

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS: A STUDY PROTOCOL FOR A RANDOMIZED CLINICAL TRIAL

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-054523
Article Type:	Protocol
Date Submitted by the Author:	15-Jun-2021
Complete List of Authors:	Shindova, Maria; Medicinski universitet-Plovdiv, Department of Paediatric Dentistry Belcheva, Ani; Medicinski universitet-Plovdiv, Department of Pediatric Dentistry
Keywords:	Paediatric anaesthesia < ANAESTHETICS, Laser therapy < DERMATOLOGY, Child & adolescent psychiatry < PSYCHIATRY, Anxiety disorders < PSYCHIATRY

SCHOLARONE™
Manuscripts

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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS: A STUDY PROTOCOL FOR A RANDOMIZED CLINICAL TRIAL

¹Maria Petrova Shindova, ²Ani Bozhidarova Belcheva

¹ DDS, PhD, Senior Assistant Professor, Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, mariya.shindova@gmail.com, Mariya.Shindova@mu-plovdiv.bg, ORCID iD: 0000-0003-2996-3700

² DDS, PhD, MSc, Professor, Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, abeltcheva@yahoo.com, vice_rector_ea@mu-plovdiv.bg, ORCID iD: 0000-0002-9625-8684

Corresponding author

Maria Shindova, DDS, MSc, PhD

Senior Assistant Professor

Department of Paediatric Dentistry

Faculty of Dental Medicine

Medical University - Plovdiv

3 Hristo Botev Blvd

4000 Plovdiv, Bulgaria

Mobile: + 359 898 390 935

email: mariya.shindova@gmail.com

Mariya.Shindova@mu-plovdiv.bg

Abstract

Introduction

When providing dental care to children with a high level of dental anxiety, the range of approaches are divided into two sections – use of behavior management techniques and application of alternative methods for caries removal. In an attempt to reduce dental anxiety, they can be mixed and matched in accordance with the dentists` choice. Owing to the promoted advantages Er:YAG laser turns into an ideal alternative technique for hard dental tissue therapy in anxious pediatric

1
2
3 patients. The aim of the study is to assess the efficacy of a modified version of the behavior
4 management technique Latent inhibition in combination with Er:YAG laser for achieving reduction
5 of dental anxiety in pediatric dental patients.
6
7

8 9 **Methods and analysis**

10
11 This is a protocol for a randomized controlled clinical trial. The participants will be children aged
12 6-12 years, requiring conservative treatment of occlusal carious lesion on a second primary molar.
13 Patients will be randomly assigned to the experimental or control group via a computer-generated
14 sequence. In both groups, Latent inhibition will be used as an anxiety-management technique. In
15 the experimental group caries treatment will be performed with Erbium:YAG laser, whereas in the
16 control group with the conventional rotary instruments. Outcome measures will be dental anxiety
17 felt before and after the treatment, reported by the patient on a modified version of Faces Scale by
18 LeBaron and the dynamics of heart rate, registered during the treatment session, measured with a
19 mobile pulse oximeter. Data will be analyzed by Independent sample t-test and paired t-test,
20 $p < 0.05$.
21
22
23
24
25
26
27
28

29 **Ethics and dissemination**

30
31 The study protocol has been approved by the Committee for Scientific Research Ethics, Medical
32 University-Plovdiv, Bulgaria (Reference number P-2839, Protocol of approval No. 3/30.04.2015)
33 and registered on a publicly accessible database. This research received institutional funding from
34 the Medical University–Plovdiv, Bulgaria. The results will be presented through peer-reviewed
35 publications and conference presentations.
36
37
38
39
40

41 **Trial registration:** ClinicalTrials.gov (Registration number: NCT04924452).
42

43 **Keywords:** Er:YAG laser, anxiety, management technique, pediatric dentistry
44
45

46 **Article Summary**

47 48 **Strengths and limitations of this study**

- 49
50
51 • The study focuses on the implementation of known behavior management technique in the
52 alternative caries treatment method resulting in a reduction of dental anxiety in pediatric dental
53 patients.
54
55
56
57
58
59
60

- This is the first trial to study the efficacy of Er:YAG laser therapy in combination with a behavior management technique in reducing anxiety among pediatric dental patients.
- A key strength of this study is that all participants meeting eligibility criteria will receive active treatment.
- Both subjective and objective tools are used to assess dental anxiety in this study.
- A limitation of this study is that it is not a split-mouth design whose advantage is the reduction of the outcome variability estimation, leading to the potential increase in statistical power.

1. Introduction

1.1. Background and rationale

When providing dental care to children with a high level of dental anxiety, most pediatric dentists find the conventional rotary treatment method inefficient and uncomfortable. According to the principles of behavioral dentistry, as part of pediatric postgraduate education, the so-called '4S' principle must be adapted and modified to the individual clinical situation to provide adequate dental care to anxious pediatric patients¹. The range of approaches can be divided into two sections – behavior management techniques (BMTs), on one hand, and alternative methods for caries removal, on the other hand. In an attempt to reduce dental anxiety, they can be mixed and matched in accordance with the dentists' choice.

As it has been found for more than 20 years that lasers are effective for caries excavation, Laser pediatric dentistry has been rapidly developed. It offers total innovation and changes the conventional restorative treatment in pedodontics². Owing to the promoted advantages such as minimal intervention and prevention, safety due to the low penetration depth of the laser beam, selective removal of caries lesion, lack of thermal damage, no pain perception and use of local anesthesia, a significant decrease of patient discomfort and dental anxiety and increase of subjective acceptance and tolerance of laser therapy in children, Er:YAG laser turns into an ideal laser for hard dental tissue therapy in anxious pediatric patients^{2,3,4}.

Based on the concepts of Minimal Invasive Dentistry (MID), the use of BMTs during the treatment of anxious children to reduce their anxiety is required⁵. Several specific BMTs are not part of the regular curricula of dental students and have been used by pediatric dentists only^{4,6,7}. Such a psychological technique is Latent inhibition also known as Gradual exposure^{8,9}. It involves a series of several positive non-painful – check-ups and preventive procedures, before any invasive or

1
2
3 painful dental manipulations. Step by step the child is exposed to potential anxiety-provoking
4 procedures or instruments, resulting in an acquaintance with the dental setting and personnel, as
5 well as being accustomed to dental treatment. Despite the specific indications, required preparation
6 and higher time consumption, the use of this technique is very rewarding as the pediatric patient
7 eventually becomes comfortable with the dental procedure and creates a feeling of ability to cope
8 within the child ^{6,7,10}.

9
10
11
12
13 Over the recent years, dentists advance in using alternative methods for caries removal as part of
14 their everyday practice. Therefore, the investigation of this synergetic effect of laser caries removal
15 and the different BMTs is crucial for the present and future development of pediatric dentistry and
16 will improve the quality of dental care.

17 18 19 20 21 1.2. Objectives

22
23 The aim of the study is to assess the efficacy of a modified version of the BMT Latent inhibition
24 in combination with Er:YAG laser for achieving a reduction of dental anxiety in paediatric dental
25 patients. The main objectives are to compare dental anxiety felt during the laser and conventional
26 dental treatment. The outcomes will be dental anxiety assessment by self-reported anxiety scale
27 during treatment in both groups as well as the measurement of heart rate dynamics during the
28 procedures.

29 30 31 32 33 1.3. Trial design

34
35 The research is designed as a randomized parallel-group controlled clinical study. Table 1 presents
36 the recruiting, allocation, interventions, monitoring, and analysis of the research in accordance with
37 the Standard Protocol Items: Recommendations for Interventional Trials recommendations¹¹. In
38 accordance with the Latent inhibition technique patients will have two visits to the dental office –
39 a preventive procedure, the first one, and treatment of caries lesion, the second one. Two groups
40 will be compared. In the experimental group the enamel conditioning of the occlusal surfaces of
41 the permanent molars before sealant application as well as the standardized caries treatment will
42 be performed with Erbium:YAG laser, whereas in the control group the conventional rotary
43 instruments - high-speed and low-speed dental handpieces, will be used for the caries treatment.

Table 1. Trial design. The table summarises the enrolment, allocation, interventions, and assessments in the trial

	STUDY PERIOD				
	Enrolment	Allocation	Post-allocation		
TIMEPOINT*	-t ₁	0	t ₁	t ₂	t ₃
ENROLMENT					
Eligibility screening	×				
Informed consent	×				
Allocation		×			
INTERVENTIONS					
Experimental group (BMT + Laser treatment of dental caries)				×	
Control group (BMT + Caries treatment with conventional rotary instruments)				×	
ASSESSMENTS					
Self-reported dental anxiety			×		×
Heart rate			←————→		

*Post-allocation time frame: t₁ - before the start of the treatment; t₂ - during laser or conventional treatment; t₃ – end of the treatment, before leaving the dental chair.

2. Methods and analyses

2.1. Study setting

The study setting of this research includes the Department of Paediatric Dentistry and the Laser Centre of the Faculty of Dental medicine, Medical University – Plovdiv, Bulgaria.

2.2. Eligibility

2.2.1. Inclusion criteria

1. Participants in the study are children aged 6-12 years, compliant with the cognitive development of the child;
2. Children, requiring conservative treatment of occlusal carious lesions on a second primary molar, without spontaneous unprovoked pain, percussion or palpation pain or other symptoms, indicating pulp involvement or periodontal pathology. Lesions are classified as a distinct cavity with visible dentin without prior restoration or sealants by the International Caries Detection and Assessment System (ICDAS) with code 05^{12,13,14}. Included are caries lesions only on vital teeth.
3. Children with one or more permanent molars giving indications for pit and fissure sealing;
4. Patients without previous experience with laser treatment of carious lesions;
5. Children who are not considered medically compromised or medically complex patients;
6. Verbal assent from the child willing to comply with all study procedures and protocol;
7. Obtained written informed consent by the patient's parent/guardian for participation in the study (see supplementary data file S1 'Patient consent form' and S2 'Information leaflet').

2.2.2. Exclusion criteria

1. Patients who were undergoing therapy with neurological, sedative, analgesic, and/or anti-inflammatory drugs 7 days prior to treatment that might affect heart rate;
2. Children, who were first-time dental patients;
3. Children with systemic diseases or physiological development delays;
4. Children with mental or cognitive problems;
5. Active infectious diseases such as influenza, scarlet fever, etc.
6. Excluded are molars which are affected by disturbances in the development of dental structures (hypoplasia, hypomineralization, fluorosis)

2.2.3. Interventions

Patients will be divided into 2 groups (41 per group) – experimental and control groups. All treatments will be carried out by the same operator (MS), without anesthesia. A baseline dental self-reported anxiety will be recorded using a Faces anxiety scale as well as the dynamics of heart rate, measured with a mobile pulse oximeter.

Er:YAG laser therapy protocol (experimental group):

Er:YAG laser (LiteTouch, Light Instruments LTD), emission wavelength 2940 nm will be used for enamel conditioning of the occlusal surfaces of the permanent molars before sealant application as well as the standardized caries treatment. Chosen protocol parameters are modified based on previously conducted studies ^{2,3,4,15,16}:

- preventive procedure – sealant application:
 - a low-speed rubber cup and pumice paste (CleanPolish, Kerr) will be used for 30 seconds for cleaning and polishing of the occlusal surface of the chosen permanent molar;
 - tooth surface will be washed for debris and organic residue removal and dried with air spray;
 - isolation;
 - laser conditioning of the occlusal enamel surface. The parameter settings used will be: tip-to-tissue distance 1.5mm from the tooth surface; tip diameter 600 µm; laser energy 70 mJ; pulse frequency 10 Hz; water spray level 8; average power 0.7 W; energy density 67 J/cm²;
 - tooth surface will be etched with 35% phosphoric acid gel (Etching gel, DMP Ltd) for 30 seconds and rinsed for the same time;
 - reisolation;
 - tooth surface will be dried with air spray for 15s;
 - fissure sealant application (Pit&Fissure Sealant, DMP Ltd);
 - light cured for 20 seconds.
- caries removal – parameters: enamel removal – energy 100-200mJ; density 9.84-13.03 J/cm², pulse frequency 20Hz; tip diameter 800 µm; water spray level 8; tip-to-tissue distance 0.5÷1 mm from the tooth surface; dentin removal - energy 100mJ; density 9.84 J/cm², pulse frequency 20Hz; tip diameter 800 µm; water spray level 8; tip-to-tissue distance 0.5÷1 mm from the tooth surface. Restoration with compomer.

