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Towards Comparative Effectiveness of Treatments for Dental Anxiety in Adult Patients: A Mixed Systematic Review

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Towards Comparative Effectiveness of Treatments for Dental Anxiety in Adult Patients: A
Mixed Systematic Review

A thesis submitted in partial satisfaction

of the requirements for the degree Master of Science

in Oral Biology

by

Benjamin Garai

2017

ABSTRACT OF THE THESIS


Towards Comparative Effectiveness of Treatments for Dental Anxiety in Adult Patients: A Mixed

Systematic Review


by


Benjamin Garai


Master of Science in Oral Biology

University of California, Los Angeles, 2017

Professor Francesco Chiappelli, Chair


**Introduction and Objective:**

Dental anxiety poses a significant barrier to treatment compliance, the use of dental services and

ability to maintain an adequate oral health quality of life.  Dental anxiety prevalence is high with

approximately 10-20% occurrence in the population of the United States and despite the

significant advancements in dental materials and technology, dental anxiety levels have remained

relatively stable since the mid-1900s (Sohn & Amid, 2005; Locker, Liddell, & Shapiro, 1999;

(Smith & Heaton, 2003).  There exists a strong association between dental anxiety, poorer oral

health status and oral health quality of life (Kumar et al., 2009; Armfield, Stewart, & Spencer, 2007; Mcgrath & Bedi, 2004; Berggren & Gunnell, 1984). The aim of this study is to conduct comparative effectiveness research to find out which dental anxiety interventions have shown to be more effective in decreasing dental anxiety in adult dental patients.

**Methods:** The research hypothesis was that cognitive behavioral therapy applied to adult dental patients with dental anxiety is more effective in reducing dental anxiety than other intervention modalities focused on reducing dental anxiety. Search for systematic reviews, randomized clinical trials, and cohort studies were done using PubMed, the Cochrane Library, and Emabase databases. The relevance of the identified systematic review, clinical trials, and cohort studies to the study and PICOTS question was assessed using the inclusion and exclusion criteria. The quality of the evidence and clinical relevance analysis achieved using validated and reliable instruments by two independent readers and all disagreements resolved by discussion after establishing the inter-rater reliability of the two readers. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) was utilized to assess the quality and clinical relevance of six systematic reviews. The CONsolidated Standards of Reporting Trials (CONSORT 2010) instrument was utilized to evaluate the quality and clinical relevance of clinical trials. The Strengthening the reporting of Observational Studies in Epidemiology (STROBE) instrument was utilized to evaluate the quality and clinical relevance of cohort studies. Acceptable sampling was done using established cutoff scores. Meta-analysis could not be done due to heterogeneity of available data.

**Results:** Two out of six systematic reviews, four out of fifty-nine randomized control trials, and four out of fifteen cohort studies were considered high-quality studies. So out of eighty studies, ten were included.

**Conclusions:**

A quantitative and qualitative consensus could not be formed due to heterogeneity of data and study design; however, multiple qualitative consensuses could be formed. For example, atraumatic restorative treatment (ART) can lower anxiety more than conventional treatment, lavender scent is effective in reducing state anxiety but not anticipatory anxiety, auricular acupuncture is more effective than placebo sham acupuncture in reducing dental anxiety, and either type of acupuncture is more effective than no acupuncture. Furthermore, premedication with the anxiolytic valium and systematic desensitization have both shown to be effective in reducing dental anxiety, while brief relaxation and music distraction are both effective in reducing dental anxiety as well, though brief relaxation is more effective in patients with high dental anxiety. We can neither accept nor reject our hypothesis because while cognitive behavioral therapy was shown to be effective in one study, and related cognitive therapy and psychological intervention was shown to be effective in two other studies, these were not demonstrated to be more effective than other anxiety treatments shown to be effective in studies where cognitive behavioral therapy was not compared. Thus, since cognitive behavioral therapy was not compared to other intervention types shown to be effective, we cannot conclude whether cognitive behavioral therapy is or is not more effective in treating dental anxiety. To do so, a

high-quality study comparing the intervention modalities shown to be effective in all the high-quality studies in our bibliome is needed.

The thesis of Benjamin Garai is approved.


Edmond R. Hewlett

Ki-Hyuk Shin

Reuben Han-Kyu Kim

Francesco Chiappelli, Committee Chair


University of California, Los Angeles

2017

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## Acknowledgments

I would like to thank Dr. Francesco Chiappelli for his mentorship and guidance, resilience, wisdom, and moral support. I have learned so much from interacting with you that I will carry with me the rest of my life. I thank my committee for pushing me to reach my full potential, for being welcoming and for your valuable feedback. I thank all my lab members for your wonderful support and dependability. I thank my family and Dr. Brittany Adriana Frederick for their constant encouragement, understanding, and love. I am indeed fortunate and forever grateful.

<center>**C h a p t e r 1**</center>

<center>**Background**</center>

# 1. Dental Anxiety:

Anxiety is an emotion marked by worried thoughts, feelings of tension, and physical changes (American Psychological Association, 2017).  It has also been described as "the apprehensive anticipation of future danger or misfortune accompanied by a feeling of worry, distress, and/or somatic symptoms of tension" (American Psychiatric Association, 2013).  In their systematic review, Khan, Hamedy, Lei, Ogawa, and White (2016) clarify how anxiety can alert one to danger and that anxiety is associated with anticipation of future concerns, while fear is a response to an immediate threat.  Both dental fear and dental anxiety are closely interconnected (Hakeberg, Berggren, & Carlsson, 1992; Wijk & Hoogstraten, 2006).

Dental anxiety poses a significant barrier to treatment compliance, the use of dental services and ability to maintain an adequate oral health quality of life.  Dental anxiety prevalence is high with approximately 10-20% occurrence in the population of the United States (Sohn & Amid, 2005; Locker, Liddell, & Shapiro, 1999).  The literature describes 5% of the general population as possessing severe dental anxiety resulting in significant avoidance behavior (Hakeberg et al., 1992; Vassend, 1993).  Despite the advancements in dental materials and technology, dental anxiety levels have remained relatively stable since the mid-1900s (Smith & Heaton, 2003). The association between dental anxiety, poorer oral health status and oral health quality of life has been established in multiple studies (Kumar et al., 2009; Armfield, Stewart, & Spencer, 2007; Mcgrath & Bedi, 2004; Berggren & Gunnell, 1984).

<center>1</center>

Individual characteristics and cognitive factors have been implicated as associated factors and determinants of dental anxiety. For example, one's general trait anxiety can be an effective means of predicting one's predisposition to developing dental anxiety (Lago-Méndez et al., 2009). In addition, women have a higher prevalence of dental anxiety than men (Rodríguez-Vázquez et al., 2008; Liddell & Locker, 1997). There have also been implications that genetics have a role in determining dental anxiety (Ray et al., 2010). Furthermore, dental anxiety has a higher prevalence with individuals with high negative mood, neuroticism, and other anxiety disorders (Hägglin et al., 2001).

Dental Anxiety can lead to many negative consequences for those who suffer from it. Sivaramakrishnan & Sridharan (2016) explain that "anxiety and fear form the mainstay of deferral in patients undergoing dental treatment" (p. 458). In fact, due to the avoidance habits in those with dental anxiety and because it interrupts the lives of those with the condition, it has been described as possessing similarities to specific phobias (Berggren, 1992; Abrahamsson, Berggren, & Carlson, 2000). Those with longer-standing dental anxiety may possess related social and psychological problems (Boman, Carlsson, Westin, & Hakeberg, 2013). Impaired social relationships, embarrassment regarding poor oral health, low self-confidence, more frequent absence or sick leave from work, as well as decreased social involvement has been reported (Armfield et al., 2007; Moore, Brødsgaard, & Rosenberg, 2004; Locker 2003). Avoidance of dental treatment due to dental anxiety can also lead to emergency or more invasive dental treatment, which maintains or exacerbates dental anxiety, producing a vicious-cycle or downward spiral (Berggren & Gunnell, 1984). In addition, dental anxiety negatively impacts dental care providers. For example, it is disruptive to scheduling, causes discomfort to

caregivers, and can make the treatment process significantly more challenging (Kent, 1984). Lahmann et al. (2008) explains how "patients who have dental anxiety tend to avoid necessary treatment, once in the dental chair, they often are difficult to treat," and "misdiagnosis may even result from a dentist-patient relationship that is dominated by severe anxiety" (p. 317).

Important distinctions between different types of anxiety are explained in the available scientific literature. For example, Khan et al. (2016) clarifies how "state anxiety is a temporary heightened emotion in response to a particular situation," whereas "trait anxiety is characteristic of an individual, a constituent personality attribute, a general baseline of their stress, nervousness, related to their personality and genetics" and "trait anxiety may include general nonspecific worry about future events" (p. 1734). As a result, the recommended approach to managing these two types of anxiety differ. For example, for state anxiety, techniques such as nitrous oxide, meditation, verbal calming, and hypnosis may be appropriate (Khan et al., 2016). It is even implied that state anxiety may decrease from treatment completion alone, or increased dental visits may increase familiarity and thus comfort for the patient (Doerr, Lang, Nyquist, & Ronis, 1998). However, it is stated that trait anxiety should encompass a broader treatment approach such as the use of pharmaceuticals or psychological treatment (Khan et al., 2016).

Many studies have explored the application of cognitive behavioral therapy for the treatment of dental anxiety. However, no published systematic review exists, to this author's knowledge, which:

1) Utilizes validated instruments to assess and accept only a very high quality of evidence;

2) Utilizes only a high level of evidence (ie. systematic reviews with or without meta-analysis, randomized and non-randomized clinical trials, and cohort studies only);

3) Includes the latest available research (up to and including January, 12th 2017 publications, which is when our search was conducted) and with no past publication cutoff date;

3) Compiles quantitative data and attempts to produce a quantitative consensus via a meta-analysis;

4) Includes studies related to any area of dentistry that involves adult dental patients.

As no such systematic review was found or known to exist for a condition that is so prevalent and has such a significant impact on one's quality of life and the clinical practice of dentistry, an area of need was therefore identified and pursued.

