An Evidence-Based Report Investigating the Most Effective Method to Reduce Dental Anxiety

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ABSTRACT

Dental anxiety has been found to be a significant cause of poor oral health as well as a contributor to both patient and practitioner stress. This evidence based review of the literature investigated the best method for reducing dental anxiety. Such a method would ideally address not only anxiety but the avoidant behaviour known to accompany it. Thereby, studies focusing on only pharmacological agents (known to have a short-term effect) were not considered. An initial search of electronic databases yielded a total of 233 articles. After filtration using specific inclusion criteria and scores based on the University of Toronto *Community Dentistry Modified Checklist to Assess Efficacy of Therapy or Prevention* were assigned, seven randomized control trial articles of sufficient evidence remained. These studies examined a variety of approaches which can be broadly categorized as cognitive, behavioural or cognitive-behavioural therapies. All therapies were found to decrease dental anxiety in comparison to a control, but no one can be concluded as being the most effective, in part due to the heterogenous nature of the studies. Based on the evidence, this study concludes that the most effective treatment of dental anxiety achievable is one that is tailored specifically for an individual patient with consideration to their needs, preference and dental phobia status. The deficiencies in the current literature along with future research recommendations are addressed within the body of this review article.

INTRODUCTION

Dental anxiety is described as an overwhelming feeling of tension, dread and apprehension associated with an unknown threat involving dentistry[1]. Dental phobia, according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), is a "marked and persistent fear of clearly discernible, circumscribed objects or situations"[2], and thus, is placed in the category of specific phobias. Terms such as dental fear, dental phobia, dental anxiety, and odontophobia are frequently encountered in the dental literature, do not have acceptable definitions[3], and are often used synonymously.

Numerous measures and scales have been developed in order to classify who is dentally anxious and to assess their level of anxiety for prevalence, etiology and treatment studies [4,10,13,16,25]. The prevalence of dental anxiety has been estimated to range from 2.6%[1] to as high as 20.4%[16] and dental phobia is estimated to affect 5% of the U.S. population[10]. Although a study by Smith and Heaton (2003) determined that the prevalence of dental anxiety is relatively stable, the true prevalence is inconclusive as investigators have used different scales, measures and arbitrary cut-offs.

Given the estimated prevalence of dental anxiety, it is a significant problem for both dental health care workers and patients. Anxious patients require more chair time, frequently cancel scheduled appointments[9,21] and are regarded by dentists as a great source of professional stress[19] so great that sometimes leads to misdiagnosis[8]. There are additional costs for the patient as well. Dentally anxious patients often go long periods between dental visits or avoid dental services all together when compared to dentally relaxed patients[12,20]. Avoiding preventive care appointments such as cleanings and check

ups may lead to severe disease situations requiring more invasive treatments that subsequently exacerbate the anxiety of the patient. Anxious patients have found to have poorer oral function and esthetics with an increased number of decayed and missing teeth[12,22].

There are numerous available treatments for dental anxiety including cognitive, behavioural, cognitive-behavioural and pharmacological therapies. Cognitive therapies are a type of psychotherapy that manage anxiety by identifying and changing a patient's negative and false thoughts regarding dentistry. These include group therapy[17], education, cognitive restructuring[6] and the positive dental experience[11]. Behavioral therapies focus on treating anxiety by changing or modifying a person's behavior. Such therapies include systematic desensitization, hypnosis[17], brief relaxation and musical distraction[14]. Cognitive-behavioral therapy combines elements of both techniques. Pharmacological treatments include intravenous conscious sedation, general anesthetics and the use of benzodiazepines and nitrous oxide[3,24,26].

The purpose of this study was to investigate the most effective method for treating dental anxiety from the patient's perspective. Numerous studies have established that pharmacological therapies significantly reduce anxiety[24,26,27]. Although medications may provide a more cost effective short term solution, there are few long term benefits, a greater rate of relapse[24], and an increased patient risk due to the potential for serious drug interactions or overdose. For the purpose of this study, only treatments that may provide a long term solution to patient anxiety were considered, and thus pharmaceutical methods were excluded. Almost all studies considered involved a combination of several treatment techniques that fall into the behavioral, cognitive or cognitive-behavioral categories.