Conventional therapy protocol (control group):

- preventive procedure – sealant application
 - a low-speed rubber cup and pumice paste (CleanPolish, Kerr) will be used for 30 seconds for cleaning and polishing of the occlusal surface of the chosen permanent molar;
 - tooth surface will be washed for debris and organic residue removal and dried with air spray;

- 1
- 2
- 3 - isolation;
- 4
- 5 - tooth surface will be etched with 35% phosphoric acid gel (Etching gel, DMP Ltd) for 30
- 6 seconds and rinsed for the same time;
- 7
- 8 - reisolation;
- 9
- 10 - tooth surface will be dried with air spray for 15s;
- 11
- 12 - fissure sealant application (Pit&Fissure Sealant, DMP Ltd);
- 13
- 14 - light cured for 20 seconds.
- 15
 - 16 • caries removal – conventional rotary instruments will be used - high-speed and low-speed
 - 17 dental handpieces. Restoration with compomer.

18 2.2.4. Clinical protocol

19 First visit:

- 20
- 21
- 22 1. Parents/guardians are informed about the protocol of the study and the laser technique. They
- 23 sign the informed consent form (see Supplementary data files S1 and S2). Verbal assent from
- 24 the child is obtained.
- 25
- 26
- 27 2. Oral examination and sealant application are performed according to the assigned intervention.
- 28
- 29 3. Patient`s self-report of dental anxiety before leaving the dental chair.
- 30

31 Second visit:

- 32
- 33
- 34 1. Patients will be asked to report their dental anxiety, pointing to the face or choose the number
- 35 which most closely depicted its state of anxiety using a modified version of the self-report Faces
- 36 Scale by LeBaron et al.¹⁷ (see Supplementary data file S3)
- 37
- 38 2. Pulse-oximeter is connected to the patient`s index finger. The start of heart rate monitoring and
- 39 recording will be 5 minutes prior to treatment. Time frame: at least 5 minutes after the dental
- 40 treatment, before leaving the dental chair.
- 41
- 42
- 43 3. Caries treatment is performed according to the assigned intervention.
- 44
- 45 4. Patient`s self-report of dental anxiety before leaving the dental chair.
- 46

47 2.3. Outcomes

48 2.3.1. Primary outcome measures

49 The primary outcome measures will be the dental anxiety felt, reported by the patient on a modified
50 version of the self-report Faces Scale by LeBaron et al. before and after the treatment session. The
51 scale comprises a row of five faces ranging from `relaxed` to `very worried` in combination with a
52
53
54
55
56
57

1
2
3 visual analog scale of 0 – 10. Each child was asked to point to the face or choose the number which
4 most closely depicted its state of anxiety.

5 6 2.3.2. Secondary outcome measures 7

8
9 The secondary outcome measures will be the dynamics of heart rate, registered during the treatment
10 session measured with a mobile pulse oximeter (CMS50F, CONTEC), placed on the index finger
11 of the left hand ¹⁸. Throughout the whole procedure of each dental visit, data were recorded and
12 analyzed by a specially developed digital processing and graphic visualization software SPO2
13 Review V1.2 rel.

14 15 16 2.3.3. Participant's timeline 17

18
19 Each eligible patient undergoes two visits. The first appointment includes screening, consenting
20 and assenting, recording of dental anxiety, sealant application according to the assigned
21 interventions for each group. The second appointment at the one-week recall includes a recording
22 of dental anxiety and treatment of a carious lesion according to the assigned interventions for each
23 group. The manipulations will be performed by one operator.
24
25
26
27
28

29 30 2.3.4. Sample size calculation 31

32 The sample size calculation is performed based on data from a pilot study with 20 subjects. The
33 sample size is calculated to assure a test power greater than 95% and a significant level of $\alpha = 0.05$.
34 We estimated a sample size of 41 patients per group to detect significant differences. Thus, the
35 final sample size for this study will be 82 patients.
36
37
38

39 2.4. Recruitment 40

41 The patients at the Department of Paediatric Dentistry of the Faculty of Dental Medicine, Medical
42 University – Plovdiv, Bulgaria, who meet the inclusion criteria, will be screened for eligibility.
43 Once identified, patients will be informed about this research project and will receive information
44 about the possibility of potential study participation. Patient recruitment starts obtaining the full
45 quota of participants within a one-year time frame. It begins in September 2021 with an estimated
46 enrollment capacity of 5 patients per month.
47
48
49
50
51
52
53
54
55
56
57
58
59
60

2.5. Participating centers

The patients are randomly selected from the visitors in the Department of Paediatric Dentistry of the Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, and treated in the Laser Centre of the same university.

2.6. Assignment of the intervention

2.6.1. Sequence generation

The patients will be randomly allocated to either the control group or the experimental group (41 patients in each group) according to the enrolment number in the trial. The randomization will be created using a computerized random generator.

2.6.2. Allocation concealment mechanism and implementation

A randomization list will be created by a random generator before the start of the treatment and kept in a locked drawer. Assignments will be kept in separate, closed opaque, sequentially numbered envelopes, enabling the sequence to be concealed until the intervention is assigned.

2.6.3. Blinding

The randomisation will be independent, that is, the patients and parents/guardians will remain blinded to group status. The operator will get acquainted with the procedure to be performed prior to the first session. The operator is selected to be the only one performing the manipulation to prevent bias. The statistician will be blinded to treatment assignment as data will be masked before the analysis without giving the statistician the key.

2.6.4. Data collection, confidentiality, storage, and monitoring of the study documents

Collection, coding, storage, and evaluation of personal data within the project will be carried out in accordance with The General Data Protection Regulation (EU) 2016/679 (GDPR). A prerequisite for data collection will be the voluntary written informed consent of the patient's parent or guardian. Confidentiality will be guaranteed by a coded ID number, access will be granted exclusively to the study investigators. The information from the paper forms will be exported to a database file and stored on a password-protected computer. Only the investigators and statistician will have access to the final data set. All data collected will be stored in sealed containers in areas

of the Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria with limited access.

3. Statistical methods

The obtained data will be recorded, tabulated, processed, and analyzed using SPSS (Statistical Package for Social Science software) version 21.0 (IBM, USA). In all tests, the significance level of 5% probability or the corresponding *P*-value will be adopted. Descriptive statistics will be calculated. Discrete variables will be summarised by frequencies or proportions. Continuous variables will be presented as means and standard deviations. We will compare anxiety mean scores according to the Faces Scale by LeBaron as well as heart rate mean score. Comparisons among groups will be performed by using the Independent sample t-test and paired t-test.

4. Patient and public involvement

The development of the research question and outcome measures will be based on the review of available evidence in this research area. Patients will not be involved in the development of the study protocol. However, their questions and concerns will be addressed during patient recruitment and study implementation. During the conduction of the study, patients will not be informed about the results of the ongoing trial since there is no planned interim analysis. The results will be disseminated to the study participants through email and routine follow-up dental check-ups.

5. Ethics and dissemination

The clinical study will be conducted in accordance with the conditions and principles of the Declaration of Helsinki, the existing EU Clinical Trial Directive (EC) No. 2001/20/EC, the recommendations of the Ethical Committee at the Medical University of Plovdiv, Bulgaria and the international ethical and scientific quality standard for designing, recording and reporting trials that involve the participation of human subjects - Good Clinical Practices (GCP).

5.1. Research ethics approval

The study was approved by the Committee for Scientific Research Ethics, Medical University - Plovdiv, Bulgaria (Reference number P-2839, Protocol of approval No.3/30.04.2015) and registered on a publicly accessible database ClinicalTrials.gov (Registration number: NCT04924452). Ethical approval for the study protocol and the written informed consent for all

1
2
3 subjects' parents/guardians was granted by the Ethics Committee of the Medical
4 University, Plovdiv, Bulgaria.
5

6 7 5.2. Consent

8
9 The operators will obtain written consent from patients' parents/guardians willing to participate in
10 the trial. Additional information will be provided for all parents for the study. Completed informed
11 consent will be collected at the Department of Pediatric Dentistry, Medical University - Plovdiv by
12 the study investigators. A copy of the signed consent form will be handed over to the participating
13 child's parent/guardian. After providing age-appropriate information about the study, verbal assent
14 will be obtained as an affirmative agreement for participation from children
15
16
17
18

19 20 21 5.3. Confidentiality

22
23 The information of the participants collected during the study will be kept strictly confidential and
24 will not be disclosed to third parties. Confidentiality will be guaranteed by a coded ID number,
25 access will be granted exclusively to the study investigators.
26
27
28

29 30 5.4. Conflict of interests

31
32 The investigators have no conflicts of interest to declare. They agree with the protocol and the
33 informed consent of the study and there is no financial interest to report.
34
35

36 37 5.5. Access to data

38
39 All data collected will be stored in sealed containers in areas of the Department of Paediatric
40 Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria with limited access.
41 The information from the paper forms will be exported to a database file and stored on a password-
42 protected computer. Only the investigators and statistician will have access to the final data set.
43
44
45

46 47 5.6. Dissemination policy

48
49 The results of the trial will be presented through peer-reviewed publications and conference
50 presentations. In addition, our results will be disseminated to clinicians, as well as key stakeholders,
51 including scientific directors of postgraduate programs "Master of Science in Lasers in Dentistry",
52 academic courses in Pedodontics and Preventive dentistry. The principle investigator (MS) and the
53
54
55
56
57

1
2
3 scientific expert (AB) will write the first draft of the manuscript without the use of professional
4 writers.
5

6 7 Conclusion

8
9 The study outlined in this protocol will be the first investigated combination of the treatment effect
10 of the Er:YAG-laser irradiation in addition to a behavior management technique. The
11 implementation of Er:YAG-laser in the regular protocol for behavior guidance during dental
12 treatment would significantly increase the success of this therapy resulting in lower levels of dental
13 anxiety among pediatric dental patients.
14
15

16
17 As the literature offers no studies reporting the effectiveness of combined use of laser therapy and
18 behavior management techniques in pediatric dentistry, there is an evident need for studies that
19 address these outcomes, since dentists advance in using alternative methods for caries removal as
20 part of their everyday practice.
21
22

23 24 Trial status

25
26 The trial is not yet recruiting patients. The process will start in September 2021 and will continue
27 until September 2022.
28

29
30 **Word count:** 3705
31

32 33 Acknowledgements

34
35 The authors would like to show their gratitude to Assoc. Prof. Georgi Tomov, PhD for the fruitful
36 discussion. Assistance with the Laser Center of the Faculty of Dental Medicine, Medical University
37 of Plovdiv, Bulgaria was greatly appreciated. The authors are also thankful to Prof. Nonka Mateva,
38 PhD for the statistical consultancy expertise in the planning of this clinical trial.
39
40

41 42 Author Contributions

43
44 We declare that all authors have made substantial contributions. MS and AB conceive the ideas.
45 AB trained MS. MS will be the primary operator, outcomes assessor, and data collector. All authors
46 will participate in the analysis and reporting of the results. Writing will be led by MS. The design
47 and protocol for this study were developed by AB and MS. All authors contributed to refining the
48 study protocol and approving the final manuscript.
49
50
51
52
53
54
55
56
57
58

Funding

This research received institutional funding from the Medical University – Plovdiv, Bulgaria.