**2. Cognitive Behavioral Therapy**

Cognitive behavioral therapy (CBT) is a psychological treatment method commonly used to ameliorate mental health and treat a variety of mental health conditions (Field, Beeson, & Jones., 2015). Shahnavaz, Rutley, Larsson, and Dahllöf (2015) describe CBT as structured and short, between one and twenty sessions, with its main features as behavioral analysis or conceptualization, psycho-education, exposure, cognitive restructuring, assertiveness techniques, and home exercises. Shahnavaz et al. further describes CBT as being "action and behavior oriented," aiding patients to "focus on their problems here and now" (p. 317). The origin of the CBT model was founded by Aaron T. Beck, was originally used to effectively treat depression, and has since found its way into treating a multitude of health conditions including dental anxiety and injection phobia (Vika, Skaret, Raadal, Öst, & Kvale, 2009). In fact, Hofmann, Asnaani, Vonk, Sawyer, & Fang (2012) identified 269 meta-analytical studies that examined

CBT's application in almost every psychiatric condition via a review of the available empirical scientific literature. Descriptions of the variety of CBT protocols are so vast, that they easily fill a three volume textbook series (Hofmann, Dozois, Rief, & Smits, 2014). Hofmann and Asmundson (2017) state CBT as being "undoubtedly one of the big success stories of contemporary psychology and psychiatry" (p. xv). To recognize Beck's contribution to the field, he received the highly prestigious Lasker Award medical prize in 2006, with the chairman of the Lasker jury stating that "cognitive therapy is one of the most important advances - if not the most advanced - in the treatment of mental disease in the last 50 years (Alman, 2006, p. A24)."

CBT does not encompass a single technique or protocol, but rather a family of intervention types and provides a scientific approach to help understand and treat mental health disorders and human suffering (Hofmann & Asmundson, 2017). Hofmann and Asmundson (2017) explain that "it includes a family of interventions that share the same basic elements of the CBT model that focus on the importance of cognitive and behavioral processes" and that "this family has evolved from a specific treatment model into a scientific approach that incorporates a wide variety of disorder-specific interventions and treatment techniques as well as several unified or transdiagnostic protocols" (p. xv). Many CBT protocols help patients change harmful patterns of thinking, including beliefs and attitudes, behaviors and emotional regulation, by developing and implementing coping strategies (Beck, 2011). CBT's intent is to treat problems related to already diagnosed cognitive disorders where the therapist is responsible for assisting the client in identifying and going through effective strategies to address selected goals in order to decrease symptoms of the condition (Schacter, Gilbert & Wegner, 2010). Traditionally, CBT has six phases that include assessment, reconceptualization, skills

acquisition, skills consolidation and application training, generalization and maintenance, and post-treatment follow-up (Gatchel & Rollings, 2008). Gatchel and Rollings (2008) go on to explain how CBT may refer to various interventions including "self-instructions (e.g. distraction, imagery, motivational self-talk), relaxation and/or biofeedback, development of adaptive coping strategies (e.g. minimizing negative or self-defeating thoughts), changing maladaptive beliefs about pain, and goal setting" (p. 40). Hudson (2011) describes CBT as also comprising of cognitive processing therapy, relaxation training, stress inoculation, exposure therapy, cognitive therapy, acceptance and commitment therapy, and dialectical behavioral therapy.

Exposure therapy has been used to effectively treat social anxiety disorder, generalized anxiety disorder, phobias, post-traumatic stress disorder, obsessive-compulsive disorder, and has been studied for its effectiveness in treating dental anxiety as well. Exposure therapy involves exposing the patient to the fear producing stimuli (e.g. object or context), while excluding any danger, to aid the patient in prevailing over their anxiety or distress (Joseph & Grey, 2008). Exposure therapy is based on the concept of respondent conditioning also known as Pavlonian extinction (Marks, 1988). The therapist finds the emotions, thoughts, as well as physiological arousals that are found alongside fear causing stimuli and then attempts to stop the pattern of escape which maintains the fear by exposing the patient to increasingly stronger fear-producing stimuli (De Silva & Rachman, 1981). Fear is decreased stepwise through a multitude of evenly increasing challenges or steps, also known as an exposure hierarchy, until the fear is ultimately gone, with the patient being able to stop the procedure at any time (Miltenberger, 2008). The three types of exposure therapy, which can be used individually or in combination, include in vivo, imaginal and interoceptive (Foa, 2011). In vivo exposes the patient to real fear-inducing

situations or stimuli.  For example, in dental injection phobia, the patient may be exposed to the

dental syringe.  Imaginal exposure therapy involves patients imagining a feared situation to aid

them in overcoming fear provoking thoughts or memories.  Interoceptive exposure therapy aids

individuals to overcome feared physical symptoms such as shortness of breath or elevated heart

rate for individuals with specific conditions such as PTSD, panic, or anxiety disorders (Foa

2011).

Cognitive restructuring (CR) is another popular technique employed in cognitive

behavioral therapy.  CR therapy attempts to find and dispute maladaptive and irrational thoughts,

known also as cognitive distortions, which include magnification, over-generalization, emotional

reasoning, magical thinking, and all-or-nothing thinking associated with a myriad of mental

health disorders (Martin & Dahlen, 2005).  Hope, Burns, Hayes, Herbert, and Warner (2010)

describe CR to entail four steps that include identifying problematic thoughts known as

automatic thoughts (ATs), finding cognitive distortions in those ATs, rationally disputing those

ATs utilizing the Socratic method, and finally creating a rational rebuttal to those ATs.  Gladding

(2009) explains ATs as being "dysfunctional or negative views of the self, world, or future,

based upon already existing beliefs about oneself, the world, or the future."  Hope et. al (2010)

further elaborates that ATs can be grouped in one of six categorized including thoughts of

avoidance, thoughts about behavioral plans and coping strategies, self-evaluated thoughts,

thoughts regarding evaluation of others, thoughts evaluating the person they are interacting with,

and any other thoughts not categorized.  The methods employed to tackle these cognitive

distortions and ATs in CR include thought recording, labeling distortions, guided imagery,

reattribution, listing rational alternatives, identification of cognitive errors, and cognitive

rehearsal (Huppert, 2009).  To successfully obtain remission, CR in CBT is typically combined

with in vivo and imaginal exposure, psychoeducation, behavioral activation, monitoring, and

homework assignments (Huppert, 2009).

## 3. Evidence-based Dentistry:

Evidence Based Dentistry (EBD) involves utilizing a systematic process in order to

"produce comparative efficacy and effectiveness research, a review, and analysis for practice"

(CEERAP) (Chiappelli & Danai, 2012).  The purpose of EBD is to also identify the best

available evidence in support of health care modalities (Chiappelli & Danaei, 2012).

The first step in the systematic process is establishing a research question (PICOTS

question) or hypothesis which defines the population (P), intervention (I), comparator (C), as

well as clinical outcome (O), time frame (T), and setting (S).  Next, components of the PICOTS

question is utilized to determine keywords and create a list of inclusion and exclusion criteria

that aids with examining the entire relevant evidence known as the bibliome.  After which, the

bibliome is reviewed systematically to exclude evidence not pertaining to the PICOTS question

nor the inclusion and exclusion criteria.  This is followed by assessing the quality of evidence by

utilizing validated grading instruments which are based on established standards for research

methodology, design, and statistical analysis ("Methods Guide," 2014).  Once the previous steps

are completed, data analysis and acceptable sampling can commence.  This step aids us in

translating the best available evidence while maintaining a high quality of evidence, which is the

ultimate objective of comparative efficacy and effectiveness research (Chiappelli, 2016).

CEERAP also involves developing overarching statistical significance analysis with non-

heterogenous outcomes where possible. CEERAP ultimately can produce a consensus of the best available evidence via the scientific process of research synthesis and reported in scientific form as a systematic review (Chiappelli, 2016).

## 3. Purpose of the study:

The aim of the study is to conduct comparative effectiveness research to find out if cognitive behavioral therapy is more effective in reducing dental anxiety in adult dental patients than other interventions intended to reduce dental anxiety. This drives the following PICOTS question:

**Population:** Adult dental patients (age 18<) who have dental anxiety

**Intervention:** Cognitive behavioral therapy

**Comparator:** Other intervention modalities focused on reducing dental anxiety

**Outcome:** Score lower on average on dental anxiety measures

**Timeline:** What's found at follow up

**Setting:** Any clinical setting

# Chapter 2

## Methodology

## 1. Hypothesis

A. **Research hypothesis**: Cognitive behavioral therapy applied to adult dental patients with dental anxiety is more effective in reducing dental anxiety than other intervention modalities focused on reducing dental anxiety.

B. **Null hypothesis**: There is no difference in the anxiolytic effect of cognitive behavioral therapy applied to adult dental patients with dental anxiety compared to other intervention modalities focused on reducing dental anxiety.

## 2. Analytical framework:

The analytical framework represents relevant clinical concepts and refines the relationship between intermediate outcome measures and ultimate health outcomes. It helps in understanding the situation in which clinical decisions are made ("Methods Guide," 2014). An analytical framework was developed and associated with the following key questions:

1. Is there a difference in dental anxiety prevalence between sexes, ethnic populations, and age?

2. Are there unrelated health conditions that can be linked to an increased likelihood of having or developing dental anxiety?

3. What is cognitive behavior therapy in the context of treating patients with dental anxiety?

4. What are limitations of cognitive behavioral therapy?

5.  What are the instruments used in the available scientific literature to measure dental anxiety in adult dental patients?

*Figure (1) in the Tables section shows the analytical framework.*

## 3. Search Strategy:

The search for systematic reviews, randomized control trials and longitudinal studies was done on January 2017 via electronic bibliographic databases using the following.