METHODS

Preliminary Research

A general preliminary search was done in order to gain a better understanding of the methods used in the reduction of dental anxiety. Group members each searched several databases such as PubMed, Medline and Scholars Portal, in order to develop a list of keywords to be used in a subsequent systematic search. It was decided at this point that behavioral and cognitive approaches, rather than contemporary pharmacological techniques, would be the focus of this research project, as they appeared to be the most effective methods for long-term and long-lasting reduction in dental anxiety with the fewest amount of side effects. The group also decided to narrow the study to healthy, human adults so as to target a specific population who would most benefit from dental anxiety treatment.

Search Strategy

Keywords developed in the preliminary search (**Figure 1**) were entered into several databases available through University of Toronto Libraries in order to compile a list of relevant publications. Databases utilized included Ovid Medline, All EMB Reviews (Cochrane DSR, ACP, Journal Club, DARE, CCTR, CMR, HTA, and NHSEED), AMED (Allied and Contemporary Medicine), Health and Psychosocial Instruments, OVID Healthstar, PsychInfo and Scopus. Each search was limited to English language, humans and adult subjects (18 years and older) when permitted by the database. A total of 233 results were collected, which were imported to Refworks. Duplicate articles were deleted leaving 167 articles to be further reviewed.

Determination of Best Evidence

The 167 articles were sequentially reviewed at the title, abstract and full-article stage (**Figure 2).** A list of inclusion criteria (**Figure 3)** was employed at each stage to eliminate articles irrelevant to this project. Agreement between at least two authors of this article was met at each stage.

Once the full-copy stage was reached, a total of 14 articles remained. Each article was evaluated by three authors and 4 articles were decided to be eliminated at this stage based on their failure to meet defined inclusion criteria (**Table 1)**. Following the full-copy stage, the 10 articles remaining were critically appraised using the *Modified Checklist to Assess Evidence of Efficacy of Therapy or Prevention* (**Figure 4**). Several items were not considered in scoring the articles, as they were considered to not be applicable and/or valuable in the evaluation of the remaining articles**.** Each article was scored by at least two authors and any discrepancy greater than one point was discussed among the authors. A score of 11/12 on the checklist was chosen as a cutoff for inclusion allowing 3 additional articles to be eliminated at this time (**Table 1**). A final total of 7 relevant articles remained to be included in this paper. These articles were also evaluated based on their Level of Evidence **(Figure 5**) and Strength of Recommendations (**Figure 6**) using scales modified from The Canadian Task Force on Preventive Health Care guidelines.

A secondary search was also done by examining the References Cited list of each article that remained at the full-article stage. No articles reviewed at this time were deemed necessary to include in this project.

RESULTS

To determine the best approach in reducing dental anxiety, seven articles met all necessary criteria, scoring a minimum of 11 out of 12 on the *Modified Checklist to Assess Evidence of Efficacy of Therapy or Prevention* (**Figure 4**), and were subsequently analyzed, with their findings reported in **Table 2**. Moore et al (2002) was found to be a three year follow up of Moore et al (1996) and therefore both studies were placed in one evidence table, incorporating the results of both. A brief description of the therapeutic interventions used in each study can be found in **Table 3.**

In the studies included in **Table 2**, all were of a Randomized Controlled Trial design, providing a strong level of evidence. In addition, all studies scored a Recommendation Grade A (**Figure 6**).Three articles[17,18,24] however, involved consecutive allocation to either an intervention or control group, resulting in restricted randomization and a CTF rating of their level of evidence falling between Level I and Level II (**Figure 5**). All studies utilized a healthy, adult (18 to 65 years old) population, with sample sizes ranging from 41 to 206. In all studies, participants were either classified as being dental phobic or reported a higher than average level of anxiety toward dental treatment; however, no two studies used the exact same inclusion criteria. Similarly, all studies also showed a high level of variation in the measures they utilized to define and measure dental anxiety. A variety of surveys and questionnaires were employed, with the most common being the Dental Anxiety Scale (DAS) which was used in five of the seven studies [6,11,17,18,24] and the State Trait Anxiety Inventory (STAI) also used in five studies [5,14,17,18,24].

The studies analyzed looked at a variety of behavioural and/or cognitive interventions. All studies, regardless of the therapeutic approach used, reported a reduction in dental anxiety in comparison to a control. In a comparison study of the two modalities by Getka and Glass (1992), cognitive therapy was not found to be superior to behavioural therapy for any dental anxiety measure, although CT subjects reported greater dental self efficacy. Moore et al (2002) found that hypnotherapy, group therapy and systematic desensitization all reduced anxiety and increased dental trust after therapy and dental treatment. However, hypnotherapy and group therapy had a greater than 50% dropout rate during both therapy and one year dental attendance follow up.

