Evaluation of the effectiveness of Virtual Reality Exposure Therapy (VRET) in the management of anxiety about dental treatment

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List of other authors and contributions

List of co-authors

Co-authors who were involved in the publications presented in this thesis:
1. Prof. Dr. Ad de Jongh.
3. Dr. Ratika Kumar.
5. Prof. Fawzia Abdullah
6. Marc Bernatchez

Authors' contributions

Chapter 2: Are technology-based interventions effective in reducing dental anxiety in children and adults?–A Systematic Review

1. Authors: Kumar Raghav Gujjar, Arjen van Wijk, Ratika Kumar, Ad de Jongh
2. Conception and study protocol: Kumar Raghav Gujjar, Ad de Jongh
3. Study implementation and data collection: Kumar Raghav Gujjar
4. Drafting of the initial manuscript: Kumar Raghav Gujjar, Ad de Jongh
5. Data analysis: Kumar Raghav Gujjar, Arjen van Wijk, Ratika Kumar, Ad de Jongh
6. Revision of the manuscript: Kumar Raghav Gujjar, Ad de Jongh
7. Agreed to the final version of the manuscript: Kumar Raghav Gujjar, Arjen van Wijk, Ratika Kumar, Ad de Jongh

Chapter 3: Virtual reality exposure therapy for treatment of dental phobia

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Chapter 4: Is Virtual Reality Exposure Therapy (VRET) the future treatment for anxious dental patients?

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Chapter 5: Virtual reality exposure therapy for the treatment of dental phobia: A controlled feasibility study

1. **Authors:** Kumar Raghav Gujjar, Arjen van Wijk, Ratika Kumar, Ad de Jongh
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3. **Study implementation and data collection:** Kumar Raghav Gujjar
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Chapter 6: Efficacy of virtual reality exposure therapy for treatment of dental phobia: a Randomized Control Trial – A study protocol

1. **Authors:** Kumar Raghav Gujjar, Arjen van Wijk, Fawzia Abdullah, Md. Nurul Islam, Marc Bernatchez, Ad de Jongh
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Chapter 7: Efficacy of Virtual Reality Exposure Therapy for the Treatment of Dental Phobia in Adults: A Randomized Controlled Trial

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6. Revision of the manuscript: Kumar Raghav Gujjar, Ad de Jongh
7. Agreed to the final version of the manuscript: Kumar Raghav Gujjar, Arjen van Wijk, Ratika Kumar, Ad de Jongh
List of publications


List of awards, conference presentations and science communication

List of awards during PhD

1. *International Association of Dental Research Giddon award 2020* for outstanding research in Behavioural Dentistry.
2. *International Association of Dental Research-ANZ Colgate Travel award* to participate at the IADR-ANZ Colgate Poster Competition 2019.
3. *Australian Government Endeavour Executive Fellowship Award in Dentistry 2018*. This is a competitive, merit-based fellowship which provides opportunities for overseas citizens and Australians to undertake study, research or professional development in Australia and overseas.

List of conference presentations during PhD

List of invited talks during PhD

1. **Gujjar (2020)** Invited Speaker “Role of Virtual Reality Exposure Therapy in Dental Anxiety reduction among patients” at the international online webinar on 14th September 2020 conducted by SDM University, India.

2. **Gujjar (2020)** Invited Speaker “Contemporary management strategies of the anxious pedodontic patient” presented at Tutor Calibration Day on 1st of February 2020 at School of Dentistry, Charles Sturt University, Orange, NSW, Australia.


6. **Gujjar (2018)** invited speaker “Virtual Reality approaches to reduce patient anxiety in the dental clinical setting” on 5th October 2018 at Research Sandpit UQ School of Dentistry, Brisbane, Australia.

List of science communications during PhD


2. Magazine articles
   - Bite magazine (Magazine for Australian dental professionals) interviewed me on my research journey of using Virtual Reality to treat dental phobia. The article was published in June 2020 which featured me on the cover page. The article can be accessed by clicking the web link below. https://issuu.com/engagemedia/docs/bite_june_2020.
Dankwoord (Acknowledgements)

For the successful completion of this PhD thesis, I thank:

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- This amazing age of technology that we live in, which makes information accessible, distances shorter, life easier and dreams possible.