Pubmed:

(((((((("dental care"[mesh] OR dental[tw] OR dentist*[tw]) AND (fear*[tw] OR phobia*[tw] OR anxi*[tw] OR "Anxiety"[mesh] OR "fear"[mesh])) OR "Dental Anxiety"[mesh])) AND (therapy[Text Word] OR therapies[Text Word] OR treatment*[Text Word] OR intervention*[Text Word])) OR ("Dental Anxiety/therapy"[mesh] OR "Dental Anxiety/psychology"[mesh])) AND ("Surveys and Questionnaires"[Mesh] OR Scale[tw] OR inventory[tw] OR measurement[tw] OR questionnaire*[tw] OR schedule*[tw] OR "anxiety level"[tw] OR "level of anxiety"[tw])) NOT ("child"[mh] NOT adult[mh])

Cochrane:

ID    Search    Hits

#1    MeSH descriptor: [Dental Anxiety] explode all trees    267

#2    MeSH descriptor: [Anxiety] explode all trees    6127

#3    MeSH descriptor: [Fear] explode all trees    1461

#4    MeSH descriptor: [Dental Care] explode all trees    565

#5    dental:ti,ab,kw or dentist*:ti,ab,kw    19406

#6    fear*:ti,ab,kw or phobia*:ti,ab,kw or anxi*:ti,ab,kw    30413

#7    therapy:ti,ab,kw or therapies:ti,ab,kw or treatment*:ti,ab,kw or intervention*:ti,ab,kw    600774

#8    MeSH descriptor: [Dental Anxiety] explode all trees and with qualifier(s): [Therapy - TH]    32

#9    MeSH descriptor: [Dental Anxiety] explode all trees and with qualifier(s): [Psychology - PX]    83

#10    MeSH descriptor: [Child] explode all trees    208

#11    MeSH descriptor: [Adult] explode all trees    1645

#12    MeSH descriptor: [Surveys and Questionnaires] explode all trees    46567

#13    Scale:ti,ab,kw or inventory:ti,ab,kw or measurement:ti,ab,kw or questionnaire*:ti,ab,kw or

schedule*:ti,ab,kw or "anxiety level":ti,ab,kw or "level of anxiety":ti,ab,kw    188185

#14    (#4 or #5) and (#2 or #3 or #6)    724

#15    #14 and #7    451

#16    #15 or #8 or #9    469

#17    #16 and (#12 or #13)    259

#18    #17 not (#10 not #11)    25

Embase:

((dentist* AND (phobia* OR anxi* OR anxiety OR fear)) OR ('dental anxiety'/exp OR (dental AND

anxiety) OR (dental AND phobia) OR (dental AND fear))) AND ((therapy OR therapies OR treatment

OR therap* OR intervention*) OR ('therapy'/exp OR 'cognitive behavioral therapy'/exp OR

'psychotherapy'/exp OR 'sedation'/exp OR sedation OR psychotherapy OR cognitive AND behavioral

AND therapy)) AND (('questionnaire'/exp OR (surveys OR questionnaire* OR scale OR inventory OR measurement)) OR 'dental anxiety scale')

## 4. Search for Systematic Reviews, Clinical Trials, and Longitudinal Studies:

The search engines explored were:

A. PubMed,

B. Cochrane library,

C. EMBASE.

## 5. Determination of the Relevance and Levels of Evidence:

The relevance of the identified systematic reviews, clinical trials and longitudinal studies to the study and PICOTS question was assessed using the following criteria:

**5.1 Inclusion Criteria:**

- Systematic reviews with or without meta-analysis, randomized control trials, non-randomized control trials, and cohort studies
- Adult dental patients (18 years or older)
- Studies investigating interventions aimed at reducing dental anxiety
- Anxiety measures are used
- Papers in English

**5.2 Exclusion Criteria:**

- Non-English language papers
- Non-adult dental patients (less than 18 years old)

- Interventions or studies not focused on reducing dental anxiety

**5.3 Levels of Evidence**

Dave Sacket and colleagues had developed "levels of evidence" to rank the validity of evidence based medicine (Sackett, Rosenberg, Gray, Haynes & Richardson, 1996). This has since been extended to evidence based dentistry, and is best illustrated by the Hierarchy of Evidence Pyramid.

*Figure (2) in the Figures section shows the Hierarchy of Evidence Pyramid.*

As illustrated by the Hierarchy of Evidence Pyramid, meta-analyses, systematic reviews, randomized control trials, non-randomized control trials, and cohort studies are considered to be higher levels of evidence, and as such only those studies were part of our inclusion criteria to include only a relatively high quality of evidence.

## 6. Measurements:

The quality of evidence and clinical relevance analysis was achieved using validated and reliable instruments to allow a systematic evaluation of the retained evidence. To do this, standardization of readers was recommended by the Cochrane group. Thus, evaluation of the quality of studies was conducted by two independent readers and all disagreements resolved by discussion. Readers' standardization and inter-rater reliability of the two readers was evaluated by obtaining the correlation coefficient (r) and the shared variance (r2). The inter-rater reliability of the two readers in three systematic reviews was 0.98 and the inter-rater reliability of the two readers in three clinical trials was 0.89.

# 7. Quality of Systematic Reviews:

The Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) instrument was utilized to assess and quantify the quality of retained systematic reviews. The PRISMA instrument includes a 27-item checklist. A score of 1 was given to a checklist item if the systematic review did not possess the item, and a score of 2 was given if the systematic review did possess the item. A similar system was used with the assessment instruments used to assess the quality of our clinical trials and observational studies. This allowed us to effectively turn a qualitative instrument into a quantitative measure. Thus, the highest possible score a systematic review could achieve via the PRISMA instrument is a score of 54.

## PRISMA 2009 Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | |
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis. | |

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## PRISMA 2009 Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | |
| **RESULTS** | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | |
| **DISCUSSION** | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | |
| **FUNDING** | | | |
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | |

*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

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## 8. Quality of Clinical Trials:

The CONsolidated Standards of Reporting Trials (CONSORT 2010) instrument was utilized to evaluate the quality of retained clinical trials. The CONSORT 2010 instrument includes a 37-item (including sub-items) checklist. A score of 1 was given to a checklist item or sub-item if the clinical trial did not possess the item, and a score of 2 was given if the clinical trial did possess the item or sub-item. This, again, allowed us to effectively turn a qualitative instrument into a quantitative measure. Thus, the highest obtainable score is 74.

**CONSORT 2010 checklist of information to include when reporting a randomised trial\***

| Section/Topic | Item No | Checklist item | Reported on page No |
|---|---|---|---|
| **Title and abstract** | | | |
| | 1a | Identification as a randomised trial in the title | |
| | 1b | Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts) | |
| **Introduction** | | | |
| Background and | 2a | Scientific background and explanation of rationale | |
| objectives | 2b | Specific objectives or hypotheses | |
| **Methods** | | | |
| Trial design | 3a | Description of trial design (such as parallel, factorial) including allocation ratio | |
| | 3b | Important changes to methods after trial commencement (such as eligibility criteria), with reasons | |
| Participants | 4a | Eligibility criteria for participants | |
| | 4b | Settings and locations where the data were collected | |
| Interventions | 5 | The interventions for each group with sufficient details to allow replication, including how and when they were actually administered | |
| Outcomes | 6a | Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed | |
| | 6b | Any changes to trial outcomes after the trial commenced, with reasons | |
| Sample size | 7a | How sample size was determined | |
| | 7b | When applicable, explanation of any interim analyses and stopping guidelines | |
| Randomisation: | | | |
| Sequence | 8a | Method used to generate the random allocation sequence | |
| generation | 8b | Type of randomisation; details of any restriction (such as blocking and block size) | |
| Allocation concealment mechanism | 9 | Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned | |
| Implementation | 10 | Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions | |
| Blinding | 11a | If done, who was blinded after assignment to interventions (for example, participants, care providers, those | |

| | | assessing outcomes) and how | |
| | 11b | If relevant, description of the similarity of interventions | ____ |
| Statistical methods | 12a | Statistical methods used to compare groups for primary and secondary outcomes | ____ |
| | 12b | Methods for additional analyses, such as subgroup analyses and adjusted analyses | ____ |
| **Results** | | | |
| Participant flow (a diagram is strongly recommended) | 13a | For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome | ____ |
| | 13b | For each group, losses and exclusions after randomisation, together with reasons | ____ |
| Recruitment | 14a | Dates defining the periods of recruitment and follow-up | ____ |
| | 14b | Why the trial ended or was stopped | ____ |
| Baseline data | 15 | A table showing baseline demographic and clinical characteristics for each group | ____ |
| Numbers analysed | 16 | For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups | ____ |
| Outcomes and estimation | 17a | For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval) | ____ |
| | 17b | For binary outcomes, presentation of both absolute and relative effect sizes is recommended | ____ |
| Ancillary analyses | 18 | Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory | ____ |
| Harms | 19 | All important harms or unintended effects in each group (for specific guidance see CONSORT for harms) | ____ |
| **Discussion** | | | |
| Limitations | 20 | Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses | ____ |
| Generalisability | 21 | Generalisability (external validity, applicability) of the trial findings | ____ |
| Interpretation | 22 | Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence | ____ |
| **Other information** | | | |
| Registration | 23 | Registration number and name of trial registry | ____ |
| Protocol | 24 | Where the full trial protocol can be accessed, if available | ____ |
| Funding | 25 | Sources of funding and other support (such as supply of drugs), role of funders | ____ |

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.

*CONSORT 2010 checklist* — *Page 2*

# 9. Quality of Cohort Studies:

The Strengthening of Observational Studies in Epidemiology (STROBE) instrument was used to assess the quality of cohort studies. The STROBE instrument includes a 34 item (including sub-items) checklist. A score of 1 was given to a checklist item or sub-item if the cohort study did not possess the item, and a score of 2 was given if the cohort study did possess the item or sub-item. This, again, allowed us to effectively turn a qualitative instrument into a quantitative measure. Thus, the highest obtainable score is 68.

