parents and children will encounter will form their first opinions and create their expectations.

Dental operatory and personnel have more resources available to them, compared to their predecessors (Wright & Kupietzky, 2014). As a result, there is now a higher expectation from parents and general societal pressures for dentistry to create better child-friendly environments. This has implications for dentists, if the measure of a successful dental treatment is qualified as treatment completed, then the hallmark is a dentist's ability to manage and communicate with children to win their confidence and trust.

The importance of a stylish dental office with warm and welcoming colours are important, the atmosphere can be made calm and unthreatening with the use of music and lighting as reported by Umamaheshwari et al. (2013). The study would align with the results from Lee and Lee (2014) which report that yellow and blue are suitable colours and the colour choice of children. Subsequently, these colours have the ability to contribute to the success or failure of engaging and treating children. Furthermore, colour as a strategy can be used for clinic rooms, for easy navigation. For example, colour can guide children when instructed to the 'blue room' for their dental treatment.

It can be seen in the research by Birardi and Pasini (2011) the non-pharmacological method TSD commonly used by dentist requires a transformation and a more pragmatic approach. One of the interesting recommendations of the research was to include a listening component (to demonstrate the noise of operatory equipment such as drills and lasers) in the TSD technique to enhance the child's dental experience. Enabling patients to 'check-in' with the dentist before treatment proceeds, provides an opportunistic and important assessment of the child's anxiety levels. The use of TSD with the addition of 'listen' would be an innovative approach to a traditional method.

In contrast, the traditional 1980s of the PPA method which required parental presence/absence as a reward technique to improve the child's behaviour has inevitably lost favour in dentistry worldwide. Closer to home in New Zealand parental presence is strongly encouraged. As early engagement supports the building of relationships, oral health information and health promotion messaging, such as the effects of sugary drinks on teeth. Not surprisingly, parental presence rather than absence needs to be considered as a much more acceptable method for treating children, this has been widely found in research (Boka et al., 2017).

Dental attire may not raise the dental anxiety of a child, but highly anxious children do prefer child-friendly apparel, adapting attire would respond to the needs of the anxious child. Even though anxious children favour child-friendly attire, it is difficult to understand why this technique is not widely used as a default strategy in paediatric dentistry. The alternative is to risk calm and cooperative behaviour or be impartial to those that need the most support.

The choice of apparel is important, as it has an influence on both children and parents. The study by Kuscu et al. (2009) attempted to distil the popular view that children are fearful of white coats. The report found children preferred the formal attire that dentist wore. Arriving at this conclusion would see participants view dentists wearing casual polo shirts, this attire was classified in the study as formal attire. This leads to the variances and the choice of dental attire worn by dental personnel, from polo shirts to full-length coverall gowns.

6.3 Effects of Contingent Distractions

Firstly, contingent distractions are based on learning principles which increase desirable behaviour and reduce undesirable behaviour (Kuhn & Allen, 1994). Excitingly, contingent distractions or escape offer promising results for child behaviour management in paediatric

dentistry. It is difficult to understand why innovative approaches that offer contingent distractions were not widely reported in the literature review. The digital age has seen ground-breaking developments in the education sector where iPads have been used to support children with learning and behaviour difficulties.

Furthermore, easy, no effort, interventions such as digital eyewear has been an effective approach to managing dental anxiety. Thus, resulting in productivity success where dentists accomplish restorative work in short timeframes and effort (Hoge et al., 2012). Importantly, this measure suggests a positive outcome for both the child and the dentist.

Chapter 7- Conclusion

The goal of this SLR is to draw on the literature to determine what techniques and strategies impact on a positive dental experience for children. The search terms used in the PubMed database would identify key NPI used in paediatric dentistry since 2000. The search strategies applied returned a range of methods. The process produced 183 studies, with results in the selection process yielding eleven evidence-based studies identified through the PRISMA reporting method.

Undoubtedly, high levels of dental caries and challenging child behaviour, unfortunately, require the use of more formal methods such as sedation, GA or nitro oxide. The application of NPI in the dental operatory has the ability to reduce dental anxiety, which has the ability to impact on the (avoidable) number of children who require surgery to remove decayed teeth. If successful, completed dental treatment will ensure children are dentally fit, as the consequences of poor oral health go beyond dental decay. With oral health being linked to overall systematic health and quality of life.