The two studies [5,4] that looked at dentally anxious patients rather than dentally phobic patients used less complex intervention methods, with no therapeutic specialist involvement. These interventions were still effective in reduction of anxiety. For example, Dailey et al (2002) found that simply handing a completed modified DAS screening sheet to the dentist versus the receptionist prior to dental treatment led to a significant reduction in anxiety in the treatment group compared to the control group. Moore et al (2002) which involved dental phobic patients, showed that although intervention subjects had a significant reduction in Dental Fear Survey (DFS) scores three years after treatment, in comparison to a control, the control group also showed a slight reduction in DFS after three years.

In an effort to resolve the question presented of whether psychological or pharmacological interventions are best in the treatment of dental anxiety, a study by Thom et al (2000), was analyzed. The outcome of the study demonstrated that both treatments led to a reduction of anxiety during surgery in comparison to the control.

However, at 2 months follow up, PYSCH patients showed further improvement while PHARM patients relapsed. Furthermore, after the conclusion of the experiment, 70% of PYSCH patients, 20% of PHARM patients and 10% of control patients continued dental treatment.

DISCUSSION

Upon review of the literature, several approaches exist for reducing dental anxiety. This heterogeny, present within the seven studies that were critically appraised, led to an inability to fruitfully pool and compare the various treatment options. Subsequently, a definitive answer to the aim of this study, that is, to determine the most effective method for treating dental anxiety from the patient's perspective, could not be reached.

All studies analyzed, despite looking at cognitive approaches, behavioural approaches, or both, reported a reduction in dental anxiety in comparison to a control. Getka and Glass[11] was the only study reviewed that directly compared both behavioural and cognitive approaches. Their finding was that cognitive therapy was not found to be superior to behavioural therapy for any dental anxiety measure, but cognitive subjects reported greater dental self-efficacy. This, however, did not seem to have a great effect, as both behavioural and cognitive approaches reported comparable reduction of dental anxiety even after one year. These findings together, indicate that both approaches are plausible and comparable therapies used to reduce dental anxiety.

Moore et al.[17,18] looked specifically at hypnotherapy, group therapy and systematic desensitization (SD), finding that all interventions comparably reduced dental

anxiety and increased dental trust, the only difference being that hypnotherapy showed greater reduction in Dental Fear Survey scores than rehearsal SD. More importantly, hypnotherapy and group therapy patients were more likely to drop out of therapy and stop attending dental treatment. Moore et al.[17,18] attribute this result to the fact that in hypnotherapy, patients experience an attribution of their success or failure to their therapist, not themselves (transference), while group therapy did not provide a strong therapist/patient bond making it difficult to learn the process of establishing trust with the dentist. Within the context of this review paper, a successful treatment for dental anxiety would address not only the anxiety of the patient but also the avoidant behaviour that accompanies it. Therefore, hypnotherapy and group therapy may be less than ideal approaches in comparison to others.

The results of a reduction in DFS scores after three years within the control group in the study by Moore et al.[18] leads to a conclusion that dental phobic patients can, on their own, start and maintain dental treatment habits, albeit to a lesser extent than patients with specialist help. This hints at the concept that complex treatments may not be necessary for all phobic patients to place them on the right path. Daily et al.[5] showed that a patient's anxiety can be reduced by simply filling out a questionnaire, and knowing that their dentist has viewed the results. This was the most basic method reviewed. Lahmann et al.[14] looked at music distraction and brief relaxation. Both methods were significantly better than the control, although brief relaxation was significantly better than music distraction. Both of these studies looked at dentally anxious patients instead of dental phobic patients. This indicates that even simple, cost effective psychological interventions can be a great help in anxiety reduction. However, De Jongh et al.[7] suggest

that these less complex methods would be inadequate for severe dental phobics who may require more comprehensive cognitive and behavioural treatments. Critical analysis of De Jongh et al. [6] and Thom et al. [24] showed that a single session of cognitive therapy could be successful in reducing dental anxiety in dental phobics. It is our conclusion that anxiety treatments therefore need not be time consuming to be effective.