STROBE Statement—checklist of items that should be included in reports of observational studies

| | Item No | Recommendation |
|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found |
| **Introduction** | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses |
| **Methods** | | |
| Study design | 4 | Present key elements of study design early in the paper |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up |
| | | *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls |
| | | *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed |
| | | *Case-control study*—For matched studies, give matching criteria and the number of controls per case |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group |
| Bias | 9 | Describe any efforts to address potential sources of bias |
| Study size | 10 | Explain how the study size was arrived at |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding |
| | | (*b*) Describe any methods used to examine subgroups and interactions |
| | | (*c*) Explain how missing data were addressed |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed |
| | | *Case-control study*—If applicable, explain how matching of cases and controls was addressed |
| | | *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy |
| | | (*e*) Describe any sensitivity analyses |

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**Results**

| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed |
| --- | --- | --- |
| | | (b) Give reasons for non-participation at each stage |
| | | (c) Consider use of a flow diagram |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders |
| | | (b) Indicate number of participants with missing data for each variable of interest |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included |
| | | (*b*) Report category boundaries when continuous variables were categorized |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses |

**Discussion**

| Key results | 18 | Summarise key results with reference to study objectives |
| --- | --- | --- |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results |

**Other information**

| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based |
| --- | --- | --- |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

# Chapter 3

## Results

## 1. Search Results and Determination of the Relevance:

### 1.1 Search for systematic reviews:

The initial bibliome search resulted in 4602 studies. After duplicate and irrelevant studies exclusion, and acceptable sampling was completed only 6 systematic reviews studies were retained as relevant to the PICOTS question and applying the inclusion/exclusion criteria:

- Anxiety related to nonsurgical root canal treatment: A systematic review (Khan et al., 2016).

- Local Anesthetic Drug Administration in Dentistry Using Computer Assisted Anesthetic Delivery System: A Systematic Review (Sivaramakrishnan & Sridharan, 2016).

- Midazolam for sedation before procedures (Morão, Ratilal, Santos & Sampaio, 2011).

- Psychological treatment of dental anxiety among adults: A systematic review (Boman, Carlsson, Westin & Hakeberg, 2013).

- Dental fear in adults: a meta-analysis of behavioral interventions (Kvale et al.).

- Effectiveness of complementary and self help treatments for anxiety disorders (Jorm et al., 2004).

**1.2 Search for Randomized Clinical Trials:**

- The initial bibliome search resulted in 4602 studies. After duplicate and irrelevant studies exclusion, and acceptable sampling was completed only 59 clinical trials were retained as relevant to the PICOTS question and applying the inclusion/exclusion criteria:

- A randomized controlled trial of the effect of a brief cognitive-behavioral intervention on dental fear (Spindler, Staugaard, Nicolaisen & Poulsen, 2015).

- Brief relaxation versus music distraction in the treatment of dental anxiety: A randomized controlled clinical trial (Lahmann et al., 2008).

- Mental retrieval of treatment context in dental phobia (Elsesser, Wannemüller, Lohrmann, Jöhren & Sartory, 2012).

- The effects of lavender scent on dental patient anxiety levels: a cluster randomized control trial (Kritsidima, Newton & Asimakopoulou, 2010).

- Reducing patients' state anxiety in general dental practice: a randomized controlled trial (Dailey, Humphris & Lennon, 2002).

- Efficacy of a trauma-focused treatment approach for dental phobia: a randomized clinical trial (Doering, Ohlmeier, Jongh, Hofmann & Bisping, 2013).

- Valeriana officinalis L. for conscious sedation of patients submitted to impacted lower third molar surgery: A randomized, double-blind, placebo-controlled split-mouth study (Pinheiro, Alcântara, Moraes & Andrade, 2014).

- Auricular acupuncture effectively reduces state anxiety before dental treatment—a randomized controlled trial (Michalek-Sauberer, Gusenleitner, Gleiss, Tepper & Deusch, 2012).

- Influences of 432 Hz Music on the Perception of Anxiety during Endodontic Treatment: A Randomized Controlled Clinical Trial (Nasso et al., 2016).

- Relief of Injection Pain During Delivery of Local Anesthesia by Computer- Controlled Anesthetic Delivery System for Periodontal Surgery: Randomized Clinical Controlled Trial (Chang et al., 2016).

- Auricular acupuncture for dental anxiety: a randomized controlled trial (Karst et al., 2007).

- Musical intervention reduces patients' anxiety in surgical extraction of an impacted mandibular third molar (Kim & Myoung, 2011).

- Effect of Audiovisual Treatment Information on Relieving Anxiety in Patients Undergoing Impacted Mandibular Third Molar Removal (Choi, Won, Cha & Hwang, 2015).

- Reducing Patients' State Anxiety in General Dental Practice: A Randomized Controlled Trial (Dailey, Humphris & Lennon 2002).

- One- vs. five-session treatment of intra-oral injection phobia: a randomized clinical study (Vika et al., 2009).

- A comparative evaluation of pain and anxiety levels in 2 different anesthesia techniques: locoregional anesthesia using conventional syringe versus intraosseous anesthesia using a computer-controlled system (Quicksleeper) (Özer, Yaltirik, Kirli & Yargic, 2012).

- Can ambient orange fragrance reduce patient anxiety during surgical removal of impacted mandibular third molars (Hasheminia, Motamedi, Ahmadabadi, Hashemzehi & Haghighat, 2014).

- Relaxation vs cognitively oriented therapies for dental fear (Berggren, Hakeberg & Carlsson 2000).

- Oral clonidine pre-treatment and diazepam/meperidine sedation (Hall, Tatakis, Walters, & Rezvan, 2006).

- A 3-year comparison of dental anxiety treatment outcomes: hypnosis, group therapy and individual desensitization vs. no specialist treatment (Moore, Brodsgaard & Abrahamsen, 2002).

- Effect of Erythrinamu lungu on anxiety during extraction of third molars (Silveira-Souto, Sao-Mateus, Almeida-Souza, & Groppo, 2014).

- Effects of Music Listening on Pre-treatment Anxiety and Stress Levels in a Dental Hygiene Recall Population (Thom, Sartory, & Johren, 2000).

- Changes induced by music therapy to physiologic parameters in patients with dental anxiety (Mejía-Rubalcava, Alanís-Tavira, Mendieta-Zerón & Sánchez-Pérez 2015).

- The effects of deep diaphragmatic breathing and focused attention on dental anxiety in a private practice setting (Biggs, Kelly, Toney, 2003).

- A partially blinded randomised controlled trial of patient-maintained propofol sedation and operator controlled midazolam sedation in third molar extractions (Leitch et al., 2004).

- Hypnosis compared with group therapy and individual desensitization for dental anxiety (Moore, Abrahamsen & Brodsgaard 1996).

- The Anxiolytic Effects of Intravenous Sedation Using Midazolam Alone or in Multiple Drug Techniques (Milgrom, Weinstein, Fiset & Beirne 1994).

- Comparison of oral triazolam and nitrous oxide with placebo and intravenous diazepam for outpatient premedication (Kaufman, Hargreaves & Dionne 1993).

- Recalling the Threat: Dental Anxiety in Patients Waiting for Dental Surgery (Bodner, Iancu, 2013).

- Does completing a dental anxiety questionnaire increase anxiety? A randomised controlled trial with adults in general dental practice (Humphris, Clarke & Freeman, 2006).

- Valeriana officinalis L. for conscious sedation of patients submitted to impacted lower third molar surgery: A randomized, double-blind, placebo-controlled split-mouth study (Pinheiro, Alcântara, Moraes & Andrade 2014).

- One- vs. five-session treatment of dental phobia: a randomized controlled study (Vika et al., 2009).

- Study comparing midazolam and nitrous oxide in dental anxiety control (Pereira-Santos et al., 2013).

- Dental patient anxiety: Possible deal with Lavender fragrance (Zabirunnisa, Gadagi, Gadde, Koneru, Myla & Thatimatla, 2014).

- Effects of hypnosis as an adjunct to intravenous sedation for third molar extraction: A randomized, blind, controlled study (Mackey, 2009).

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- Group therapy compared with individual desensitization for dental anxiety (Moore & Brødsgaard, 1994).

- Generalization of effects of dental fear treatment in a self-referred population of odontophobics (Moore, Brødsgaard, Berggren & Carlsson, 1991).

- Comparison of a controlled injection pressure system with a conventional technique (Goodell, Gallagher & Nicoll, 2000).

- Effectiveness of a Videotaped Behavioral Intervention in Reducing Anxiety in Emergency Oral Surgery Patients (Robertson, Gatchel & Fowler, 1991).

- Adequate information to patients on lorazepam and its expected actions enhances the antianxiety effect of this drug during dental treatment (Nishikawa, Nakamura & Nakano, 2005).

- The effect of pre-operative information in relieving anxiety in oral surgery patients (Ng, Chau & Leung, 2004).

- Sedative-analgesic activity of remifentanil and effects of preoperative anxiety on perceived pain in outpatient mandibular third molar surgery (Torun et al.,2017).

- Changes induced by music therapy to physiologic parameters in patients with dental anxiety (Mejía-Rubalcava, Alanís-Tavira, Mendieta-Zerón & Sánchez-Pérez, 2015).

- Use of orally administered diazepam in the reduction of dental anxiety (Baker, May, Revicki, Kessler & Crawford, 1984).

- Functional changes in brain activity after hypnosis in patients with dental phobia (Halsband & Wolf, 2015).

- Reducing fear of pain associated with endodontic therapy (Wijk & Hoogstraten, 2006).

- Preoperative Hypnotic Techniques Reduce Consumption of Analgesics after Surgical Removal of Third Mandibular Molars: A Brief Communication (Enqvist & Fischer, 1997).

- Stress reduction prior to oral surgery (Steven, Kathleen, & Gene, 1984).

- Evaluation of effect of 3D video glasses on perceived pain and unpleasantness induced by restorative dental treatment (Bentsen, Svensson & Wenzel, 2001).

- A prospective randomised controlled study of patient-controlled propofol sedation in phobic dental patients (Girdler, Rynn, Lyne & Wilson, 2000).

- The efficacy of passiflora incarnata linnaeus in reducing dental anxiety in patients undergoing periodontal treatment (Kaviani, Tavakoli, Tabanmehr, Havaei, 2013).

- The effects of disclosure on pain during dental hygiene treatment: the moderating role of catastrophizing (Sullivan & Neish, 1999).