Furthermore, poor management and lack of awareness of the needs of the child patient has several ramifications, not only to the dentist but more importantly to the child's oral health status. Impacting on the child's quality of life, ability to learn, eat and sleep. Whether the objective is to reduce dental anxiety or create a positive experience this research is an important asset to the future health and wellbeing of all children. In addition, providing routine dental treatment will benefit the child and reduce the pressure on healthcare systems where resources could then be repurposed.

Routine dental care is carried out on children who are alert and well, thus they are fully aware of their surroundings and have a full perception of what is happening to them. In general, dental procedures take a couple of minutes to accomplish with a cooperative and calm child. Having the ability to understand a child's feelings and anxiety is likely to result in a more productive clinic, calm and compliant child in the dental chair. It needs to be considered a powerful tool for dentists in the management of children during dental treatment, a tool just as important as dental instruments.

The lack of any significant innovative practices was surprising. However, this lack may have been missed due to the limitations of the research approach and the limitations of only searching within

PubMed. In addition, this review has potential limitations due to the lack of sufficient ability to undertake a full assessment of study quality. It can be concluded that searching only one database is not adequate in gathering enough literature on positive interventions for children visiting the dental clinic.

The integration of innovative approaches such as mobile technology will require a rethink of service provisions to deliver basic routine dental care. The literature identifies studies where children have self-reported technology like digital eyewear as a favourable intervention for which they would like introduced. The fact is tech-savvy children are high users of digital technology which has proven to have positive effects on a child's development. It will require a collection of armamentariums for the dentist to carry out successful dental treatment for children. Millennials are now parents who are choosing to do things differently from any other generation before them. Dentistry will need to be responsive and consider the worldview of these generations.

The sub-question considers the use of innovative approaches in paediatric dentistry, however, the research would identify little evidence to support this view. Alternatively, the research identified current NPI used in paediatric dentistry are getting tired. The traditional methods are not to be rejected, rather revised. Paediatric dentistry needs to go further to explore new approaches and modify traditional methods. This research now identifies this secondary question would be answered by further research to consider "What are the NPI that are transferrable to digital devices".

Further research is needed to explore traditional NPI and how they can be integrated into platforms such as iPads and augmented reality apps. The research has explored and uncovered the factors that create a positive dental experience for children. The question of whether children would respond to modification of NPI such as AAT through digital eyewear or using iPads in waiting rooms to deliver the eSAID questionnaire has been answered in this review.

It would seem innovative approaches in paediatric dentistry has not kept up with the rapid pace of the digital age. Only a small number of studies showed innovative approaches which result in a positive outcome for children who visit the dental clinic. Considering that the measure of treatment success is a calm and cooperative child, new strategies are vital in the care and treatment of children. Rather than a token gesture to NPI taught as a training component. The consequence of not responding has the potential to jeopardise a child's oral health outcomes.

To conclude, when it comes to healthcare, members of the millennial generation have identified that traditional methods are ineffective in capturing their interest. The contribution of this research provides an insight into techniques and strategies for a positive experience, but more importantly a directive for further research in the modernisation of traditional NPI leading them into the 21st century. The evidence presented leads me to conclude that innovative approaches are yet to encounter the dental chair.

Chapter 8– References

Alsarheed, M. (2011). Children's Perception of Their Dentists. *European journal of dentistry, 5*(2), 186-190.

Andaleeb, S. S. (2001). Service quality perceptions and patient satisfaction: a study of hospitals in a developing country. *Social Science & Medicine, 52*(9), 1359-1370.

Anthonappa, R. P., Ashley, P. F., Bonetti, D. L., Lombardo, G., & Riley, P. (2017). Non-pharmacological interventions for managing dental anxiety in children. *The Cochrane Database of Systematic Reviews, 2017*(6), CD012676. doi:10.1002/14651858.CD012676

Appukuttan, D. P. (2016). Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clinical, cosmetic and investigational dentistry, 8*, 35-50. doi:10.2147/CCIDE.S63626

Bach, K., & Manton, D. (2014). Early childhood caries: a New Zealand perspective. *Journal of Primary Health Care, 6*(2), 169-174.