During our preliminary search, pharmacological interventions were concluded to lack a provision of long term effects to the patient and were therefore not a main focus for this review. Thom et al.'s [24] findings supported this decision, as, after one year, PHARM patients, who showed an initial reduction in anxiety, relapsed, with only 20% continuing regular treatment compared to 70% of PYSCH patients.

All studies included in this review had a randomized controlled trial design, although three[17,18,24] were restricted randomization. Despite this, according to the Canadian Task Force Rating System, all studies scored high on their level of evidence and scored a recommendation Grade A. Therefore, there is good evidence to recommend clinical action based on the results of these studies.

The major limitation in the appraised articles, which prevented a valid comparison of various methods of anxiety reduction, was the use of different anxiety measurement tools, as well as the use of different cut-off scores. Future research should focus on using consistent measuring tools, and cut-offs for deciding which patients are dentally 'anxious'. Another limitation was the use of static reference controls. The majority of the appraised articles used waiting list groups as controls. These controls completed pre and post-procedure questionnaires without undergoing actual dental procedures. Ethically, it is difficult to use a clinical control group as patients who are dentally anxious

may suffer needlessly if forced to undergo dental procedures without a clinical intervention to help alleviate this anxiety. Finally, two of the studies[5,24] did not have a specific dental treatment standard provided to the subjects. This could have led to result bias.

CONCLUSION

Due to the heterogenous nature of the studies on the treatment modalities of dental anxiety, no single therapy can be concluded as being the most effective. Rather, psychological strategies as a whole, including both behavioural and cognitive therapies can be said to be the most reported effective therapy in reducing dental anxiety in the long term. However, the time required along with the large number of patients who did not continue regular dental treatment, raises questions about the advantage of hypnotherapy and group therapy over other psychological therapies. According to the evidence, the choice of an appropriate therapy method should take into consideration the individual needs and the dental phobia status of the patient. Patient preference should also play a role. Therefore, the most effective treatment of dental anxiety achievable will be one that is tailored specifically for each individual patient.

RECCOMENDATIONS FOR FUTURE RESEARCH

To corroborate the results of this report, more research is certainly required. Future studies should incorporate large sample sizes so results can be generalized to the greater population. They should utilize consistent measuring tools and cut-off scores for

assessing dental anxiety to allow for easier comparison between studies. Finally, to best assess treatment methods of dental anxiety, an ideal research design would be a Randomized Controlled Trial using a true control rather than waiting list controls. This, however, may not be plausible due to it being unethical. Potentially, future research could look into the possibility of using sham controls.

ARTICLES REJECTED AT THE FULL COPY STAGE

The following articles were rejected at the full copy stage and therefore were not included in evidence based tables **(Table 1)**. Rejection was due to either failure to meet inclusion criteria or failure to meet the cut-off score after critical appraisal using the *Checklist to Assess Evidence of Efficacy of Therapy or Prevention* **(Figure 3)**.

1. Beck, F. M., Kaul, T. J., & Russell, R. K. (1978). Treatment of dental anxiety by cue-controlled relaxation. *Journal of Counseling Psychology, 25*(6), 591-591.

2. Berggren, U., Hakeberg, M., & Carlsson, S. G. (2001). No differences could be demonstrated between relaxation therapy and cognitive therapy for dental fear. *J.Evid.-Based Dent.Pract., 1*(2), 117-118.

3. Hammarstrand, G., Berggren, U., & Hakeberg, M. (1995). Psychophysiological therapy vs. hypnotherapy in the treatment of patients with dental phobia. *European Journal of Oral Sciences, 103*(6), 399-404.

4. Moore, R., & Brodsgaard, I. (1994). Group therapy compared with individual desensitization for dental anxiety. *Community Dentistry & Oral Epidemiology, 22*(4), 258-262.

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6. De Jongh, A. D., Muris, R., Ter Horst, G., Van Zuuren, F., Schoenmakers, N., & Makkes, P. (1995). One-session cognitive treatment of dental phobia: preparing dental phobics for treatment by restricting negative cognitions. *Behavioral Research Therapy, 33*(8), 947-954.

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9. Filewich, R. J., Jackson, E., & Shore, H. (1981). Effects of dental fear on efficiency of routine dental procedures. *Journal of Dental Research, 60*(A), 533.

10. Gatchel, R. (1989). The prevalence of dental fear and avoidance: expanded adult and recent adolescent surveys. *Journal of American Dental Association, 118,* 591-593.