- A psychological intervention for reducing pain during dental hygiene treatment (Sullivan & Neish, 1999).

- Ambient odors of orange and lavender reduce anxiety and improve mood in a dental office (Lehrner, Lehrner, Marwinski, Lehr, Deecke, 2005).

- Effect of 'Perceived control' in management of anxious patients undergoing endodontic therapy by use of an electronic communication system (Singh, Meshram, Warhadpande & Kapoor, 2012).

- Assessment and comparison of efficacy of midazolam and diazepam as preoperative medication (Kandel & Thapa, 2016).

- Effects of audiovisual distraction during dental prophylaxis (Frere, Crout, Yorty & Mcnei,l 2001).

- The Use of Immersive Visualization for the Control of Dental Anxiety During Oral Debridement (Padrino-Barrios, McCombs, Diawara, & De Leo, 2015).

- Initial injection pressure for dental local anesthesia: effects on pain and anxiety (Kudo, 2005).

## 1.3 Search for Cohort Studies:

The initial bibliome search resulted in 4602 studies. After duplicate and irrelevant studies exclusion, and acceptable sampling was completed only 15 cohort studies were retained as relevant to the PICOTS question and applying the inclusion/exclusion criteria:

- Comparison between one-session psychological treatment and benzodiazapine in dental phobia (Thom, Sartory, & Johren, 2000).

- Effects of cognitive therapy, applied relaxation and nitrous oxide sedation. A five-year follow-up study of patients treated for dental fear (Willumsen & Vassend, 2003).

- Atraumatic restorative treatment and dental anxiety in outpatients attending public oral health clinics in South Africa (Mickenautsch, Frencken, & Van't Hof, 2007).

- A 10-year follow-up of patients treated for dental fear (Hakeberg et al., 1990).

- Parallel study about the effects of psychotherapy on patients with dental phobia (Naumovaet al., 2016).

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- Quality of life before and after cognitive behavioral therapy (Agdal, Raadal, Öst, & Skaret, 2011).

- Effects of conscious sedation on patients recall of anxiety and pain after oral surgery (Wilson, Mcneil, Kyle, Weaver, & Graves, 2014).

- Treatment of dental anxiety disorders. Outcomes related to DSM-IV diagnosis (Kvale et al., 2002).

- Long-term effects on dental care behaviour and dental health after treatments for dental fear (Hakeberg et al., 1992).

- Fear reduction in patients with dental treatment phobia (Jöhren, Jackowski, Gängler, Sartory, & Thom, 2000).

- One-year follow-up of patients treated for dental fear: Effects of cognitive therapy applied relaxation, and nitrous oxide sedation (Willumsen & Vassend, 2003).

- Repeated measurements of mood during psychological treatment of dental fear (Hakeberg, M., Berggren, U., Carlsson, & Gustafsson, 1997).

- Dental fear treatment: comparison of a video training procedure and clinical rehearsals (Moore, 1991).

- Recovery profile and patient satisfaction after ambulatory anesthesia for dental treatment (Ohkushi, Fukuda, Koukita, Kaneko, & Ichinohe, 2016).

## 2. Measurements and Quality Assessment:

### 2.1. Quality of Systematic Reviews:

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) was

utilized to assess the quality and clinical relevance of six systematic reviews.

*Table (1) in the Tables section shows the score of each systematic review.*

### 2.2. Quality of Clinical Trials:

The CONsolidated Standards of Reporting Trials (CONSORT-10) instrument was utilized to

evaluate the quality and clinical relevance of fifty-nine clinical trials.

*Table (2) in the Tables section shows the score of each clinical trial.*

### 2.3. Quality of Cohort Studies:

The Strengthening the reporting of Observational Studies in Epidemiology (STROBE)

instrument was utilized to evaluate the quality and clinical relevance of fifteen cohort studies.

*Table (3) in the Tables section shows the score of each cohort study.*

### 3. Data Analysis

#### 3.1. Acceptable Sampling (Quality of the Systematic Reviews):

A cutoff of low-quality studies yielded only two out of six systematic reviews to be considered

as high-quality studies.  The cutoff score was 49, which equated to accepting studies in

approximately the top 10% of possible scores using the PRISMA instrument. Studies with scores below this cutoff were deemed to be missing too many components described in the PRISMA instrument as needing to be present in a high-quality systematic review, and thus were not accepted. The accepted studies were the following:

- Anxiety Related to Nonsurgical Root Canal Treatment: A Systematic Review (Khan et al., 2016).

- Local Anesthetic Drug Administration in Dentistry Using Computer Assisted Anesthetic Delivery System: A Systematic Review (Sivaramakrishnan & Sridharan, 2016).

### 3.2. Acceptable Sampling (Quality of the Clinical Trials):

A cutoff of the low-quality studies yielded only four out of fifty-nine randomized control studies to be considered as high-quality studies. The cutoff score was 64, which equated to accepting studies in approximately the top 14% of possible scores using the CONSORT 2010 instrument. Studies with scores below this cutoff were deemed to be missing too many components described in the CONSORT 2010 instrument as needing to be present in a high-quality clinical trial, and thus were not accepted. The accepted studies were the following:

- A randomized controlled trial of the effect of a brief cognitive-behavioral intervention on dental fear (Spindler et al., 2015).

- Brief relaxation versus music distraction in the treatment of dental anxiety: A randomized controlled clinical trial (Lahmann et al., 2008).

- Auricular acupuncture effectively reduces state anxiety before dental treatment-a randomized controlled trial (Michalek-Sauberer et al., 2012).

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- The effects of lavender scent on dental patient anxiety levels: a cluster randomized control trial (Kritsidia et al., 2010).

### 3.3. Acceptable Sampling (Quality of the Cohort Studies):

A cutoff of the low-quality studies yielded only four out of fifteen cohort studies to be considered as high-quality studies. The cutoff score was 61, which equated to accepting studies in approximately the top 10% of possible scores using the STROBE instrument. Studies with scores below this cutoff were deemed to be missing too many components described in the STROBE instrument as needing to be present in a high-quality cohort study, and thus were not accepted. The accepted studies were the following:

- Comparison between one-session psychological treatment and benzodiazapine in dental phobia (Thom et al., 2000).

- Effects of cognitive therapy, applied relaxation and nitrous oxide sedation. A five-year follow-up study of patients treated for dental fear (Willumsen & Vassend, 2003).

- Atraumatic restorative treatment and dental anxiety in outpatients attending public oral health clinics in South Africa (Mickenautsch et al., 2007).

- A 10-year follow-up of patients treated for dental fear (Hakeberg et al., 1990).

**3.4 Data Extraction:**

Accepted studies were reviewed thoroughly for data extraction. The types of data extracted where available included the study name, study design, sample size, intervention type, comparator, assessment time points, method of assessment, and anxiety measure findings. Summary statements were also compiled to assist in producing a qualitative consensus.

*Please see Table (4.1.1, 4.1.2, and 4.2) in the Tables section for the Data Extraction tables.*

As you can see from the table, the data that was able to be captured varied greatly depending on data availability and due to heterogeneity. Some types of data could only be found in one of our accepted studies, "A randomized controlled trial of the effect of a brief cognitive-behavioral intervention on dental fear," such as pre and post-intervention Dental Anxiety Scale (DAS) and Denteal Fear Survey (DFS) scores as represented in means and standard deviation. In our accepted study "Brief relaxation versus music distraction in the treatment of dental anxiety: a randomized controlled clinical trial," pre and post-intervention Stait-Trait Anxiety Inventory (STAI) scores were present and thus recorded. For our accepted study "A 10-year follow up of patients treated for dental fear," pre and post-intervention DAS scores were present though they were published as medians and without control data, and recorded as such. The majority of the remaining studies lacked available usable quantitative data and thus only significant findings were recorded for those accepted studies to aid in a qualitative consensus.

**3.5 Heterogeneity of Data and Ability to Conduct a Meta-analysis:**

A meta-analysis was not possible due to: limited number of acceptable, high-quality studies available; variation in how data was gathered, such as by using the Dental Anxiety Scale (DAS), the Dental Fear Survey (DFS), and the State-Trait Anxiety Inventory (STAI), or physiological parameters such as systolic and diastolic blood pressure, heart rate, and respiratory rate; heterogeneity in reporting statistical data, including mean, median, or percent change, and varied follow up times or lack of reported data. Thus, a qualitative analysis of the acceptable high-quality studies was instead pursued.

## Chapter 4

## Discussion

## 1. Interpretation and qualitative analysis:

### 1.1 Interpretation and qualitative analysis of systematic review:

**1.1.1.** Anxiety Related to Nonsurgical Root Canal Treatment: A Systematic Review (Khan et al., 2016)

This study was designed to conduct a systematic review of dental anxiety as it pertained to nonsurgical root canal treatment (NSRT). The following databases were searched: MEDLINE, Cochrane library, psychINFO. Manual and citation searches were also conducted. Thirty-six studies satisfied the inclusion criteria which included several study types: observational, prospective/follow-up, retrospective, survey, randomized controlled, questionnaire, clinical study, cross-sectional, and observational. The study found that state anxiety can be effectively managed in ways such as cognitive behavioral therapy, meditation, hypnosis, verbal calming, or directing reason on the specific causal situation. Furthermore, the systematic review found that frequent dental visits can lower anxiety levels due to the experience becoming familiar and thus more comfortable for the patient. The authors also concluded that by being compassionate, providing information to patients, ensuring proper pain management, and possessing effective coping skills can reduce anxiety and negative experiences for dental patients.

**1.1.2.** Local Anesthetic Drug Administration in Dentistry Using Computer Assisted Anesthetic Delivery System: A Systematic Review (Sivaramakrishnan & Sridharan, 2016)

A systematic review designed to evaluate the effectiveness of computer-controlled local anaesthetic delivery (CCLAD) in reducing dental anxiety and pain. Studies that were included in the review were only studies with randomized controlled design. The following databases were searched: Medline (via PubMed), Cochrane central register of clinical trials (CENTRAL) and Database of Abstracts of Reviews of Effects (DARE) and further supplemented by hand searching of relevant references from review articles. Six studies satisfied the inclusion criteria for this review, which individually showed the newer method of delivering local anesthesia via CCLAD was in fact more effective than conventional techniques. However, due to heterogeneity of data amongst those six studies, a meta-analysis could not be conducted, an overall quantitative consensus of the effectiveness of CCLAD could not be produced, and it was determined that more high-quality studies examining the usefulness of CCLAD was needed.