Bernstein, D. A., Kleinknecht, R. A., & Alexander, L. D. (1979). Antecedents of dental fear. *Journal of Public Health Dentistry, 39*(2), 113-124.

Birardi, V., & Pasini, F. (2011). Study about the effects of dental noises on the emotional experiences of children aged 6 to 10 years. A pilot study. *European journal of paediatric dentistry : official journal of European Academy of Paediatric Dentistry, 12*, 236-238.

Boka, V., Arapostathis, K., Charitoudis, G., Veerkamp, J., van Loveren, C., & Kotsanos, N. (2017). A study of parental presence/absence technique for child dental behaviour management. *Eur Arch Paediatr Dent, 18*(6), 405-409. doi:10.1007/s40368-017-0313-9

Cole, K. M., & Gawlinski, A. (2000). Animal-assisted therapy: the human-animal bond. *AACN Advanced Critical Care, 11*(1), 139-149.

Coles, E., Wells, M., Maxwell, M., Harris, F. M., Anderson, J., Gray, N. M., . . . MacGillivray, S. (2017). The influence of contextual factors on healthcare quality improvement initiatives: what works, for whom and in what setting? Protocol for a realist review. *Systematic Reviews, 6*(1), 168. doi:10.1186/s13643-017-0566-8

Dallas, S., Li, J., Kruse, K., & McBride-Henry, K. (2015). *A Literature Review on Oral Health in Preschoolers*. Wellington: Health Promotion Agency

Gopalakrishnan, S., & Ganeshkumar, P. (2013). Systematic Reviews and Meta-analysis: Understanding the Best Evidence in Primary Healthcare. *Journal of family medicine and primary care, 2*(1), 9-14. doi:10.4103/2249-4863.109934

Health Promotion Agency. (2015). In Fact: Research fact from the HPA. *4*(14U).

Hoge, M. A., Howard, M. R., Wallace, D. P., & Allen, K. D. (2012). Use of video eyewear to manage distress in children during restorative dental treatment. *Pediatric dentistry, 34*(5), 378-382.

International Telecommunications Union. (2018). Artificial Intelligence | Emerging Trends | ICT4SDG | SDG4 | Youth. Retrieved from https://www.itu.int/en/Pages/default.aspx

Jamieson, L., Elani, H., Mejia, G., Ju, X., Kawachi, I., Harper, S., . . . Kaufman, J. (2016). Inequalities in indigenous oral health: findings from Australia, New Zealand, and Canada. *Journal of dental research, 95*(12), 1375-1380.

Kuhn, B., & Allen, K. (1994). Expanding child behavior management technology in pediatric dentistry: A behavioral science perspective. *Pediatric dentistry, 16*, 13-17.

Kuscu, O., Caglar, E., Kayabasoglu, N., & Sandalli, N. (2009). Preferences of dentist's attire in a group of Istanbul school children related with dental anxiety. *European Archives of Paediatric Dentistry, 10*(1), 38-41.

Law, C. S., & Blain, S. (2003). Approaching the pediatric dental patient: A review of nonpharmacologic behavior management strategies. *CDA J, 31*, 703-713.

Lee, J. E., & Lee, B. D. (2014). Behaviour Management in Dentistry for Children. In G. Wright & A. Kupietzky (Eds.), *The Dental Office* (2nd ed., pp 227-239). In: John Wiley & Sons, Inc.

Linder, D. E., Siebens, H. C., Mueller, M. K., Gibbs, D. M., & Freeman, L. M. (2017). Animal-assisted interventions: A national survey of health and safety policies in hospitals, eldercare facilities, and therapy animal organizations. *American journal of infection control, 45*(8), 883-887. doi:10.1016/j.ajic.2017.04.287

Ministry of Health. (2006). *Good Oral Health for All, for Life: The Strategic Vision for Oral Health in New Zealand*. Wellington: Ministry of Health

Minja, I., & Kahabuka, F. (2019). Dental Anxiety and Its Consequences to Oral Health Care Attendance and Delivery, Anxiety Disorders - From Childhood to Adulthood. Retrieved from https://www.intechopen.com/books/anxiety-disorders-from-childhood-to-adulthood/dental-anxiety-and-its-consequences-to-oral-health-care-attendance-and-delivery

Mishra, G., Thakur, S., Singhal, P., Ghosh, S. N., Chauhan, D., & Jayam, C. (2016). Assessment of child behavior in dental operatory in relation to sociodemographic factors, general anxiety, body mass index and role of multi media distraction. *Journal of Indian Society of Pedodontics and Preventive Dentistry, 34*(2), 159.