Competing interests

None declared.

Patient consent for publication

(see Supplementary data file S1 `Patient consent form`)

References

1. Walsh LJ. Anxiety prevention: implementing the 4S principle in conservative dentistry. *Auxilliary*. 2007; 17; 24-26.
2. Pagano S, Lombardo G, Orso M, Abraha I, Capobianco B, Cianetti S. Lasers to prevent dental caries: a systematic review. *BMJ Open*. 2020 Oct 28;10(10):e038638. doi: 10.1136/bmjopen-2020-038638.
3. Galui S, Pal S, Mahata S, Saha S, Sarkar S. Laser and its use in pediatric dentistry: A review of literature and a recent update. *Int J Ped Reh* 2019;4(1):1-5. DOI: 10.4103/ijpr.ijpr_17_18
4. American Academy of Pediatric Dentistry. Policy on the use of lasers for pediatric dental patients. *The Reference Manual of Pediatric Dentistry*. Chicago, Ill.: American Academy of Pediatric Dentistry; 2020:116-8.
5. Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, Eden E. Minimal intervention dentistry for managing dental caries - a review: report of a FDI task group. *Int Dent J*. 2012 Oct;62(5):223-43. doi: 10.1111/idj.12007.
6. Buldur B. Behavior Management in Pediatric Dentistry: An Overview and Interpretation. *PBOCI* 2019;19(1):e4649. DOI: 10.4034/PBOCI.2019.191.ed1
7. Khandelwal M, Shetty RM, Rath S. Effectiveness of Distraction Techniques in Managing Pediatric Dental Patients. *Int J Clin Pediatr Dent*. 2019 Jan-Feb;12(1):18-24. doi: 10.5005/jp-journals-10005-1582.
8. Gunasekaran G, Ramakrishnan M. Evaluation of factors affecting the behaviour of uncooperative pedodontic patients. *PJAE* 2020;17(7), 2027- 2038. ISSN 1567-214x.

- 1
2
3 9. Subramaniam P, Haq M, Gupta M. Assessment of trait and state anxiety in 3-6-year old
4 children during sequential phases of dental treatment. *Contemp Pediatr Dent* 2020;1(1):22-32.
5 DOI: 10.51463/cpd.2020.10
6
- 7
8 10. Tajadura-Jimenez A, Grehl S, Tsakiris M. The other in me: Interpersonal multisensory
9 stimulation changes the mental representation of the self. *PLoS ONE*. 2012;7.
- 10
11 11. Chan AW, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, Hróbjartsson
12 A, Mann H, Dickersin K, Berlin JA, Doré CJ, Parulekar WR, Summerskill WS, Groves T,
13 Schulz KF, Sox HC, Rockhold FW, Rennie D, Moher D. SPIRIT 2013 statement: defining
14 standard protocol items for clinical trials. *Ann Intern Med*. 2013 Feb 5;158(3):200-207. doi:
15 10.7326/0003-4819-158-3-201302050-00583. PMID: 23295957; PMCID: PMC5114123.
16
- 17 12. Ismail AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H, Pitts NB. The International Caries
18 Detection and Assessment System (ICDAS): an integrated system for measuring dental caries.
19 *Community Dent Oral Epidemiol*. 2007 Jun;35(3):170-8. doi: 10.1111/j.1600-
20 0528.2007.00347.x.
21
- 22 13. International Caries Detection and Assessment System (ICDAS) Coordinating Committee.
23 Rationale and Evidence for the International Caries Detection and Assessment System
24 (ICDAS II). 2011 Sept. Available from: <http://www.icdas.org>.
25
- 26 14. Pitts N. "Pitts N. "ICDAS"--an international system for caries detection and assessment being
27 developed to facilitate caries epidemiology, research and appropriate clinical management.
28 *Community Dent Health*. 2004 Sep;21(3):193-8. PMID: 15470828.
29
- 30 15. Yilmaz H, Keles S. The effect of the Er: YAG laser on the clinical success of hydrophilic
31 fissure sealant: a randomized clinical trial. *Eur Oral Res*. 2020;54(3):148-153.
32 doi:10.26650/eor.20200029
33
- 34 16. Rattanacharonthum A, Na-Lamphun P, Kantrong N. Altered adhesion of dental sealant to
35 tooth enamel microscopically modified by Er:YAG laser irradiation: An in vitro study. *Laser*
36 *Ther*. 2019;28(1):19-25. doi:10.5978/islsm.28_19-OR-02
37
- 38 17. LeBaron S, Zeltzer L. Assessment of acute pain and anxiety in children and adolescents by
39 self-reports, observer reports, and a behavior checklist. *J Consult Clin Psychol* 1984; 52:729-
40 38. DOI: 10.1037//0022-006x.52.5.729
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 18. Song JS, Chung HC, Sohn S, Kim YJ. Effects of psychological behaviour management
4 programme on dental fear and anxiety in children: A randomised controlled clinical trial. Eur
5 J Paediatr Dent. 2020 Dec;21(4):287-291. doi: 10.23804/ejpd.2020.21.04.6.
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Consent form

For a patient's consent to publication of images and/or information about them in BMJ publications.

Name of patient:

Patient's parent/guardian:

Material – text (information about your child's oral health, level of dental anxiety and dynamics of heart rate):

Provisional title of article in which Material will be included:

Efficacy of Combined Er:YAG Laser Therapy and Behaviour Management Technique in Reducing Anxiety among Paediatric Dental Patients

CONSENT

I _____ [ENTER YOUR FULL NAME] give my consent for the Material about my child to appear in a BMJ publication.

I confirm that I: (please tick boxes to confirm)

- have seen the text or other material about my child**
 have read the article to be submitted to BMJ
 am legally entitled to give this consent.

I understand the following:

- (1) The Material will be published without my child's name attached, however I understand that complete anonymity cannot be guaranteed. It is possible that somebody somewhere may recognise my child.
- (2) The Material may show or include details of my child's medical condition or injury and any prognosis, treatment or surgery that I have/the patient has, had or may have in the future.
- (3) The article may be published in a journal which is distributed worldwide. BMJ's publications go mainly to doctors and other healthcare professionals but are also seen by many others including academics, students and journalists.
- (4) The article, including the Material, may be the subject of a press release, and may be linked to from social media and/or used in other promotional activities. Once published, the article will be placed on a BMJ website and may also be available on other websites.
- (5) The text of the article will be edited for style, grammar and consistency before publication.
- (6) I and my child will not receive any financial benefit from publication of the article.

Patient consent form 050419



- 1
2
3
4 (7) The article may also be used in full or in part in other publications and products published by BMJ
5 and/or by other publishers. This includes publication in English and in translation, in print, in digital
6 formats, and in any other formats that may be used by BMJ or other publishers now and in the
7 future. The article may appear in local editions of journals or other publications, published in the UK
8 and overseas.
9
10
11 (8) I can revoke my consent at any time before publication, but once the article has been committed to
12 publication (“gone to press”) it will not be possible to revoke the consent.
13
14 (9) This consent form will be retained securely and in confidence by BMJ in accordance with the law,
15 for no longer than necessary. Personal data provided in this form will be used and retained in
16 accordance with BMJ’s Privacy Policy available at <https://www.bmj.com/company/your-privacy/>.
17
18

19 *Signed:* _____ *Print name:* _____

20
21 *Address:* _____ *Email address:* _____

22
23 _____ *Telephone no:* _____

24
25 * *signing on behalf of the patient who is under the age of 18*

26
27 _____ *Date:* _____

28
29 **Corresponding author**

30 *Signed:* _____

Author’s name: Maria Shindova

31
32 *Position: Senior Assistant Professor*

Address: 3 Hristo Botev Bulv., Plovdiv, Bulgaria

33
34 *Institution: Department of Pediatric*

35
36 *Dentistry, Faculty of Dental Medicine,*

37
38 *Medical University of Plovdiv*

39
40 *Email address:*

Telephone no: + 359 898 390 935

41 *mariya.shindova@gmail.com*

42
43 *Date:* _____

INFORMATION LEAFLET

DEPARTMENT OF PAEDIATRIC DENTISTRY LASER CENTER FACULTY OF DENTAL MEDICINE, MEDICAL UNIVERSITY OF PLOVDIV, BULGARIA

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS

DESCRIPTION: You and your child are invited to participate in a research study on the efficiency of Er:YAG laser therapy in combination with behavior management technique in reducing anxiety among pediatric dental patients.

PROCEDURES: With your permission, we would like to collect information about your children's dental anxiety before, during and after dental treatment of a caries lesion. This study does not involve any experiments, just preventive procedures and dental treatment, collection, and study of the required information.

RISKS AND BENEFITS: There are no anticipated risks associated with this study. You will not receive any direct benefit from participation.

TIME INVOLVEMENT: Your child's participation in this study will not require more time from you other than for the first visit including an explanation of the study, oral examination and a preventive procedure (sealant application). The second appointment at 7-day recall will include dental treatment.

PAYMENTS: You will not be paid to participate in this study. You will not pay for the treatment of your child in this study.

PARTICIPANT'S RIGHTS: If you have read this form and have decided your child to participate in this research, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

The results of this research study may be presented at scientific or professional meetings or published in scientific journals. However, your identity will not be disclosed.

Thank you for your time and attention!

1
2
3 Name of parent/guardian

4
5 Signature of parent /guardian

6
7
8 Name of patient

9
10 Telephone number

11
12
13 Name of the dentist

14
15 Signature of the dentist

16
17
18
19 For additional information regarding the trial, you can contact us at the given address, emails, or
20 phone numbers.
21

22
23 **Researchers:**

24 Maria Shindova, DDS, MSc, PhD
25 Chief Assistant Professor
26 Department of Pediatric Dentistry
27 Faculty of Dental Medicine
28 Medical University – Plovdiv
29 3 Hristo Botev Blvd
30 4000 Plovdiv, Bulgaria
31 Mobile: + 359 898 390 935
32 mariya.shindova@gmail.com
33 Mariya.Shindova@mu-plovdiv.bg

Ani Belcheva, DDS, MSc, PhD
Professor
Department of Pediatric Dentistry
Faculty of Dental Medicine
Medical University - Plovdiv
3 Hristo Botev Blvd
4000 Plovdiv, Bulgaria
Mobile: + 359 889 528 932
abeltcheva@yahoo.com

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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



94x24mm (150 x 150 DPI)

Reporting checklist for protocol of a clinical trial.

Based on the SPIRIT guidelines.