**2. Interpretation and qualitative analysis:**

**2.1 Interpretation and qualitative analysis of clinical trials:**

**2.1.1.** A randomized controlled trial of the effect of a brief cognitive-behavioral intervention on dental fear (Spindler et al., 2015)

The clinical trial was conducted to assess the efficacy of a brief cognitive-behavioral intervention for patients with dental fear in a private dental clinic. Dental anxiety was measured via the Dental Anxiety Scale (DAS) as well as the Dental Fear Survey (DFS). The researchers also followed up with as many patients as possible two years after treatment completion. Statistically significant reduction in dental fear was shown in the immediate intervention group as compared

to a waitlist control group.  Ultimately, all who participated in the brief intervention showed significantly decreased dental fear and the effect maintained in the follow-up subgroup two years later.

**2.1.2.** Brief relaxation versus music distraction in the treatment of dental anxiety: A randomized controlled clinical trial (Lahmann et al., 2008)

The purpose of this clinical trial was to assess the efficacy of brief relaxation technique versus music distraction as compared to a control group in treating dental anxiety. The study measured subject's anxiety via the state anxiety subscale of the Stait-Trait Anxiety Inventory (STAI).  The study found that both brief relaxation and music distraction showed significant reduced dental anxiety while the control group did not.  In addition, brief relaxation had also been shown to be more effective in subjects who had high levels of dental anxiety, while the effectiveness of music distraction was not significant in these subjects.

**2.1.3.** Auricular acupuncture effectively reduces state anxiety before dental treatment-a randomized controlled trial (Michalek-Sauberer et al., 2012)

The purpose of this study was to assess the effectiveness of auricular acupuncture, as compared to both sham acupuncture (placebo acupuncture) and a control group in reducing dental anxiety before a dental procedure. The Stait-Trait Anxiety Index (STAI) was used to measure dental anxiety.  Auricular acupuncture was conducted in relaxation, tranquilizer, and master cerebral anxiety reducing acupoints on and in the ear. Sham acupuncture was conducted on the finger, shoulder, and tonsil points.  The control group received no acupuncture. The results showed a reduction in anxiety in the auricular acupuncture group that was more effective than sham

acupuncture. Both the auricular and sham acupuncture group showed the reduction in anxiety that was statistically significant. In comparison, anxiety actually increased in the control group.

**2.1.4.** The effects of lavender scent on dental patient anxiety levels: a cluster randomized control trial (Kritsidima et al., 2010)

The purpose of this study was to assess the effectiveness of lavender scent on reducing dental anxiety. Dental anxiety was measured via the State Trait Anxiety Indicator (STAI), and generalized dental anxiety was assessed by the Modified Dental Anxiety Scale (MDAS). According to this study, previous studies have shown lavender scent reduced state anxiety in a dental setting, which was confirmed by this study. However, this study showed that lavender scent failed to show reduction in dental anxiety as measured by MDAS. The reason, the study states, is because state anxiety as measured by the STAI reflects how patients feel right now, whereas anxiety as measured by MDAS is anticipatory anxiety about future dental appointments. Thus, the study concludes, lavender scent shows a significant reduction in dental state anxiety but not future anticipatory dental anxiety.

**3. Interpretation and qualitative analysis:**

**3.1 Interpretation and qualitative analysis of cohort studies:**

**3.1.1.** Comparison between one-session psychological treatment and benzodiazapine in dental phobia (Thom et al., 2000)

The purpose of this study was to assess the effectiveness of psychological treatment as compared to acute administration of benzodiazepine and a no treatment control group for dental anxiety. Dental anxiety was measured via the Dental Anxiety Scale (DAS), the Dental Fear Survey

(DFS), and the Stait-Trait Anxiety Inventory (STAI).  Psychological treatment consisted of stress

management training with daily relaxation exercises the patients followed via an audio tape.  The

exercises also consisted of imaginal exposure to phobic stimuli as well as homework

assignments.  The benzodiazepine group received the anxiolytic 30 minutes prior to dental

treatment.  Both treatment groups showed reduction in anxiety, however phobic dental patients

did experience relapse after the dental treatment.  The group that received psychological

treatment, in comparison, showed enduring reduction in dental anxiety until the follow-up two

months later.  Those who received psychological treatment continued dental treatment at a rate

of 70%, whereas the benzodiazepine group continued at 20% and the control group at 10%.

**3.1.2.** Effects of cognitive therapy, applied relaxation and nitrous oxide sedation.  A five-year

follow-up study of patients treated for dental fear (Willumsen & Vassend, 2003)

The purpose of this study was to assess the effectiveness of cognitive therapy, applied relaxation,

and nitrous oxide sedation in lowering dental anxiety.  Anxiety was measured with the Dental

Anxiety Scale (DAS) and the Dental Fear Survey (DFS) at enrollment, after treatment, and at a

one-year follow up.  Significant reduction in dental anxiety measures was observed in all three

treatment groups after treatment.  However, no significant changes were found between the after-

treatment levels and the one-year follow up. The study states lower distress levels were found in

the nitrous oxide group as compared to the applied relaxation group.  No other significant

differences in treatment groups were described.  At five-year follow up, 95% of subjects reported

their treatment program to have been beneficial and 75% reported better oral health.  Subjects

from the psychological intervention groups, however, were reported to have a relatively more

responsible attitude towards their dental attendance and oral health.

**3.1.3.** Atraumatic restorative treatment and dental anxiety in outpatients attending public oral health clinics in South Africa (Mickenautsch et al., 2007)

The purpose of this study was to assess the effectiveness of atraumatic restorative treatment in reducing dental anxiety in dental patients as compared to conventional restorative techniques in a period of one year. Atraumatic restorative treatment involves the use of only hand instruments in removing insensitive outer carious dentin and the avoidance of anesthesia and dental hand pieces (electric or air driven dental "drills"), thus minimizing pain. The Dental Anxiety Scale (DAS) was used to measure dental anxiety in adults. The results showed a significant decrease in dental anxiety in the group of adult dental patients who were given atraumatic restorative treatment as compared to conventional restorative treatment.

**3.1.4.** A 10-year follow-up of patients treated for dental fear (Hakeberg et al., 1990)

This study assessed the efficacy of systematic desensitization, as compared to premedication with valium (diazapam) before dental treatment, in reducing dental anxiety. Anxiety was assessed using the Dental Anxiety Scale (DAS) and there was a 10-year follow-up assessment. The results demonstrated a significant decrease in dental anxiety in the systematic desensitization group, whereas the reduction in dental anxiety amongst subject in the premedication group was neither as evident nor statistically significant. However, during the 10 year follow-up, the systematic desensitization group showed slightly increased levels of anxiety while the premedication group showed a continued decrease that was not statistically significant. The authors of the study speculated that the reason for the increase in the systematic desensitization group was due to the systematic desensitization group obtaining a well-developed relaxation method that eventually leads to the decreased need for the use of such methods. This, the authors

explain, likely evolves to an increased, but adequate tension that had been referred to as a tension increase due to over learning of relaxation in therapy.

## 4. Conclusion

Due to heterogeneity of available data in this study's bibliome, a qualitative consensus needed to conduct a meta-analysis could not be established. Likewise, a qualitative consensus of the best available intervention to reduce dental anxiety in adult dental patients could also not be established. This is due to the nature of most studies exclusively looking at only several intervention modalities. Thus, instead of a single consensus being established, multiple individual sub-consensuses are formed. For example, we know that atraumatic restorative treatment (ART) can lower anxiety more than conventional treatment, lavender scent is effective in reducing state anxiety but not anticipatory anxiety, auricular acupuncture is more effective than placebo sham acupuncture in reducing dental anxiety, and either type of acupuncture is more effective than no acupuncture. Furthermore, premedication with the anxiolytic valium and systematic desensitization have both shown to be effective in reducing dental anxiety, while brief relaxation and music distraction are both effective in reducing dental anxiety as well, though brief relaxation is more effective in patients with high dental anxiety. We can neither accept nor reject our hypothesis because while cognitive behavioral therapy was shown to be effective in one study, and related cognitive therapy and psychological intervention was shown to be effective in two other studies, these were not demonstrated to be more effective than other anxiety treatments shown to be effective in studies where cognitive behavioral therapy was not compared. Thus, since cognitive behavioral therapy was not compared to other intervention types shown to be effective, we cannot conclude whether cognitive behavioral therapy is or is not

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more effective in treating dental anxiety.  To do so, a high-quality study comparing the intervention modalities shown to be effective in all our accepted high-quality studies is needed.

The importance of providing knowledge and information regarding these intervention modalities shown to be effective in high-quality studies, to clinicians, patients, and stakeholders cannot be overstated.  Clinicians should be educated regarding the findings of such studies in order to make better informed treatment decisions for anxious patients, whom likely comprise a portion of their patient base.  They can also then seek the training needed to provide such interventions to patients, refer patients to the right specialists, or at least become better aware of the challenge this significant part of the population faces.  Providing patients with knowledge that such interventions exist and have been scientifically validated as being effective can also empower them to seek the anxiety treatment they need, while also providing hope that improving their oral health quality of life is within their reach.