Lastly, I want to thank the Almighty for all the wonderful people in my life and giving me the strength to move ahead against all odds.
Kumar Raghav is a general dentist and a lecturer in Clinical Dentistry at the School of Dentistry and Health Sciences, Charles Sturt University, Australia. He was born in Dharwad, India and did his schooling from Shaktinagar, a rural Indian town that had limited access to dental care. Kumar's passion of working with anxious dental patients stems from his own childhood traumatic dental experiences that resulted in him developing dental anxiety. He obtained his Bachelor’s in Dentistry (B.D.S) in 2002 and Master’s in Paediatric Dentistry (Children’s Dentistry) in 2006 from India and started working with anxious dental patients, especially children who were afraid of dentists. Kumar has worked as an academic and clinician across India, Libya, Malaysia and Australia. His interest in treating children and adults with dental phobia led him to pursue a PhD focusing on dental phobia from ACTA School of Dentistry, University of Amsterdam. His PhD investigates whether Virtual Reality Exposure Therapy could be used for treatment of dental phobia in adults. The PhD study is a self-funded project and is steered under the supervision of promotor prof. dr. A. de Jongh and co-promoter dr. A. J. van Wijk.
Appendix-A. Response to “Use of Virtual Reality for the Management of Anxiety and Pain in Dental Treatments: Systematic Review and Meta-Analysis”¹⁷

Kumar Raghav Gujjar, Ad de Jongh

Letter to the editor

With interest we read the systematic review and meta-analysis written by López-Valverde and colleagues (Lopez-Valverde et al., 2020). The authors gathered the existing evidence of Virtual Reality (VR) on the reduction of pain and dental anxiety during dental treatments. The authors included studies until November 2019 that compared virtual reality distractions systems with standard care situations in children and adults with dental anxiety. Based on the results of their study, the authors concluded that VR is an effective tool to reduce pain and anxiety during dental treatment.

Although this article is meant to inform dental professionals about the relative effectiveness of VR, an emerging technology-based intervention for treatment of dental anxiety (Gujjar, van Wijk, Kumar, & de Jongh, 2019), regrettably, the conclusions drawn by López-Valverde et al (Lopez-Valverde et al., 2020) are based on noteworthy methodological errors and wrong interpretations from the included articles in their study. In view of the impact this meta-analysis may have in the development of treatment guidelines and policies, we believe that it is our moral responsibility to express our thoughts about this article to the authors, the editors and the readers of this journal. To this end, we would like to highlight the following, in our opinion, problematic points.

Firstly, the authors assessed the quality of the included studies by using the modified Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines (von Elm et al., 2008) for observational studies, rather than the standard Consolidated Standards of Reporting Trials (CONSORT) guidelines (Moher et al., 2010) which are specifically meant for assessing the quality of randomised controlled trials. Secondly, despite the purpose of the research question was to

determine the dental anxiety reduction with VR *distraction* during dental treatment it seems that the authors were not aware of the fact that Virtual Reality *exposure* therapy (VRET) is a fully different treatment with a different indication (long term rather than a short term alleviation of the fear response) with an entirely different mechanism of action (Gujjar et al., 2019). Consequently, the authors wrongly included two articles that explored the efficacy of VRET for the treatment of dental phobia (Gujjar et al., 2019; Raghav et al., 2016) rather than of VR distraction, the purpose of their study. Thirdly, a remarkable mistake was that one of the included study on VRET, was a study *protocol* (Raghav et al., 2016) and not an RCT. Fourthly, in stark contrast to authors’ inclusion criteria (i.e. RCT participants undergoing VR distraction during dental treatment), the study participants in Gujjar et al’s (2019) study did not undergo actual dental treatment during VRET (Gujjar et al., 2019). Fifthly, the authors boldly stated that none of the included studies blinded the outcome assessor. However, in the study conducted by Gujjar et al, the outcome assessor (statistician) was blinded (Gujjar et al., 2019). Lastly, a wide array of other flaws need to be mentioned. For example, in Table 3, the authors have swapped the MDAS scores of the test and control for Gujjar et al’s study (Gujjar et al., 2019). In Figure 7, the authors wrongly interpreted the study results of Gujjar et al.’s study that used a visual analogue scale to determine the level of participants’ state anxiety rather than the severity of pain (Gujjar et al., 2019). Finally, in Table 4, the authors exchanged the visual analogue scale scores of the experimental and the control group for the study of Gujjar et al. (2019).

In summary, the conclusions drawn by authors casts serious doubts as these are based on range of inconsistencies in the methods and results of their systematic review. Given these methodological problems and inconsistencies we request the editors to take their responsibility and have authors review their methods and results to prevent further dissemination of incorrect information in the scientific community.

**References**