		Reporting Item	Page Number
Administrative information			
Title	#1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	#2a	Trial identifier and registry name. If not yet registered, name of intended registry	2
Trial registration: data set	#2b	All items from the World Health Organization Trial Registration Data Set	2
Protocol version	#3	Date and version identifier	2
Funding	#4	Sources and types of financial, material, and other support	2,14
Roles and responsibilities: contributorship	#5a	Names, affiliations, and roles of protocol contributors	1

1	Roles and	#5b	Name and contact information for the trial sponsor	2
2				
3	responsibilities:			
4				
5	sponsor contact			
6				
7	information			
8				
9				
10				
11	Roles and	#5c	Role of study sponsor and funders, if any, in study design;	13
12				
13	responsibilities:		collection, management, analysis, and interpretation of data;	
14				
15	sponsor and funder		writing of the report; and the decision to submit the report for	
16				
17			publication, including whether they will have ultimate	
18			authority over any of these activities	
19				
20				
21				
22				
23	Roles and	#5d	Composition, roles, and responsibilities of the coordinating	n/a
24				
25	responsibilities:		centre, steering committee, endpoint adjudication	
26				
27	committees		committee, data management team, and other individuals or	
28				
29			groups overseeing the trial, if applicable (see Item 21a for	
30				
31			data monitoring committee)	
32				
33				
34				
35	Introduction			
36				
37				
38	Background and	#6a	Description of research question and justification for	3,4
39				
40	rationale		undertaking the trial, including summary of relevant studies	
41				
42			(published and unpublished) examining benefits and harms	
43				
44			for each intervention	
45				
46				
47				
48	Background and	#6b	Explanation for choice of comparators	3,4
49				
50	rationale: choice of			
51				
52	comparators			
53				
54				
55				
56	Objectives	#7	Specific objectives or hypotheses	4
57				
58				
59				
60				

1	Trial design	#8	Description of trial design including type of trial (eg, parallel	4
2			group, crossover, factorial, single group), allocation ratio,	
3			and framework (eg, superiority, equivalence, non-inferiority,	
4			exploratory)	
5				
6				
7				
8				
9				
10				
11	Methods:			
12				
13	Participants,			
14				
15	interventions, and			
16				
17	outcomes			
18				
19				
20				
21	Study setting	#9	Description of study settings (eg, community clinic,	5
22			academic hospital) and list of countries where data will be	
23			collected. Reference to where list of study sites can be	
24			obtained	
25				
26				
27				
28				
29				
30				
31	Eligibility criteria	#10	Inclusion and exclusion criteria for participants. If applicable,	5,6
32			eligibility criteria for study centres and individuals who will	
33			perform the interventions (eg, surgeons, psychotherapists)	
34				
35				
36				
37				
38				
39	Interventions:	#11a	Interventions for each group with sufficient detail to allow	5,6
40			replication, including how and when they will be	
41	description		administered	
42				
43				
44				
45				
46	Interventions:	#11b	Criteria for discontinuing or modifying allocated interventions	n/a
47			for a given trial participant (eg, drug dose change in	
48	modifications		response to harms, participant request, or improving /	
49			worsening disease)	
50				
51				
52				
53				
54				
55				
56	Interventions:	#11c	Strategies to improve adherence to intervention protocols,	n/a
57				
58				
59				
60				

1	adherence		and any procedures for monitoring adherence (eg, drug	
2			tablet return; laboratory tests)	
3				
4				
5				
6			Non-adherence interventions in the present study	
7				
8				
9	Interventions:	#11d	Relevant concomitant care and interventions that are	n/a
10				
11	concomitant care		permitted or prohibited during the trial	
12				
13				
14			No permitted or prohibited during the trial concomitant care	
15			and interventions	
16				
17				
18				
19	Outcomes	#12	Primary, secondary, and other outcomes, including the	8,9
20			specific measurement variable (eg, systolic blood pressure),	
21			analysis metric (eg, change from baseline, final value, time	
22			to event), method of aggregation (eg, median, proportion),	
23			and time point for each outcome. Explanation of the clinical	
24			relevance of chosen efficacy and harm outcomes is strongly	
25			recommended	
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36	Participant timeline	#13	Time schedule of enrolment, interventions (including any	9
37			run-ins and washouts), assessments, and visits for	
38			participants. A schematic diagram is highly recommended	
39			(see Table 1)	
40				
41				
42				
43				
44				
45				
46	Sample size	#14	Estimated number of participants needed to achieve study	9
47			objectives and how it was determined, including clinical and	
48			statistical assumptions supporting any sample size	
49			calculations	
50				
51				
52				
53				
54				
55				
56	Recruitment	#15	Strategies for achieving adequate participant enrolment to	9
57				
58				
59				
60				

reach target sample size

Methods:

**Assignment of
interventions (for
controlled trials)**

Allocation: sequence generation	#16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	10
Allocation concealment mechanism	#16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	10
Allocation: implementation	#16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	10
Blinding (masking)	#17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	10
Blinding (masking): emergency unblinding	#17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	n/a

1 open-label trial
2
3

4 **Methods: Data**

5
6 **collection,**

7
8 **management, and**

9
10 **analysis**

11			
12			
13			
14	Data collection plan	#18a	Plans for assessment and collection of outcome, baseline, 10
15			
16			and other trial data, including any related processes to
17			promote data quality (eg, duplicate measurements, training
18			of assessors) and a description of study instruments (eg,
19			questionnaires, laboratory tests) along with their reliability
20			and validity, if known. Reference to where data collection
21			forms can be found, if not in the protocol
22			
23			
24			
25			
26			
27			
28			
29			
30			
31	Data collection plan:	#18b	Plans to promote participant retention and complete follow- 10,11
32			
33	retention		up, including list of any outcome data to be collected for
34			participants who discontinue or deviate from intervention
35			protocols
36			
37			
38			
39			
40			
41	Data management	#19	Plans for data entry, coding, security, and storage, including 10,11
42			
43			any related processes to promote data quality (eg, double
44			data entry; range checks for data values). Reference to
45			where details of data management procedures can be
46			found, if not in the protocol
47			
48			
49			
50			
51			
52			
53	Statistics: outcomes	#20a	Statistical methods for analysing primary and secondary 11
54			
55			outcomes. Reference to where other details of the statistical
56			analysis plan can be found, if not in the protocol
57			
58			
59			
60			

1	Statistics: additional	#20b	Methods for any additional analyses (eg, subgroup and	11
2			adjusted analyses)	
3	analyses			
4				
5				
6	Statistics: analysis	#20c	Definition of analysis population relating to protocol non-	11
7			adherence (eg, as randomised analysis), and any statistical	
8	population and		methods to handle missing data (eg, multiple imputation)	
9	missing data			
10				
11				
12				
13				
14	Methods: Monitoring			
15				
16				
17	Data monitoring:	#21a	Composition of data monitoring committee (DMC); summary	12
18	formal committee		of its role and reporting structure; statement of whether it is	
19			independent from the sponsor and competing interests; and	
20			reference to where further details about its charter can be	
21			found, if not in the protocol. Alternatively, an explanation of	
22			why a DMC is not needed	
23				
24				
25				
26				
27				
28				
29				
30				
31				
32	Data monitoring:	#21b	Description of any interim analyses and stopping guidelines,	n/a
33	interim analysis		including who will have access to these interim results and	
34			make the final decision to terminate the trial	
35				
36				
37				
38				
39	Harms	#22	Plans for collecting, assessing, reporting, and managing	n/a
40			solicited and spontaneously reported adverse events and	
41			other unintended effects of trial interventions or trial conduct	
42				
43				
44				
45				
46				
47	Auditing	#23	Frequency and procedures for auditing trial conduct, if any,	n/a
48			and whether the process will be independent from	
49			investigators and the sponsor	
50				
51				
52				
53				
54	Ethics and			
55	dissemination			
56				
57				
58				
59				
60				

1	Research ethics	#24	Plans for seeking research ethics committee / institutional	11,12
2				
3	approval		review board (REC / IRB) approval	
4				
5				
6	Protocol	#25	Plans for communicating important protocol modifications	11,12
7				
8	amendments		(eg, changes to eligibility criteria, outcomes, analyses) to	
9			relevant parties (eg, investigators, REC / IRBs, trial	
10			participants, trial registries, journals, regulators)	
11				
12				
13				
14				
15				
16	Consent or assent	#26a	Who will obtain informed consent or assent from potential	12
17			trial participants or authorised surrogates, and how (see	
18			Item 32)	
19				
20				
21				
22				
23				
24	Consent or assent:	#26b	Additional consent provisions for collection and use of	n/a
25			participant data and biological specimens in ancillary	
26	ancillary studies		studies, if applicable	
27				
28				
29				
30				
31				
32	Confidentiality	#27	How personal information about potential and enrolled	12
33			participants will be collected, shared, and maintained in	
34			order to protect confidentiality before, during, and after the	
35			trial	
36				
37				
38				
39				
40				
41				
42	Declaration of	#28	Financial and other competing interests for principal	12
43			investigators for the overall trial and each study site	
44	interests			
45				
46				
47	Data access	#29	Statement of who will have access to the final trial dataset,	12
48			and disclosure of contractual agreements that limit such	
49			access for investigators	
50				
51				
52				
53				
54				
55	Ancillary and post	#30	Provisions, if any, for ancillary and post-trial care, and for	n/a
56			compensation to those who suffer harm from trial	
57	trial care			
58				
59				
60				

1		participation	
2			
3			
4	Dissemination	#31a	Plans for investigators and sponsor to communicate trial
5			
6	policy: trial results		results to participants, healthcare professionals, the public,
7			
8			and other relevant groups (eg, via publication, reporting in
9			
10			results databases, or other data sharing arrangements),
11			
12			including any publication restrictions
13			
14			
15			
16	Dissemination	#31b	Authorship eligibility guidelines and any intended use of
17			
18	policy: authorship		professional writers
19			
20			
21	Dissemination	#31c	Plans, if any, for granting public access to the full protocol,
22			
23	policy: reproducible		participant-level dataset, and statistical code
24			
25	research		
26			
27			
28			
29	Appendices		
30			
31			
32	Informed consent	#32	Model consent form and other related documentation given
33			
34	materials		to participants and authorised surrogates
35			
36			
37			
38			
39			
40	Biological specimens	#33	Plans for collection, laboratory evaluation, and storage of
41			
42			biological specimens for genetic or molecular analysis in the
43			
44			current trial and for future use in ancillary studies, if
45			
46			applicable
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			

BMJ Open

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS: A STUDY PROTOCOL FOR A RANDOMIZED CLINICAL TRIAL

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-054523.R1
Article Type:	Protocol
Date Submitted by the Author:	13-Dec-2021
Complete List of Authors:	Belcheva, Ani; Medicinski universitet-Plovdiv, Department of Paediatric Dentistry Shindova, Maria; Medicinski universitet-Plovdiv, Department of Paediatric Dentistry
Primary Subject Heading:	Dentistry and oral medicine
Secondary Subject Heading:	Dentistry and oral medicine
Keywords:	Paediatric anaesthesia < ANAESTHETICS, Laser therapy < DERMATOLOGY, Child & adolescent psychiatry < PSYCHIATRY, Anxiety disorders < PSYCHIATRY

SCHOLARONE™
Manuscripts

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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS: A STUDY PROTOCOL FOR A RANDOMIZED CLINICAL TRIAL

¹Ani Bozhidarova Belcheva, ²Maria Petrova Shindova

¹ DDS, PhD, MSc, Professor, Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, abeltcheva@yahoo.com, vice_rector_ea@mu-plovdiv.bg, ORCID iD: 0000-0002-9625-8684

² DDS, PhD, Senior Assistant Professor, Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, mariya.shindova@gmail.com, Mariya.Shindova@mu-plovdiv.bg, ORCID iD: 0000-0003-2996-3700

Corresponding author

Maria Shindova, DDS, MSc, PhD

Senior Assistant Professor

Department of Paediatric Dentistry

Faculty of Dental Medicine

Medical University - Plovdiv

3 Hristo Botev Blvd

4000 Plovdiv, Bulgaria

Mobile: + 359 898 390 935

email: mariya.shindova@gmail.com

Mariya.Shindova@mu-plovdiv.bg

Abstract

Introduction

When providing dental care to children with a high level of dental anxiety, the range of approaches are divided into two sections – use of behavior management techniques and application of alternative methods for caries removal. In an attempt to reduce dental anxiety, they can be mixed and matched in accordance with the dentists` choice. Owing to the promoted advantages Er:YAG laser turns into an ideal alternative technique for hard dental tissue therapy in anxious pediatric

1
2
3 patients. The aim of the study is to assess the efficacy of a modified version of the behavior
4 management technique Latent inhibition in combination with Er:YAG laser for achieving a
5 reduction of dental anxiety in pediatric dental patients.
6
7