There are additional implications that can be made from this study in its application towards clinical dentistry.  It would be of value to not only incorporate the principles of evidence-based dentistry into standard dental school curriculum, but also the findings of high-quality dental anxiety studies due to the prevalence of dental anxiety in the U.S. population and abroad.  Informing dental students before they begin their careers will help to ensure that dental anxiety is not something clinicians accidentally overlook.  It would also possibly prevent unintentionally contributing to the maintenance or exacerbation of dental anxiety by not being sensitive to those patient's needs.  An emphasis can be places on the fact that appointments will likely be smoother and patients happier as a result of being more knowledgeable and responsive towards patients with dental anxiety.  Additionally, there presents a tremendous opportunity for

providers of continuing education courses, and dental consultants where appropriate, to not only inform dentists of the findings of high-quality dental anxiety studies, but to also teach and provide training to effectively integrate techniques from these studies into one's practice. An emphasis can also be placed on the benefits of interdisciplinary partnerships between dentists and psychotherapists for the purpose of providing patients additional options for effective therapy techniques such as cognitive behavioral therapy.

# 5. Limitations:

## 5.1 Study Limitations:

We limited our study to English language papers which may have lent our study to selection bias. This may have been avoided by utilizing translation services. Another limitation of our study was that only three databases were utilized. With additional time and resources, additional databases could have been utilized. Additionally, another limitation was that we only utilized one quality assessment instrument per study type (systematic reviews with or without meta-analysis, randomized and non-randomized control trials, or cohort study). With additional time and resources, additional quality assessment instruments could have been utilized to assess these study types.

**5.2 Field Limitations**

A limitation of the field is the limited number of high-quality studies on the topic of lowering dental anxiety in adult dental patients. This prevents us from being able to assess the effectiveness of a variety of intervention modalities not discussed in our accepted studies, and hinders our ability to compare intervention modalities. More high-quality studies on this subject can increase the number of studies that compare multiple intervention types and include homogeneous data that can be used in a meta-analysis to produce a quantitative consensus of the best available treatment for dental anxiety. This leads us to the next field limitation - since there is no widely standardized method of publishing data in studies, our accepted studies published data on dental anxiety measurements in a wide variety of methods, including mean and standard deviation, percent change, line graphs, or did not publish data at all, thus preventing the ability to produce a quantitative analysis. If a standardization of published data was to be established, specifically one that emphasized the publication of means and standard deviations of measured anxiety levels before and after anxiety treatment, then a meta-analysis and quantitative consensus of the best available treatment could possibly be developed by future researchers. Dental health practitioners could then provide patients with the highest standard of evidence-based treatments to improve oral health and quality of life.

# Tables



| A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | Sum |
|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Anxiety Related to Nonsurgical Root Canal Treatment: A Systematic Review | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 51 |
| Local Anaesthetic Drug Administration in Dentistry Using Computer Assisted Anaesthetic Delivery System: A Systematic Review | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 49 |
| Midazolam for sedation before procedures | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 47 |
| Psychological treatment of dental anxiety among adults: a systematic review | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 46 |
| Dental fear in adults: a meta-analysis of behavioral interventions | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 46 |
| Effectiveness of complementary and self-help treatments for anxiety disorders | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 38 |

Table 1. Systematic reviews grading scores (PRISMA Instrument)



| CONSORT-21 (RCTs) | 1a | 1b | 2a | 2b | 3a | 3b | 4a | 4b | 5 | 6a | 6b | 7a | 7b | 8a | 8b | 9 | 10 | 11a | 11b | 12a | 12b | 13a | 13b | 14a | 14b | 15 | 16 | 17a | 17b | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Sum |
|---|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|---|----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|-----|----|----|----|----|----|----|----|----|-----|
| A randomized controlled trial of the effect of a brief cognitive-behavioral intervention on dental fear | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | | 67 |
| Brief relaxation versus music distraction in the treatment of dental anxiety: a randomized controlled clinical trial | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 66 |
| Auricular acupuncture effectively reduces state anxiety before dental treatment-a randomised controlled trial | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | | 65 |
| The effects of lavender scent on dental patient anxiety levels: a cluster randomised-controlled trial | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | | 64 |
| Reducing Patients' State Anxiety in General Dental Practice: A Randomized Controlled Trial | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | | 63 |
| Efficacy of a trauma-focused treatment approach for dental phobia: a randomized clinical trial | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | | | | | 63 |
| Valeriana officinalis L. for conscious sedation of patients submitted to impacted lower third molar surgery: A randomized, double-blind, placebo-controlled split-mouth study | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | | | | 62 |
| Auricular acupuncture effectively reduces state anxiety before dental treatment—a randomised controlled trial | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | | | | | 62 |
| Influences of 432 Hz Music on the Perception of Anxiety during Endodontic Treatment: A Randomized Controlled Clinical Trial | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | 61 |

Table 2. Clinical trials grading scores (CONSORT-10 Instruments)

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| Article Title | 1a | 1b | 2 | 3 | 4 | 5 | 6a | 6b | 7 | 8 | 9 | 10 | 11 | 12a | 12b | 12c | 12d | 12e | 13a | 13b | 13c | 14a | 14b | 14c | 15 | 16a | 16b | 16c | 17 | 18 | 19 | 20 | 21 | 22 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Comparison between one-session psychological treatment and benzodiazepine in dental phobia | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 65 |
| Effects of cognitive therapy, applied relaxation and nitrous oxide sedation. A five-year follow-up study of patients treated for dental fear (NOTE: IN FILES) | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 62 |
| Atraumatic restorative treatment and dental anxiety in outpatients attending public oral health clinics in South Africa | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 62 |
| A 10-year follow-up of patients treated for dental fear | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 61 |
| Parallel study about the effects of psychotherapy on patients with dental phobia | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 60 |
| Quality of life before and after cognitive behavioral therapy | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 60 |
| Effects of conscious sedation on patient recall of anxiety and pain after oral surgery | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 59 |
| Treatment of dental anxiety disorders. Outcome related to DSM-IV diagnoses | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 59 |
| Long-term effects on dental care behavior and dental health after treatments for dental fear | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 59 |
| Fear reduction in patients with dental treatment phobia | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 59 |
| One-year follow-up of patients treated for dental fear: effects of cognitive therapy, applied relaxation, and nitrous oxide sedation | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 57 |
| Repeated Measurements of mood during psychologic treatment of dental fear | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 57 |
| Dental fear treatment: comparison of a video training procedure and clinical rehearsals | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 57 |
| Recovery profile & patient satisfaction after ambulatory anesthesia for dental treatment | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 55 |

Table 3. Longitudinal studies grading scores (STOBE Instrument)

Table 4.1.1

| Article Title | Study Type | Intervention | follow up time (years) | sample size | Intervention size | Pre-intervention_DAS median | Post-intervent ion_DAS median | Follow-up_DAS median | Pre-Intervention_DAS mean (SD) | Post-Intervent ion_DAS mean(SD) | 2 year follow up_DAS mean(SD) | Pre Intervention_DFS mean(SD) | Post-Intervention_DFS mean(SD) | 2 year follow up_DFS mean(SD) | STAI-S_pre_mean(SD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A randomized controlled trial of the effect of a brief cognitive-behavioral intervention on dental fear | RCT | CBT | 2 | 102 | 52 | | | | 16(3.0) {80} | 9.7(2.9) {48.5} | 10.3(3.5) | 70.1(13.4) | 49.6(13.5) | 52.1(17.7) | |
| Brief relaxation versus music distraction in the treatment of dental anxiety: a randomized controlled clinical trial | RCT | Breif relaxation (BR) and Music distraction (MD) | | 87 | 29 (BR) 28 (MD) | | | | | | | | | | 42.4(10.4) BR {53} 41.3(9.6) MD {51.625} |
| A 10-year follow up of patients treated for dental fear | Longitudinal study | Systematic desensitisation and premedication with valium | 10 | 12 | 6 (sytematic desensitization) 6 (valium) | 15.5 (syetematic desensitzatin ) {77.5} 17.0 (valium) {85} 16.5 (total) {82.5} | 8.0 (systematic desensitizati on) {40} 15.0 (valium) {75} 10.5 (total) {52.5} | 11.0 (systematic desensitizati on) 12.0 (valium) 12.0 (total) | | | | | | | |

Table 4.1.1. Data Extraction

Table 4.1.2

| STAI-S_post_mean(SD) | control size_placebo | control size_no placebo | Pre-control_DAS mean(SD) | Post-control_DAS mean(SD) | 2 year follow up_DAS mean(SD) | Pre-control_DFS mean(SD) | Post-control_DFS mean(SD) | 2 year follow up_DFS mean(SD) | STAI-S_control_placebo_pre_mean(SD) | STAI-S_control_placebo_post_mean(SD) | Intervention_Change in STAI-S mean(SE) | control_change in STAI-S mean(S) | Significant findings |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 16.6(2.6) {83} | 10.2(2.8) {51} | 9.9(3.0) | 72.0(13.4) | 46.8(13.0) | 46.2(11.4) | | | | | Dental fear significanctly reduced in immediate intervention group (d=1.5-2.2) compared with the waiting list group (d=0.3-0.4). All participants sig decreased dental fear following brief intervention. Effect maintained in follow-up subgroup 2 years later. |
| 29.4(6.3) BR {36.75} 36.8(9.8) MD {46} | | 30 | | | | | | | 41.9(11.5) {52.375} | 40.5(11.2) {50.625} | 13.0(9.5) BR 4.4(4.6) MD | 1.4(4.4) | Both breif relaxation (BR) and music distraction (MD) reduced dental anxiety significantly. In contrast, patients in the control (C) group did not exhibit a significant change in their anxiety level. BR was significantly superior to MD. Stratification according to the patient's general level of dental anxiety revealed that BR also was particularly effective in highly anxious subjects, whereas MD did not have a clinically relevant effect on these subjects. |
| | | | | | | | | | | | | | Pre to post tx, systematic desensitization group has sig decrease in dental fear (DAS), compared with valium group. At follow-up, this was not significant anymore.The SDpatients had a more clear and significant reduction of dental fear after treatment compared to the P-patients. Most investigated individuals maintained regular dental care 10 years after initial tx, more evidentom systematic desensitization group, where all patients reported receiving regular dental check ups and tx. |