Moffat, S. M., Foster Page, L. A., & Thomson, W. M. (2017). New Zealand's School Dental Service over the Decades: Its Response to Social, Political, and Economic Influences, and the Effect on Oral Health Inequalities. *Frontiers in Public Health, 5*(177). doi:10.3389/fpubh.2017.00177

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine, 151*(4), 264-269.

Muppa, R., Bhupatiraju, P., Duddu, M., Penumatsa, N. V., Dandempally, A., & Panthula, P. (2013). Comparison of anxiety levels associated with noise in the dental clinic among children of age group 6-15 years. *Noise and Health, 15*(64), 190.

Nammalwar, R. B., & Rangeeth, P. (2018). A bite out of anxiety: Evaluation of animal-assisted activity on anxiety in children attending a pediatric dental outpatient unit. *Journal of Indian Society of Pedodontics and Preventive Dentistry, 36*(2), 181.

Ninot, G. (2013). Defining the Concept of Non-Pharmacological Intervention (NPI) Blog en Sante, L16.

Odendaal, J. S., & Meintjes, R. A. (2003). Neurophysiological correlates of affiliative behaviour between humans and dogs. *The Veterinary Journal, 165*(3), 296-301.

Pati, D., & Nanda, U. (2011). Influence of positive distractions on children in two clinic waiting areas. *HERD: Health Environments Research & Design Journal, 4*(3), 124-140.

Petrilli, C. M., Saint, S., Jennings, J. J., Caruso, A., Kuhn, L., Snyder, A., & Chopra, V. (2018). Understanding patient preference for physician attire: a cross-sectional observational study of 10 academic medical centres in the USA. *BMJ Open, 8*(5), e021239. doi:10.1136/bmjopen-2017-021239

Pruyn, A., & Smidts, A. (1998). Effects of waiting on the satisfaction with the service: Beyond objective time measures. *International journal of research in marketing, 15*(4), 321-334.

Roguski, M., Gregory, N., & McLaren, F. (2015). *Oral Health in Preschoolers*. Retrieved from Wellington:

Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom. *The urban review, 3*(1), 16-20.

Santos, C. M. d. C., Pimenta, C. A. d. M., & Nobre, M. R. C. (2007). The PICO strategy for the research question construction and evidence search. *Revista latino-americana de enfermagem, 15*(3), 508-511.

Siddaway, A. (2014). What is a systematic literature review and how do I do one. *University of Stirling*(I), 1.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology, 11*(3), 201-230.

Umamaheshwari, N., Asokan, S., & Kumaran, T. S. (2013). Child friendly colors in a pediatric dental practice. *Journal of Indian Society of Pedodontics and Preventive Dentistry, 31*(4), 225.

WHO. (2019). Oral Health Fact Sheet. Retrieved from https://www.who.int/news-room/fact-sheets/detail/oral-health

Whyman, R., Mahoney, E. K., Stanley, J., & Morrison, D. (2012). *Admission to New Zealand Public Hospitals for Dental Care: A 20 Year Review*. Wellington: Ministry of Health

Williamson, P. O., & Minter, C. I. J. (2019). Exploring PubMed as a reliable resource for scholarly communications services. *Journal of the Medical Library Association : JMLA, 107*(1), 16-29. doi:10.5195/jmla.2019.433

Wright, G. Z., & Kupietzky, A. (2014). *Behavior management in dentistry for children*: Wiley Online Library.

Yee, R., Jones, L., & Hosey, M. (2017). What the child "SAID" to the dentist: A UK randomized controlled trial. *Child: care, health and development, 43*(6), 926-932.

Zhou, Y., Cameron, E., Forbes, G., & Humphris, G. (2011). Systematic review of the effect of dental staff behaviour on child dental patient anxiety and behaviour. *Patient Education and Counseling, 85*(1), 4-13. doi:https://doi.org/10.1016/j.pec.2010.08.002