8 9 **Methods and analysis**

10
11 This is a protocol for a randomized controlled clinical trial. The participants will be children aged
12 6-9 years, requiring conservative treatment of occlusal carious lesion on a second primary molar.
13 Patients will be randomly assigned to the experimental or control group via a computer-generated
14 sequence. In both groups, Latent inhibition will be used as an anxiety-management technique. In
15 the experimental group caries treatment will be performed with Erbium:YAG laser, whereas in the
16 control group with the conventional rotary instruments. Outcome measures will be dental anxiety
17 felt before and after the treatment, reported by the patient on a modified version of Faces Scale by
18 LeBaron and the dynamics of heart rate, registered during the treatment session, measured with a
19 mobile pulse oximeter. Data will be analyzed by Independent sample t-test and paired t-test,
20 $p < 0.05$.
21
22
23
24
25
26
27
28

29 **Ethics and dissemination**

30
31 The study protocol has been approved by the Committee for Scientific Research Ethics, Medical
32 University-Plovdiv, Bulgaria (Reference number P-2839, Protocol of approval No. 3/30.04.2015)
33 and registered on a publicly accessible database. This research received institutional funding from
34 the Medical University–Plovdiv, Bulgaria. The results will be presented through peer-reviewed
35 publications and conference presentations.
36
37
38
39
40

41 **Trial registration:** ClinicalTrials.gov (Registration number: NCT04924452).
42

43 **Keywords:** Er:YAG laser, anxiety, management technique, pediatric dentistry
44
45

46 **Article Summary**

47 48 **Strengths and limitations of this study**

- 49
50
51 • The study focuses on the implementation of a known behavior management technique in the
52 alternative caries treatment method resulting in a reduction of dental anxiety in pediatric dental
53 patients.
54
55
56
57
58
59
60

- This is the first trial to study the efficacy of Er:YAG laser therapy in combination with a behavior management technique in reducing anxiety among pediatric dental patients.
- A key strength of this study is that all participants meeting eligibility criteria will receive active treatment.
- Both subjective and objective tools are used to assess dental anxiety in this study.
- A limitation of this study is that it is not a split-mouth design whose advantage is the reduction of the outcome variability estimation, leading to the potential increase in statistical power.

1. Introduction

1.1. Background and rationale

When providing dental care to children with a high level of dental anxiety, most pediatric dentists find the conventional rotary treatment method inefficient and uncomfortable. According to the principles of behavioral dentistry, as part of pediatric postgraduate education, the so-called '4S' principle must be adapted and modified to the individual clinical situation to provide adequate dental care to anxious pediatric patients¹. The range of approaches can be divided into two sections – behavior management techniques (BMTs), on one hand, and alternative methods for caries removal, on the other hand. In an attempt to reduce dental anxiety, they can be mixed and matched in accordance with the dentists' choice.

As it has been found for more than 20 years that lasers are effective for caries excavation, Laser pediatric dentistry has been rapidly developed. It offers total innovation and changes the conventional restorative treatment in pedodontics². Owing to the promoted advantages such as minimal intervention and prevention, safety due to the low penetration depth of the laser beam, selective removal of caries lesion, lack of thermal damage, no pain perception and use of local anesthesia, a significant decrease of patient discomfort and dental anxiety and increase of subjective acceptance and tolerance of laser therapy in children, Er:YAG laser turns into an ideal laser for hard dental tissue therapy in anxious pediatric patients^{2,3,4}.

Based on the concepts of Minimal Invasive Dentistry (MID), the use of BMTs during the treatment of anxious children to reduce their anxiety is required⁵. Several specific BMTs are not part of the regular curricula of dental students and have been used by pediatric dentists only^{4,6,7}. Such a psychological technique is Latent inhibition also known as Gradual exposure^{8,9}. It involves a series of several positive non-painful – check-ups and preventive procedures, before any invasive or

1
2
3 painful dental manipulations. Step by step the child is exposed to potential anxiety-provoking
4 procedures or instruments, resulting in an acquaintance with the dental setting and personnel, as
5 well as being accustomed to dental treatment. Despite the specific indications, required preparation
6 and higher time consumption, the use of this technique is very rewarding as the pediatric patient
7 eventually becomes comfortable with the dental procedure and creates a feeling of ability to cope
8 within the child ^{6,7,10}.

9
10
11
12
13 Over the recent years, dentists advance in using alternative methods for caries removal as part of
14 their everyday practice. Therefore, the investigation of this synergetic effect of laser caries removal
15 and the different BMTs is crucial for the present and future development of pediatric dentistry and
16 will improve the quality of dental care.

17 18 19 20 21 1.2. Objectives

22
23 The aim of the study is to assess the efficacy of a modified version of the BMT Latent inhibition
24 in combination with Er:YAG laser for achieving a reduction of dental anxiety in paediatric dental
25 patients. The main objectives are to compare dental anxiety felt during the laser and conventional
26 dental treatment. The outcomes will be dental anxiety assessment by self-reported anxiety scale
27 during treatment in both groups as well as the measurement of heart rate dynamics during the
28 procedures.

29 30 31 32 33 1.3. Trial design

34
35 The research is designed as a randomized parallel-group controlled clinical study. Table 1 presents
36 the recruiting, allocation, interventions, monitoring, and analysis of the research in accordance with
37 the Standard Protocol Items: Recommendations for Interventional Trials recommendations¹¹. In
38 accordance with the Latent inhibition technique patients will have two visits to the dental office –
39 a preventive procedure, the first one, and treatment of caries lesion, the second one. Two groups
40 will be compared. In the experimental group the enamel conditioning of the occlusal surfaces of
41 the permanent molars before sealant application as well as the standardized caries treatment will
42 be performed with Erbium:YAG laser, whereas in the control group the conventional rotary
43 instruments - high-speed and low-speed dental handpieces, will be used for the caries treatment.

Table 1. Trial design. The table summarises the enrolment, allocation, interventions, and assessments in the trial

	STUDY PERIOD				
	Enrolment	Allocation	Post-allocation		
TIMEPOINT*	-t ₁	0	t ₁	t ₂	t ₃
ENROLMENT					
Eligibility screening	×				
Informed consent	×				
Allocation		×			
INTERVENTIONS					
Experimental group (BMT + Laser treatment of dental caries)				×	
Control group (BMT + Caries treatment with conventional rotary instruments)				×	
ASSESSMENTS					
Self-reported dental anxiety			×		×
Heart rate			←————→		

*Post-allocation time frame: t₁ - before the start of the treatment; t₂ - during laser or conventional treatment; t₃ – end of the treatment, before leaving the dental chair.

2. Methods and analyses

2.1. Study setting

The study setting of this research includes the Department of Paediatric Dentistry and the Laser Centre of the Faculty of Dental medicine, Medical University – Plovdiv, Bulgaria.

2.2. Eligibility

2.2.1. Inclusion criteria

1. Participants in the study are children aged 6-9 years, compliant with the cognitive development of the child;
2. Children, requiring conservative treatment of occlusal carious lesions on a second primary molar, without spontaneous unprovoked pain, percussion or palpation pain or other symptoms, indicating pulp involvement or periodontal pathology. Lesions are classified as a distinct cavity with visible dentin without prior restoration or sealants by the International Caries Detection and Assessment System (ICDAS) with code 05^{12,13,14}. Included are caries lesions only on vital teeth.
3. Children with one or more permanent molars giving indications for pit and fissure sealing;
4. Patients without previous experience with laser treatment of carious lesions;
5. Children who are not considered medically compromised or medically complex patients;
6. Verbal assent from the child willing to comply with all study procedures and protocol;
7. Obtained written informed consent by the patient's parent/guardian for participation in the study (see supplementary data file S1 'Patient consent form' and S2 'Information leaflet').

2.2.2. Exclusion criteria

1. Patients who were undergoing therapy with neurological, sedative, analgesic, and/or anti-inflammatory drugs 7 days prior to treatment that might affect heart rate;
2. Children, who were first-time dental patients;
3. Children with systemic diseases or physiological development delays;
4. Children with mental or cognitive problems;
5. Active infectious diseases such as influenza, scarlet fever, etc.
6. Excluded are molars which are affected by disturbances in the development of dental structures (hypoplasia, hypomineralization, fluorosis)

2.2.3. Interventions

Patients will be divided into 2 groups (41 per group) – experimental and control groups. All treatments will be carried out by the same operator (MS), without anesthesia. A baseline dental self-reported anxiety will be recorded using a Faces anxiety scale as well as the dynamics of heart rate, measured with a mobile pulse oximeter.

Er:YAG laser therapy protocol (experimental group):

Er:YAG laser (LiteTouch, Light Instruments LTD), emission wavelength 2940 nm will be used for enamel conditioning of the occlusal surfaces of the permanent molars before sealant application as well as the standardized caries treatment. Chosen protocol parameters are modified based on previously conducted studies ^{2,3,4,15,16}:

- preventive procedure – sealant application:
 - a low-speed rubber cup and pumice paste (CleanPolish, Kerr) will be used for 30 seconds for cleaning and polishing of the occlusal surface of the chosen permanent molar;
 - tooth surface will be washed for debris and organic residue removal and dried with air spray;
 - isolation with rubber dam;
 - laser conditioning of the occlusal enamel surface. The parameter settings used will be: tip-to-tissue distance 1.5mm from the tooth surface; tip diameter 600 µm; laser energy 70 mJ; pulse frequency 10 Hz; water spray level 8; average power 0.7 W; energy density 67 J/cm²;
 - tooth surface will be etched with 35% phosphoric acid gel (Etching gel, DMP Ltd) for 30 seconds and rinsed for the same time;
 - tooth surface will be dried with air spray for 15s;
 - fissure sealant application (Pit&Fissure Sealant, DMP Ltd);
 - light cured for 20 seconds.
- caries removal – parameters: enamel removal – energy 100-200mJ; density 9.84-13.03 J/cm², pulse frequency 20Hz; tip diameter 800 µm; water spray level 8; tip-to-tissue distance 0.5÷1 mm from the tooth surface; dentin removal - energy 100mJ; density 9.84 J/cm², pulse frequency 20Hz; tip diameter 800 µm; water spray level 8; tip-to-tissue distance 0.5÷1 mm from the tooth surface. Restoration with compomer. Time for caries removal procedure – max 8 minutes ^{17,18,19,20}.

Conventional therapy protocol (control group):

- preventive procedure – sealant application
 - a low-speed rubber cup and pumice paste (CleanPolish, Kerr) will be used for 30 seconds for cleaning and polishing of the occlusal surface of the chosen permanent molar;
 - tooth surface will be washed for debris and organic residue removal and dried with air spray;
 - isolation with rubber dam;

- 1 - tooth surface will be etched with 35% phosphoric acid gel (Etching gel, DMP Ltd) for 30
- 2 seconds and rinsed for the same time;
- 3 - tooth surface will be dried with air spray for 15s;
- 4 - fissure sealant application (Pit&Fissure Sealant, DMP Ltd);
- 5 - light cured for 20 seconds.

6 • caries removal – conventional rotary instruments will be used - high-speed and low-speed
7 dental handpieces. For the bur preparation 1.2 mm diameter diamond round bur Drendel &
8 Zweiling No. 801.314. and Komet Steel round bur 016, Komet Dental Gebr were used. A new bur
9 was used for each preparation. Restoration with compomer. Time for caries removal procedure –
10 max 4 minutes.

11 2.2.4. Clinical protocol

12 First visit:

- 13 1. Parents/guardians are informed about the protocol of the study and the laser technique. They
14 sign the informed consent form (see Supplementary data files S1 and S2). Verbal assent from
15 the child is obtained.
- 16 2. Oral examination and sealant application are performed according to the assigned intervention.
- 17 3. Patient`s self-report of dental anxiety before leaving the dental chair.