11. Getka, E. J., & Glass, C. R. (1992). Behavioral and cognitive-behavioral approaches to the reduction of dental anxiety. *Behavior Therapy, 23*(3), 433-433.

12. Hagglin, C., Hakeberg, M., Ahlqwist, M., Sullivan, M., & Berggren, U. (2000). Factors associated with dental anxiety and attendance in middle-aged and elderly women. *Community Dentistry Oral Epidemiology, 28*(6), 451-460.

13. Kleinknecht, R., Klepac, R., & Alexander, L. (1973). Origins and characteristics of fear of dentistry. *Journal of American Dental Association, 20,* 437-443.

14. Lahmann, C., Schoen, R., Henningsen, P., Ronel, J., Muehlbacher, M., Loew, T., et al. (2008). Brief relaxation versus music distraction in the treatment of dental anxiety: A randomized controlled clinical trial. *Journal of the American Dental Association (1939), 139*(3), 317; Mar-324.

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APPENDIX A: FIGURES

Dental anxiety OR dental fear OR dental phobia OR odontophobia	AND	Behavioral therapy OR cognitive therapy OR hypnosis/dental hypnosis OR acupuncture therapy OR psychotherapy OR group therapy OR self-help group OR relaxation therapy OR conscious sedation OR conditioning

Fig. 1. Keywords entered into databases to search for relevant articles

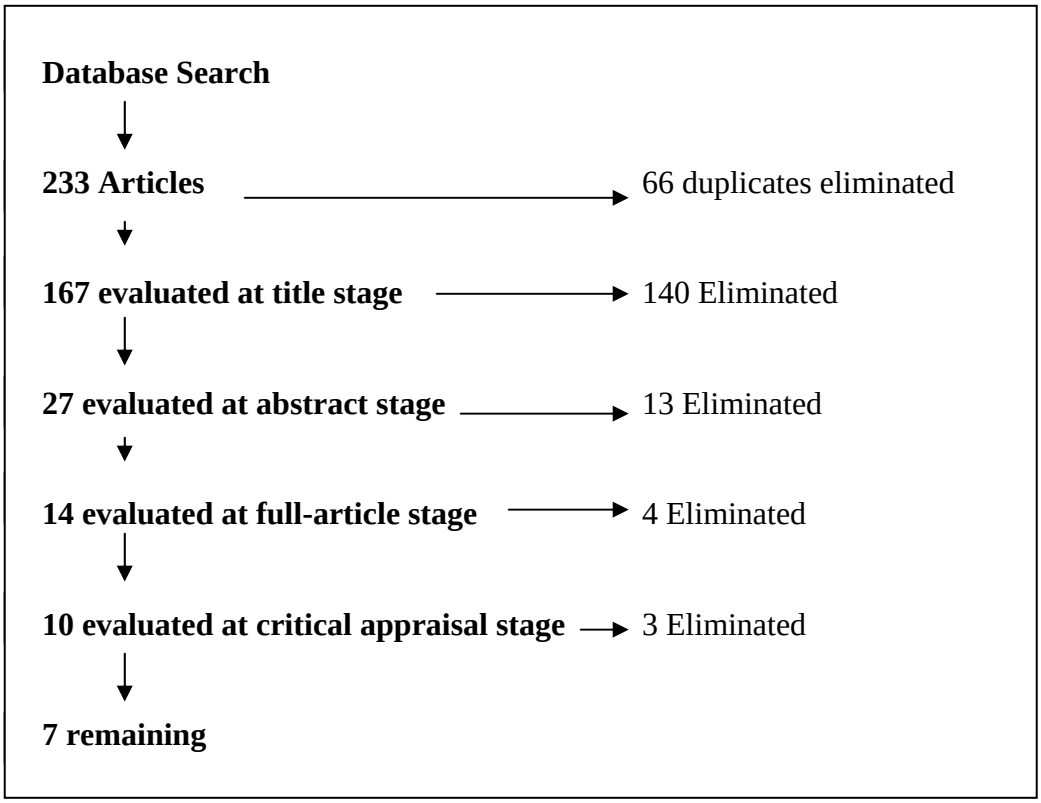

Fig. 2. Sequential elimination of irrelevant articles generated in the database search