Table 4.1.2. Data Extraction (continued)

| Article Title | Study Type | Intervention | sample size | Intervention size | control size | Intervention MDAS_mean(SD) | Control MDAS_mean (SD) | Intervention_STAI_mean(SD) | Control_STAI_mean(SD) | Significant Findings |
|---|---|---|---|---|---|---|---|---|---|---|
| The Effects of lavender scent on dental patient anxiety levels: A cluster randomized-controlled trial | RCT | aromatherapy-lavender | 340 | 170 | 170 | 9.84(4.74) | 10.65(5.40) | 7.41(2.43) | 10.71(4.35) | Results: Analyses of variance (anovas) showed that although both groups showed similar, moderate levels of generalized dental anxiety the lavender group reported significantly lower current anxiety than the control group. Conclusions: Although anxiety about future dental visits seems to be unaffected, lavender scent reduces state anxiety in dental patients. |
| Auricular acupuncture effectively reduces state anxiety before dental treatment—a randomised controlled trial | RCT | Acupuncture | 182 | | | | | | | After correcting for group differences in baseline state anxiety, the reduction in anxiety was − 7.3 score points (CI − 9.0 to −5.6) in the auricular acupuncture group and − 3.7 score points (CI− 5.4 to − 1.9) in the sham group ( p 00.008). Conclusion: Auricular acupuncture, a minimally invasive method, effectively reduces state anxiety before dental treatment. |
| Comparison between one-session psychological treatment and benzodiazepine in dental phobia | Longitudinal study | psychological treatment, benzodiazepine, no treatment | 50 | 20 (psych) 20 (benz) | 10 | | | | | Psych treatment was significantly more effective than benzodiazepine group or no treatment group. Both treatment conditions led to less anxiety during dental surgery than did the control condition. Phobic patients in the benzodiazepine condition showed a relapse after dental treatment, whereas those in the psych condition showed further improvement until the follow up 2 months later. Of the latter group, 70% continued dental treatment; only 20% and 10% returned in the benzodiazepine and control conditions, respectively. |
| Effects of cognitive therapy, applied relaxation and nitrous oxide sedation. A five-year follow-up study of patients treated for dental fear | Longitudinal study | CBT, NO2, and applied relaxation | 62 | | | | | | | Significant changes across the assesment phases (enrolment after tx and five years after) were found for both dental fear and general distres. Hoever, no significant changes between measures obtained after treatment and at follow-up. The majority (81%) assessed the dental fear treatment received five years previously to have been useful for them. In conclusion, the favorable effects on dental fear and general psychological distress continued at five year follow up for all treatment groups. Almost all individuals (95%) still reported the treatment program to have been beneficial and three-quarters reported better oral health. The results did not suggest any differential treatment effects concerning dental anxiety or general distress. However, it seems that partipants from the two psychological treatment groups achieved a more responsible attitude towards their oral health and dental attendance. |
| Atraumatic restorative treatment and dental anxiety in outpatients attending public oral public oral health clinics in South Africa | Longitudinal study | Atraumatic Restorative Treatment | | | | | | | | The mean DAS score for test-group adults was statistically significant lower than the control. No significant correlation was observed between dental anxiety level and restoration/extraction ratio per operator. |
| Local Anaesthetic Drug Administration in Dentistry Using Computer Assisted Anaesthetic Delivery System: A Systematic Review | systematic review | computer assisted local anaesthetic delivery system | 6 studies (3 conducted on children; 3 on adults) | | | | | | | Unfortunately because of the clinical heterogeneity, meta-analysis could not be performed. Hence it is difficult to conclude that the computer assisted delivery is better than the conventional method, although it was found to perform better. Many high quality studies assessing the efficacy and cost-efficiency of various modes of administration are required to confirm the utility of computer assisted delivery systems. |
| Anxiety Related to Nonsurgical Root Canal Treatment: A Systematic Review | SR& MA | Many various types | | | | | | | | This systematic review revealed that anxiety associated with NSRCT was generally moderate; anxiety decreased after NSRCT. Limited evidence suggested that anxiety is influenced by patient and treatment factors. Meta-analysis of 4 articles including 232 subjects gave a post-treatment anxiety rating of 27 (standard deviation, 5) on a normalized 100-point scale, representing a 30% reduction. A L'Abbe plot of 5 studies also showed that anxiety decreased after NSRCT. |

Table 4.2. Data Extraction (continued)

**Figures**
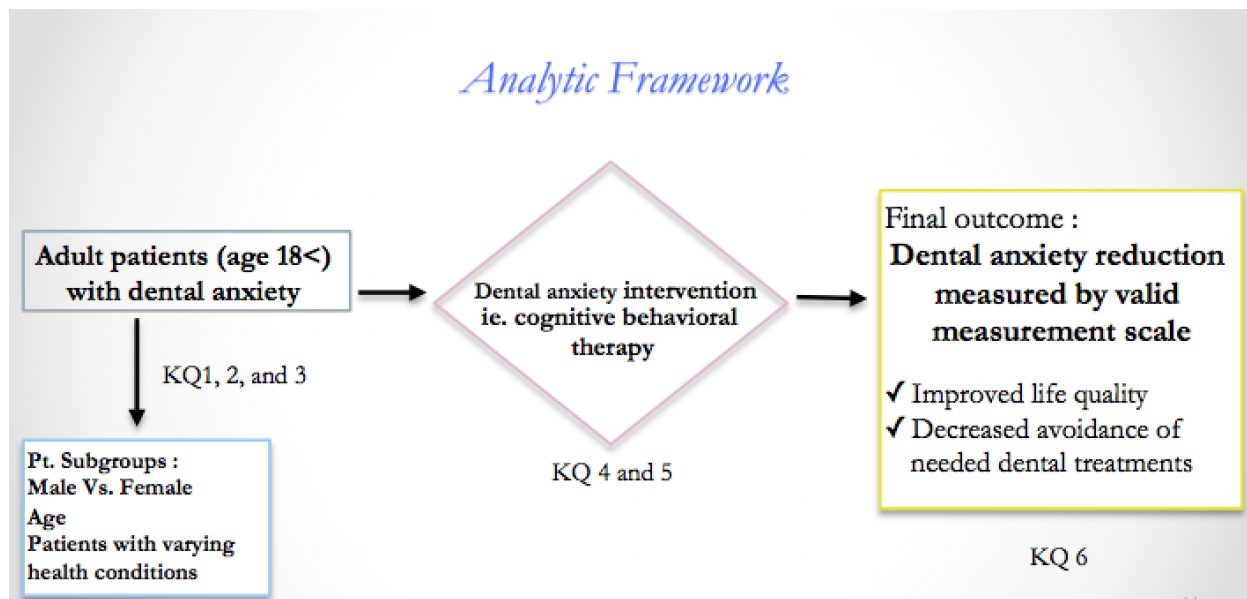


Figure 1. Analytic Framework. KQ (Key Questions).
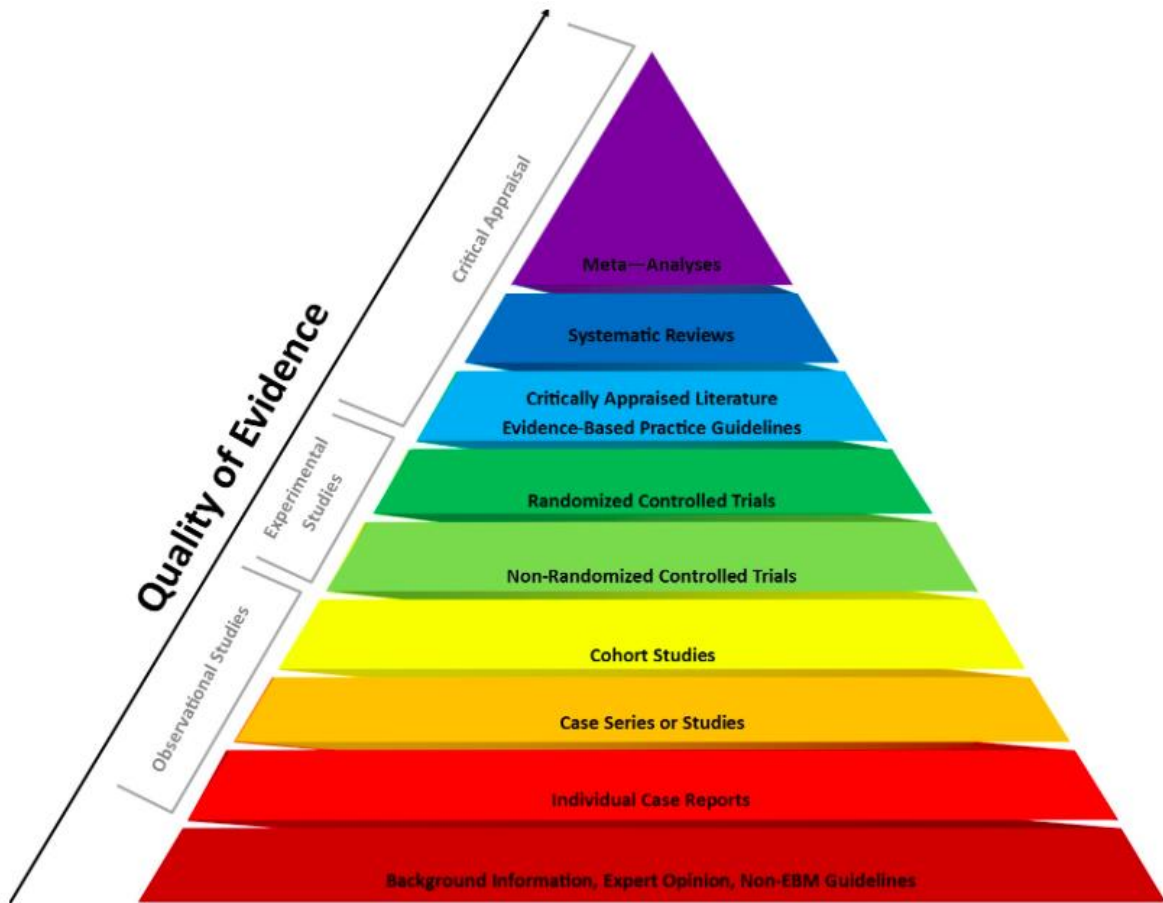
Figure 2. Hierarchy of Evidence Pyramid

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