18 Second visit:

- 19 1. Patients will be asked to report their dental anxiety, pointing to the face or choose the number
20 which most closely depicted its state of anxiety using a modified version of the self-report Faces
21 Scale by LeBaron et al.²¹ (see Supplementary data file S3)
- 22 2. Pulse-oximeter is connected to the patient`s index finger. The start of heart rate monitoring and
23 recording will be 5 minutes prior to treatment. Time frame: at least 5 minutes after the dental
24 treatment, before leaving the dental chair.
- 25 3. Caries treatment is performed according to the assigned intervention.
- 26 4. Patient`s self-report of dental anxiety before leaving the dental chair.

27 2.3. Outcomes

28 2.3.1. Primary outcome measures

29 The primary outcome will be the dental anxiety before and after the treatment session, reported by
30 the patient on a modified version of the self-report Faces Scale by LeBaron et al.. The scale

1
2
3 comprises a row of five faces ranging from `relaxed` to `very worried` in combination with a visual
4 analog scale of 0 – 10. Each child was asked to point to the face or choose the number which most
5 closely depicted its state of anxiety.
6
7

8 2.3.2. Secondary outcome measures 9

10 The secondary outcome will be the dynamics of heart rate, registered during the treatment session
11 measured with a mobile pulse oximeter (CMS50F, CONTEC), placed on the index finger of the
12 left hand ²². Throughout the whole procedure of each dental visit, data were recorded and analyzed
13 by a specially developed digital processing and graphic visualization software SPO2 Review V1.2
14 rel.
15
16
17
18

19 2.3.3. Participant`s timeline 20

21 Each eligible patient undergoes two visits. The first appointment includes screening, consenting
22 and assenting, recording of dental anxiety, sealant application according to the assigned
23 interventions for each group. The second appointment at the one-week recall includes a recording
24 of dental anxiety and treatment of a carious lesion according to the assigned interventions for each
25 group. The manipulations will be performed by one operator.
26
27
28
29
30

31 2.3.4. Sample size calculation 32

33 The sample size calculation is performed based on data from a pilot study with 20 subjects. To
34 estimate sample size for the primary outcome—self-reported anxiety felt, according to the Faces
35 Scale by LeBaron—a t-test for paired groups has been used (G* Power software V.3.1,6 since we
36 have two groups). The effect size was determined using the formula
37
38
39
40

$$41 ES = \frac{Control - Treated}{SD_{pooled}} = \frac{2.33 - 0.33}{3.25} = 0.62$$

42
43 where SD is the pooled SD, an average of the SD of the experimental and control groups. The
44 sample size is calculated to assure a test power greater than 95% and a significant level of $\alpha = 0.05$.
45 We estimated a sample size of 41 patients per group to detect significant differences. Thus, the
46 final sample size for this study will be 82 patients.
47
48
49
50

51 2.4. Recruitment 52

53 The patients at the Department of Paediatric Dentistry of the Faculty of Dental Medicine, Medical
54 University – Plovdiv, Bulgaria, who meet the inclusion criteria, will be screened for eligibility.
55
56
57
58
59
60

Once identified, patients will be informed about this research project and will receive information about the possibility of potential study participation. Patient recruitment starts obtaining the full quota of participants within a one-year time frame. It begins in September 2021 with an estimated enrollment capacity of 5 patients per month.

2.5. Participating centers

The patients are randomly selected from the visitors in the Department of Paediatric Dentistry of the Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, and treated in the Laser Centre of the same university.

2.6. Assignment of the intervention

2.6.1. Sequence generation

The patients will be randomly allocated to either the control group or the experimental group (41 patients in each group) according to the enrolment number in the trial. The randomization will be created using a computerized random generator.

2.6.2. Allocation concealment mechanism and implementation

A randomization list will be created by a random generator before the start of the treatment and kept in a locked drawer. Assignments will be kept in separate, closed opaque, sequentially numbered envelopes, enabling the sequence to be concealed until the intervention is assigned.

2.6.3. Blinding

The randomisation will be independent, that is, the patients and parents/guardians will remain blinded to group status. The operator will get acquainted with the procedure to be performed prior to the first session. The operator is selected to be the only one performing the manipulation to prevent bias. The statistician will be blinded to treatment assignment as data will be masked before the analysis without giving the statistician the key.

2.6.4. Data collection, confidentiality, storage, and monitoring of the study documents

Collection, coding, storage, and evaluation of personal data within the project will be carried out in accordance with The General Data Protection Regulation (EU) 2016/679 (GDPR). A prerequisite for data collection will be the voluntary written informed consent of the patient's

parent or guardian. Confidentiality will be guaranteed by a coded ID number, access will be granted exclusively to the study investigators. The information from the paper forms will be exported to a database file and stored on a password-protected computer. Only the investigators and statistician will have access to the final data set. All data collected will be stored in sealed containers in areas of the Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria with limited access.

3. Statistical methods

The obtained data will be recorded, tabulated, processed, and analyzed using SPSS (Statistical Package for Social Science software) version 21.0 (IBM, USA). In all tests, the significance level of 5% probability or the corresponding *P*-value will be adopted. Descriptive statistics will be calculated. Discrete variables will be summarised by frequencies or proportions. Continuous variables will be presented as means and standard deviations. We will compare anxiety mean scores according to the Faces Scale by LeBaron as well as heart rate mean score. Comparisons among groups will be performed by using the Independent sample t-test and paired t-test.

4. Patient and public involvement

The development of the research question and outcome measures will be based on the review of available evidence in this research area. Patients will not be involved in the development of the study protocol. However, their questions and concerns will be addressed during patient recruitment and study implementation. During the conduction of the study, patients will not be informed about the results of the ongoing trial since there is no planned interim analysis. The results will be disseminated to the study participants through email and routine follow-up dental check-ups.

5. Ethics and dissemination

The clinical study will be conducted in accordance with the conditions and principles of the Declaration of Helsinki, the existing EU Clinical Trial Directive (EC) No. 2001/20/EC, the recommendations of the Ethical Committee at the Medical University of Plovdiv, Bulgaria and the international ethical and scientific quality standard for designing, recording and reporting trials that involve the participation of human subjects - Good Clinical Practices (GCP).

5.1. Research ethics approval

1
2
3 The study was approved by the Committee for Scientific Research Ethics, Medical University -
4 Plovdiv, Bulgaria (Reference number P-2839, Protocol of approval No.3/30.04.2015) and
5 registered on a publicly accessible database ClinicalTrials.gov (Registration number:
6 NCT04924452). Ethical approval for the study protocol and the written informed consent for all
7 subjects` parents/guardians was granted by the Ethics Committee of the Medical
8 University, Plovdiv, Bulgaria.
9

10 5.2. Consent

11 The operators will obtain written consent from patients` parents/guardians willing to participate in
12 the trial. Additional information will be provided for all parents for the study. Completed informed
13 consent will be collected at the Department of Pediatric Dentistry, Medical University - Plovdiv by
14 the study investigators. A copy of the signed consent form will be handed over to the participating
15 child`s parent/guardian. After providing age-appropriate information about the study, verbal assent
16 will be obtained as an affirmative agreement for participation from children
17
18
19
20
21
22
23
24
25
26
27

28 5.3. Confidentiality

29 The information of the participants collected during the study will be kept strictly confidential and
30 will not be disclosed to third parties. Confidentiality will be guaranteed by a coded ID number,
31 access will be granted exclusively to the study investigators.
32
33
34
35
36

37 5.4. Conflict of interests

38 The investigators have no conflicts of interest to declare. They agree with the protocol and the
39 informed consent of the study and there is no financial interest to report.
40
41
42

43 5.5. Access to data

44 All data collected will be stored in sealed containers in areas of the Department of Paediatric
45 Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria with limited access.
46 The information from the paper forms will be exported to a database file and stored on a password-
47 protected computer. Only the investigators and statistician will have access to the final data set.
48
49
50
51
52

53 5.6. Dissemination policy

1
2
3 The results of the trial will be presented through peer-reviewed publications and conference
4 presentations. In addition, our results will be disseminated to clinicians, as well as key stakeholders,
5 including scientific directors of postgraduate programs "Master of Science in Lasers in Dentistry",
6 academic courses in Pedodontics and Preventive dentistry. The principle investigator (MS) and the
7 scientific expert (AB) will write the first draft of the manuscript without the use of professional
8 writers.
9

14 Conclusion

16 The study outlined in this protocol will be the first investigated combination of the treatment effect
17 of the Er:YAG-laser irradiation in addition to a behavior management technique. The
18 implementation of Er:YAG-laser in the regular protocol for behavior guidance during dental
19 treatment would significantly increase the success of this therapy resulting in lower levels of dental
20 anxiety among pediatric dental patients.
21
22

23 As the literature offers no studies reporting the effectiveness of combined use of laser therapy and
24 behavior management techniques in pediatric dentistry, there is an evident need for studies that
25 address these outcomes, since dentists advance in using alternative methods for caries removal as
26 part of their everyday practice.
27
28

33 Trial status

34 The trial is not yet recruiting patients. The process will start in September 2021 and will continue
35 until September 2022.
36
37

38 **Word count:** 3705
39

42 Acknowledgements

43 The authors would like to show their gratitude to Assoc. Prof. Georgi Tomov, PhD for the fruitful
44 discussion. Assistance with the Laser Center of the Faculty of Dental Medicine, Medical University
45 of Plovdiv, Bulgaria was greatly appreciated. The authors are also thankful to Prof. Nonka Mateva,
46 PhD for the statistical consultancy expertise in the planning of this clinical trial.
47
48

52 Author Contributions

53
54
55
56
57
58
59
60

We declare that all authors have made substantial contributions. MS and AB conceive the ideas. AB trained MS. MS will be the primary operator, outcomes assessor, and data collector. All authors will participate in the analysis and reporting of the results. Writing will be led by MS. The design and protocol for this study were developed by AB and MS. All authors contributed to refining the study protocol and approving the final manuscript.

Funding

This research received institutional funding from the Medical University – Plovdiv, Bulgaria.

Competing interests

None declared.

Patient consent for publication

(see Supplementary data file S1 'Patient consent form')

References

1. Walsh LJ. Anxiety prevention: implementing the 4S principle in conservative dentistry. *Auxilliary*. 2007; 17; 24-26.
2. Pagano S, Lombardo G, Orso M, Abraha I, Capobianco B, Cianetti S. Lasers to prevent dental caries: a systematic review. *BMJ Open*. 2020 Oct 28;10(10):e038638. doi: 10.1136/bmjopen-2020-038638.
3. Galui S, Pal S, Mahata S, Saha S, Sarkar S. Laser and its use in pediatric dentistry: A review of literature and a recent update. *Int J Ped Reh* 2019;4(1):1-5. DOI: 10.4103/ijpr.ijpr_17_18
4. American Academy of Pediatric Dentistry. Policy on the use of lasers for pediatric dental patients. *The Reference Manual of Pediatric Dentistry*. Chicago, Ill.: American Academy of Pediatric Dentistry; 2020:116-8.
5. Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, Eden E. Minimal intervention dentistry for managing dental caries - a review: report of a FDI task group. *Int Dent J*. 2012 Oct;62(5):223-43. doi: 10.1111/idj.12007.
6. Buldur B. Behavior Management in Pediatric Dentistry: An Overview and Interpretation. *PBOCI* 2019;19(1):e4649. DOI: 10.4034/PBOCI.2019.191.ed1