APPENDIX A: FIGURES

INCLUSION CRITERIA

1. Must be published in English language
2. Humans subjects only
3. Adult subjects only (18 years and older)
4. Intervention must be cognitive and/or behavioral in nature
5. Subjects must be healthy/absent of disease, with the exception of dental anxiety
6. Subjects must have possess form of dental anxiety/fear/phobia at onset
7. Must be Randomized Controlled Trial design
8. Control group must be present

Fig. 3. Inclusion criteria utilized in the sequential elimination of irrelevant articles

APPENDIX A: FIGURES

Checklist to Assess Evidence of Efficacy of Therapy or Prevention
Citation:

1. Was the study ethical? ___
2. Was a strong design used to assess efficacy? ___
3. Were outcomes (benefits and harms) validly and reliably measured? ___
4. Were interventions validly and reliably measured? ___
5. What were the results?
   a. Was the treatment effect large enough to be clinically important? ___
   b. Was the estimate of the treatment effect beyond chance and relatively precise? ___
   c. If the findings were "no difference" was the power of the study 80% or better ___
6. Are the results of the study valid?
   a. Was the assignment of patients to treatments randomized? ___
   b. Were all patients who entered the trial properly accounted for and attributed at its conclusion? ___
   c. Was loss to follow-up less than 20% and balanced between test and controls ___
   d. Were patients analyzed in the groups to which they were randomized? ___
   e. Was the study of sufficient duration? ___
   f. Were patients, health workers, and study personnel "blind" to treatment? ___
   g. Were the groups similar at the start of the trial? ___
   h. Aside from the experimental intervention, were the groups treated equally? ___
   i. Was care received outside the study identified and controlled for ___
7. Will the results help in caring for your patients?
   Were all clinically important outcomes considered? ___
   Are the likely benefits of treatment worth the potential harms and costs? ___

Adapted from: Fletcher, Fletcher and Wagner. Clinical epidemiology – the essentials. 3rd ed. 1996, and Sackett et al. Evidence-based medicine: how to practice and teach EBM. 1997 [24]

Fig. 4. Checklist used at critical appraisal stage. Items 5c., 6d., 6e., and 6i. were deemed to be irrelevant to this project and were not considered in the scoring of articles. Item # 6b. and 6c. were evaluated with lesser value than other criteria, being worth 1 point combined.

APPENDIX A: FIGURES

I	Evidence from randomized controlled trial(s)
II-1	Evidence from controlled trial(s) without randomization
II-2	Evidence from cohort or case-control analytic studies, preferably from more than one centre or research group
II-3	Evidence from comparisons between times or places with or without the intervention; dramatic results in uncontrolled experiments could be included here
III	Opinions of respected authorities, based on clinical experience; descriptive studies or reports of expert committees

Fig. 5. Level of evidence classifications modified from The Canadian Task Force on Preventive Health Care guidelines

A	The CTF concludes that there is **good** evidence to recommend the clinical preventive action.
B	The CTF concludes that there is **fair** evidence to recommend the clinical preventive action.
C	The CTF concludes that the existing evidence is **conflicting** and does not allow making a recommendation for or against use of the clinical preventive action, however other factors may influence decision-making.
D	The CTF concludes that there is **fair** evidence to recommend against the clinical preventive action.
E	The CTF concludes that there is **good** evidence to recommend against the clinical preventive action.
I	The CTF concludes that there is **insufficient** evidence (in quantity and/or quality) to make a recommendation, however other factors may influence decision making.
	The CTF recognizes that in many cases patient specific factors need to be considered and discussed, such as the value the patient places on the clinical preventive action; its possible positive and negative outcome; and the context and/or personal circumstances of the patient (medical and other). In certain circumstances where the evidence is complex, conflicting or insufficient, a more detailed discussion may be required.

Fig. 6. Strength of recommendations classification modified from The Canadian Task Force on Preventive Health Care guidelines

APPENDIX B: TABLES

Citation	Stage of Elimination	Reason for Rejection
Beck , et al. 1978	Full-article stage	No control group
Berggren, et al. 2001	Full-article stage	No control group
Schmid-Leuz, et al. 2007	Full-article stage	No control group
Willumsen, et al. 2001	Full-article stage	No control group
Hammarstrand, et al. 1995	Critical Appraisal (Checklist)	Scored below the cut-off
Moore, et al. 1994	Critical Appraisal (Checklist)	Scored below the cut-off
Moses, et al. 1985	Critical Appraisal (Checklist)	Scored below the cut-off

Table 1. Articles eliminated beyond full-article stage and reason for rejection