- 1
2
3 7. Khandelwal M, Shetty RM, Rath S. Effectiveness of Distraction Techniques in Managing
4 Pediatric Dental Patients. *Int J Clin Pediatr Dent*. 2019 Jan-Feb;12(1):18-24. doi: 10.5005/jp-
5 journals-10005-1582.
6
- 7
8 8. Gunasekaran G,Ramakrishnan M. Evaluation of factors affecting the behaviour of
9 uncooperative pedodontic patients. *PJAE* 2020;17(7), 2027- 2038. ISSN 1567-214x.
10
- 11 9. Subramaniam P, Haq M, Gupta M.Assessment of trait and state anxiety in 3-6-year old
12 children during sequential phases of dental treatment. *Contemp Pediatr Dent* 2020;1(1):22-32.
13 DOI: 10.51463/cpd.2020.10
14
- 15 10. Tajadura-Jimenez A, Grehl S, Tsakiris M. The other in me: Interpersonal multisensory
16 stimulation changes the mental representation of the self.*PLoS ONE*. 2012;7.
17
- 18 11. Chan AW, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, Hróbjartsson
19 A, Mann H, Dickersin K, Berlin JA, Doré CJ, Parulekar WR, Summerskill WS, Groves T,
20 Schulz KF, Sox HC, Rockhold FW, Rennie D, Moher D. SPIRIT 2013 statement: defining
21 standard protocol items for clinical trials. *Ann Intern Med*. 2013 Feb 5;158(3):200-207. doi:
22 10.7326/0003-4819-158-3-201302050-00583. PMID: 23295957; PMCID: PMC5114123.
23
- 24 12. Ismail AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H, Pitts NB. The International Caries
25 Detection and Assessment System (ICDAS): an integrated system for measuring dental caries.
26 *Community Dent Oral Epidemiol*. 2007 Jun;35(3):170-8. doi: 10.1111/j.1600-
27 0528.2007.00347.x.
28
- 29 13. International Caries Detection and Assessment System (ICDAS) Coordinating Committee.
30 Rationale and Evidence for the International Caries Detection and Assessment System
31 (ICDAS II). 2011 Sept. Available from: <http://www.icdas.org>.
32
- 33 14. Pitts N. " Pitts N. "ICDAS"--an international system for caries detection and assessment being
34 developed to facilitate caries epidemiology, research and appropriate clinical management.
35 *Community Dent Health*. 2004 Sep;21(3):193-8. PMID: 15470828.
36
- 37 15. Yilmaz H, Keles S. The effect of the Er: YAG laser on the clinical success of hydrophilic
38 fissure sealant: a randomized clinical trial.*Eur Oral Res*. 2020;54(3):148-153.
39 doi:10.26650/eor.20200029
40
- 41 16. Rattanachonthum A, Na-Lamphun P, Kantrong N. Altered adhesion of dental sealant to
42 tooth enamel microscopically modified by Er:YAG laser irradiation: An in vitro study. *Laser*
43 *Ther*. 2019;28(1):19-25. doi:10.5978/islsm.28_19-OR-02
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
17. Sarmadi R, Andersson EV, Lingström P, Gabre P. A Randomized Controlled Trial Comparing Er:YAG Laser and Rotary Bur in the Excavation of Caries - Patients' Experiences and the Quality of Composite Restoration. *Open Dent J* 2018;12:443-454. doi:10.2174/1874210601812010443.
 18. Li T, Zhang X, Shi H, Ma Z, Lv B, Xie M. Er:YAG laser application in caries removal and cavity preparation in children: a meta-analysis. *Lasers Med Sci* 2018. doi:10.1007/s10103-018-2582-x
 19. Johar S, Goswami M, Kumar G, Dhillon JK. Caries removal by Er,Cr:YSGG laser and Air-rotor handpiece comparison in primary teeth treatment: an *in vivo* study. *Laser Ther*. 2019;28(2):116-122. doi:10.5978/islsm.19-OR-08.
 20. Montedori A, Abraha I, Orso M, D'Errico PG, Pagano S, Lombardo G. Lasers for caries removal in deciduous and permanent teeth. *Cochrane Database Syst Rev* 2016;9(9):CD010229. doi:10.1002/14651858.CD010229.pub2
 21. LeBaron S, Zeltzer L. Assessment of acute pain and anxiety in children and adolescents by self-reports, observer reports, and a behavior checklist. *J Consult Clin Psychol* 1984; 52:729-38. DOI: 10.1037//0022-006x.52.5.729
 22. Song JS, Chung HC, Sohn S, Kim YJ. Effects of psychological behaviour management programme on dental fear and anxiety in children: A randomised controlled clinical trial. *Eur J Paediatr Dent*. 2020 Dec;21(4):287-291. doi: 10.23804/ejpd.2020.21.04.6.

Consent form

For a patient's consent to publication of images and/or information about them in BMJ publications.

Name of patient:

Patient's parent/guardian:

Material – text (information about your child's oral health, level of dental anxiety and dynamics of heart rate):

Provisional title of article in which Material will be included:

Efficacy of Combined Er:YAG Laser Therapy and Behaviour Management Technique in Reducing Anxiety among Paediatric Dental Patients

CONSENT

I _____ [ENTER YOUR FULL NAME] give my consent for the Material about my child to appear in a BMJ publication.

I confirm that I: (please tick boxes to confirm)

- have seen the text or other material about my child**
 have read the article to be submitted to BMJ
 am legally entitled to give this consent.

I understand the following:

- (1) The Material will be published without my child's name attached, however I understand that complete anonymity cannot be guaranteed. It is possible that somebody somewhere may recognise my child.
- (2) The Material may show or include details of my child's medical condition or injury and any prognosis, treatment or surgery that I have/the patient has, had or may have in the future.
- (3) The article may be published in a journal which is distributed worldwide. BMJ's publications go mainly to doctors and other healthcare professionals but are also seen by many others including academics, students and journalists.
- (4) The article, including the Material, may be the subject of a press release, and may be linked to from social media and/or used in other promotional activities. Once published, the article will be placed on a BMJ website and may also be available on other websites.
- (5) The text of the article will be edited for style, grammar and consistency before publication.
- (6) I and my child will not receive any financial benefit from publication of the article.

Patient consent form 050419



- 1
2
3
4 (7) The article may also be used in full or in part in other publications and products published by BMJ
5 and/or by other publishers. This includes publication in English and in translation, in print, in digital
6 formats, and in any other formats that may be used by BMJ or other publishers now and in the
7 future. The article may appear in local editions of journals or other publications, published in the UK
8 and overseas.
9
10
11 (8) I can revoke my consent at any time before publication, but once the article has been committed to
12 publication (“gone to press”) it will not be possible to revoke the consent.
13
14 (9) This consent form will be retained securely and in confidence by BMJ in accordance with the law,
15 for no longer than necessary. Personal data provided in this form will be used and retained in
16 accordance with BMJ’s Privacy Policy available at <https://www.bmj.com/company/your-privacy/>.
17
18

19 *Signed:* _____ *Print name:* _____

20
21 *Address:* _____ *Email address:* _____

22
23 _____ *Telephone no:* _____

24
25 * *signing on behalf of the patient who is under the age of 18*

26
27 _____ *Date:* _____

28
29 **Corresponding author**

30 *Signed:* _____

Author’s name: Maria Shindova

31
32 *Position: Senior Assistant Professor*

Address: 3 Hristo Botev Bulv., Plovdiv, Bulgaria

33
34 *Institution: Department of Pediatric*

35
36 *Dentistry, Faculty of Dental Medicine,*

37
38 *Medical University of Plovdiv*

39
40 *Email address:*

Telephone no: + 359 898 390 935

41 *mariya.shindova@gmail.com*

42
43 *Date:* _____

INFORMATION LEAFLET

**DEPARTMENT OF PAEDIATRIC DENTISTRY
LASER CENTER
FACULTY OF DENTAL MEDICINE,
MEDICAL UNIVERSITY OF PLOVDIV, BULGARIA**

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS

DESCRIPTION: You and your child are invited to participate in a research study on the efficiency of Er:YAG laser therapy in combination with behavior management technique in reducing anxiety among pediatric dental patients.

PROCEDURES: With your permission, we would like to collect information about your children's dental anxiety before, during and after dental treatment of a caries lesion. This study does not involve any experiments, just preventive procedures and dental treatment, collection, and study of the required information.

RISKS AND BENEFITS: There are no anticipated risks associated with this study. You will not receive any direct benefit from participation.

TIME INVOLVEMENT: Your child's participation in this study will not require more time from you other than for the first visit including an explanation of the study, oral examination and a preventive procedure (sealant application). The second appointment at 7-day recall will include dental treatment.

PAYMENTS: You will not be paid to participate in this study. You will not pay for the treatment of your child in this study.

PARTICIPANT'S RIGHTS: If you have read this form and have decided your child to participate in this research, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

The results of this research study may be presented at scientific or professional meetings or published in scientific journals. However, your identity will not be disclosed.

Thank you for your time and attention!

1
2
3 Name of parent/guardian

4
5 Signature of parent /guardian

6
7
8 Name of patient

9
10 Telephone number

11
12
13 Name of the dentist

14
15 Signature of the dentist

16
17
18
19 For additional information regarding the trial, you can contact us at the given address, emails, or
20 phone numbers.
21

22
23 **Researchers:**

24 Maria Shindova, DDS, MSc, PhD
25 Chief Assistant Professor
26 Department of Pediatric Dentistry
27 Faculty of Dental Medicine
28 Medical University – Plovdiv
29 3 Hristo Botev Blvd
30 4000 Plovdiv, Bulgaria
31 Mobile: + 359 898 390 935
32 mariya.shindova@gmail.com
33 Mariya.Shindova@mu-plovdiv.bg

Ani Belcheva, DDS, MSc, PhD
Professor
Department of Pediatric Dentistry
Faculty of Dental Medicine
Medical University - Plovdiv
3 Hristo Botev Blvd
4000 Plovdiv, Bulgaria
Mobile: + 359 889 528 932
abeltcheva@yahoo.com

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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



94x24mm (150 x 150 DPI)

Reporting checklist for protocol of a clinical trial.

Based on the SPIRIT guidelines.

		Reporting Item	Page Number
Administrative information			
Title	#1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	#2a	Trial identifier and registry name. If not yet registered, name of intended registry	2
Trial registration: data set	#2b	All items from the World Health Organization Trial Registration Data Set	2
Protocol version	#3	Date and version identifier	2
Funding	#4	Sources and types of financial, material, and other support	2,14
Roles and responsibilities: contributorship	#5a	Names, affiliations, and roles of protocol contributors	1

1	Roles and	#5b	Name and contact information for the trial sponsor	2
2				
3	responsibilities:			
4				
5	sponsor contact			
6				
7	information			
8				
9				
10				
11	Roles and	#5c	Role of study sponsor and funders, if any, in study design;	13
12				
13	responsibilities:		collection, management, analysis, and interpretation of data;	
14				
15	sponsor and funder		writing of the report; and the decision to submit the report for	
16				
17			publication, including whether they will have ultimate	
18			authority over any of these activities	
19				
20				
21				
22				
23	Roles and	#5d	Composition, roles, and responsibilities of the coordinating	n/a
24				
25	responsibilities:		centre, steering committee, endpoint adjudication	
26				
27	committees		committee, data management team, and other individuals or	
28				
29			groups overseeing the trial, if applicable (see Item 21a for	
30				
31			data monitoring committee)	
32				
33				
34				
35	Introduction			
36				
37				
38	Background and	#6a	Description of research question and justification for	3,4
39				
40	rationale		undertaking the trial, including summary of relevant studies	
41				
42			(published and unpublished) examining benefits and harms	
43				
44			for each intervention	
45				
46				
47				
48	Background and	#6b	Explanation for choice of comparators	3,4
49				
50	rationale: choice of			
51				
52	comparators			
53				
54				
55				
56	Objectives	#7	Specific objectives or hypotheses	4
57				
58				
59				
60				

1	Trial design	#8	Description of trial design including type of trial (eg, parallel	4
2			group, crossover, factorial, single group), allocation ratio,	
3			and framework (eg, superiority, equivalence, non-inferiority,	
4			exploratory)	
5				
6				
7				
8				
9				
10				
11	Methods:			
12				
13	Participants,			
14				
15	interventions, and			
16				
17	outcomes			
18				
19				
20				
21	Study setting	#9	Description of study settings (eg, community clinic,	5
22			academic hospital) and list of countries where data will be	
23			collected. Reference to where list of study sites can be	
24			obtained	
25				
26				
27				
28				
29				
30				
31	Eligibility criteria	#10	Inclusion and exclusion criteria for participants. If applicable,	5,6
32			eligibility criteria for study centres and individuals who will	
33			perform the interventions (eg, surgeons, psychotherapists)	
34				
35				
36				
37				
38				
39	Interventions:	#11a	Interventions for each group with sufficient detail to allow	5,6
40			replication, including how and when they will be	
41	description		administered	
42				
43				
44				
45				
46	Interventions:	#11b	Criteria for discontinuing or modifying allocated interventions	n/a
47			for a given trial participant (eg, drug dose change in	
48	modifications		response to harms, participant request, or improving /	
49			worsening disease)	
50				
51				
52				
53				
54				
55				
56	Interventions:	#11c	Strategies to improve adherence to intervention protocols,	n/a
57				
58				
59				
60				

1	adherence		and any procedures for monitoring adherence (eg, drug	
2			tablet return; laboratory tests)	
3				
4				
5				
6			Non-adherence interventions in the present study	
7				
8				
9	Interventions:	#11d	Relevant concomitant care and interventions that are	n/a
10				
11	concomitant care		permitted or prohibited during the trial	
12				
13				
14			No permitted or prohibited during the trial concomitant care	
15			and interventions	
16				
17				
18				
19	Outcomes	#12	Primary, secondary, and other outcomes, including the	8,9
20			specific measurement variable (eg, systolic blood pressure),	
21			analysis metric (eg, change from baseline, final value, time	
22			to event), method of aggregation (eg, median, proportion),	
23			and time point for each outcome. Explanation of the clinical	
24			relevance of chosen efficacy and harm outcomes is strongly	
25			recommended	
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36	Participant timeline	#13	Time schedule of enrolment, interventions (including any	9
37			run-ins and washouts), assessments, and visits for	
38			participants. A schematic diagram is highly recommended	
39			(see Table 1)	
40				
41				
42				
43				
44				
45				
46	Sample size	#14	Estimated number of participants needed to achieve study	9
47			objectives and how it was determined, including clinical and	
48			statistical assumptions supporting any sample size	
49			calculations	
50				
51				
52				
53				
54				
55				
56	Recruitment	#15	Strategies for achieving adequate participant enrolment to	9
57				
58				
59				
60				

reach target sample size

Methods:

**Assignment of
interventions (for
controlled trials)**

Allocation: sequence generation	#16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	10
Allocation concealment mechanism	#16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	10
Allocation: implementation	#16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	10
Blinding (masking)	#17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	10
Blinding (masking): emergency unblinding	#17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	n/a

1 open-label trial
2
3

4 **Methods: Data**

5
6 **collection,**

7
8 **management, and**

9
10 **analysis**

11			
12			
13			
14	Data collection plan	#18a	Plans for assessment and collection of outcome, baseline, 10
15			
16			and other trial data, including any related processes to
17			promote data quality (eg, duplicate measurements, training
18			of assessors) and a description of study instruments (eg,
19			questionnaires, laboratory tests) along with their reliability
20			and validity, if known. Reference to where data collection
21			forms can be found, if not in the protocol
22			
23			
24			
25			
26			
27			
28			
29			
30			
31	Data collection plan:	#18b	Plans to promote participant retention and complete follow- 10,11
32			
33	retention		up, including list of any outcome data to be collected for
34			participants who discontinue or deviate from intervention
35			protocols
36			
37			
38			
39			
40			
41	Data management	#19	Plans for data entry, coding, security, and storage, including 10,11
42			
43			any related processes to promote data quality (eg, double
44			data entry; range checks for data values). Reference to
45			where details of data management procedures can be
46			found, if not in the protocol
47			
48			
49			
50			
51			
52			
53	Statistics: outcomes	#20a	Statistical methods for analysing primary and secondary 11
54			
55			outcomes. Reference to where other details of the statistical
56			analysis plan can be found, if not in the protocol
57			
58			
59			
60			

1	Statistics: additional	#20b	Methods for any additional analyses (eg, subgroup and	11
2			adjusted analyses)	
3	analyses			
4				
5				
6	Statistics: analysis	#20c	Definition of analysis population relating to protocol non-	11
7			adherence (eg, as randomised analysis), and any statistical	
8	population and		methods to handle missing data (eg, multiple imputation)	
9	missing data			
10				
11				
12				
13				
14	Methods: Monitoring			
15				
16				
17	Data monitoring:	#21a	Composition of data monitoring committee (DMC); summary	12
18	formal committee		of its role and reporting structure; statement of whether it is	
19			independent from the sponsor and competing interests; and	
20			reference to where further details about its charter can be	
21			found, if not in the protocol. Alternatively, an explanation of	
22			why a DMC is not needed	
23				
24				
25				
26				
27				
28				
29				
30				
31				
32	Data monitoring:	#21b	Description of any interim analyses and stopping guidelines,	n/a
33	interim analysis		including who will have access to these interim results and	
34			make the final decision to terminate the trial	
35				
36				
37				
38				
39	Harms	#22	Plans for collecting, assessing, reporting, and managing	n/a
40			solicited and spontaneously reported adverse events and	
41			other unintended effects of trial interventions or trial conduct	
42				
43				
44				
45				
46				
47	Auditing	#23	Frequency and procedures for auditing trial conduct, if any,	n/a
48			and whether the process will be independent from	
49			investigators and the sponsor	
50				
51				
52				
53				
54	Ethics and			
55	dissemination			
56				
57				
58				
59				
60				

1	Research ethics	#24	Plans for seeking research ethics committee / institutional	11,12
2				
3	approval		review board (REC / IRB) approval	
4				
5				
6	Protocol	#25	Plans for communicating important protocol modifications	11,12
7				
8	amendments		(eg, changes to eligibility criteria, outcomes, analyses) to	
9			relevant parties (eg, investigators, REC / IRBs, trial	
10			participants, trial registries, journals, regulators)	
11				
12				
13				
14				
15				
16	Consent or assent	#26a	Who will obtain informed consent or assent from potential	12
17			trial participants or authorised surrogates, and how (see	
18			Item 32)	
19				
20				
21				
22				
23				
24	Consent or assent:	#26b	Additional consent provisions for collection and use of	n/a
25			participant data and biological specimens in ancillary	
26	ancillary studies		studies, if applicable	
27				
28				
29				
30				
31				
32	Confidentiality	#27	How personal information about potential and enrolled	12
33			participants will be collected, shared, and maintained in	
34			order to protect confidentiality before, during, and after the	
35			trial	
36				
37				
38				
39				
40				
41				
42	Declaration of	#28	Financial and other competing interests for principal	12
43			investigators for the overall trial and each study site	
44	interests			
45				
46				
47	Data access	#29	Statement of who will have access to the final trial dataset,	12
48			and disclosure of contractual agreements that limit such	
49			access for investigators	
50				
51				
52				
53				
54				
55	Ancillary and post	#30	Provisions, if any, for ancillary and post-trial care, and for	n/a
56			compensation to those who suffer harm from trial	
57	trial care			
58				
59				
60				

1		participation	
2			
3			
4	Dissemination	#31a	Plans for investigators and sponsor to communicate trial
5			
6	policy: trial results		results to participants, healthcare professionals, the public,
7			
8			and other relevant groups (eg, via publication, reporting in
9			
10			results databases, or other data sharing arrangements),
11			
12			including any publication restrictions
13			
14			
15			
16	Dissemination	#31b	Authorship eligibility guidelines and any intended use of
17			
18	policy: authorship		professional writers
19			
20			
21	Dissemination	#31c	Plans, if any, for granting public access to the full protocol,
22			
23	policy: reproducible		participant-level dataset, and statistical code
24			
25	research		
26			
27			
28			
29	Appendices		
30			
31			
32	Informed consent	#32	Model consent form and other related documentation given
33			
34	materials		to participants and authorised surrogates
35			
36			
37			
38			
39			
40	Biological specimens	#33	Plans for collection, laboratory evaluation, and storage of
41			
42			biological specimens for genetic or molecular analysis in the
43			
44			current trial and for future use in ancillary studies, if
45			
46			applicable
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			

BMJ Open

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS: A STUDY PROTOCOL FOR A RANDOMIZED CLINICAL TRIAL

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-054523.R2
Article Type:	Protocol
Date Submitted by the Author:	21-Jun-2022
Complete List of Authors:	Belcheva, Ani; Medicinski universitet-Plovdiv, Department of Paediatric Dentistry Shindova, Maria; Medicinski universitet-Plovdiv, Department of Paediatric Dentistry
Primary Subject Heading:	Dentistry and oral medicine
Secondary Subject Heading:	Dentistry and oral medicine
Keywords:	Paediatric anaesthesia < ANAESTHETICS, Laser therapy < DERMATOLOGY, Child & adolescent psychiatry < PSYCHIATRY, Anxiety disorders < PSYCHIATRY

SCHOLARONE™
Manuscripts

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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

**EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH
BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG
PAEDIATRIC DENTAL PATIENTS: A STUDY PROTOCOL FOR A RANDOMIZED
CLINICAL TRIAL**

¹Ani Bozhidarova Belcheva, ²Maria Petrova Shindova

¹ DDS, PhD, MSc, Professor, Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, abeltcheva@yahoo.com, vice_rector_ea@mu-plovdiv.bg, ORCID iD: 0000-0002-9625-8684

² DDS, PhD, Senior Assistant Professor, Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, mariya.shindova@gmail.com, Mariya.Shindova@mu-plovdiv.bg, ORCID iD: 0000-0003-2996-3700

Corresponding author

Maria Shindova, DDS, MSc, PhD

Senior Assistant Professor

Department of Paediatric Dentistry

Faculty of Dental Medicine

Medical University - Plovdiv

3 Hristo Botev Blvd

4000 Plovdiv, Bulgaria

Mobile: + 359 898 390 935

email: mariya.shindova@gmail.com

Mariya.Shindova@mu-plovdiv.bg

Abstract

Introduction

When providing dental care to children with a high level of dental anxiety, the range of approaches are divided into two sections – use of behavior management techniques (BMTs) and application of alternative methods for caries removal. In an attempt to reduce dental anxiety, they can be mixed and matched in accordance with the dentists` choice. Owing to the promoted advantages Erbium-doped Yttrium Aluminium Garnet (Er:YAG) laser turns into an ideal alternative technique for hard

1
2
3 dental tissue therapy in anxious pediatric patients. The aim of the study is to assess the efficacy of
4 a modified version of the BMT Latent inhibition in combination with Er:YAG laser for achieving
5 a reduction of dental anxiety in pediatric dental patients.
6
7

8 9 **Methods and analysis**

10
11 This is a protocol for a randomized controlled clinical trial. The participants will be children aged
12 6-9 years, requiring conservative treatment of occlusal carious lesion on a second primary molar.
13 Patients will be randomly assigned to the experimental or control group via a computer-generated
14 sequence. In both groups, Latent inhibition will be used as an anxiety-management technique. In
15 the experimental group caries treatment will be performed with Er:YAG laser, whereas in the
16 control group with the conventional rotary instruments. Outcome measures will be dental anxiety
17 felt before and after the treatment, reported by the patient on a modified version of Faces Scale by
18 LeBaron and the dynamics of heart rate, registered during the treatment session, measured with a
19 mobile pulse oximeter. Data will be analyzed by Independent sample t-test and paired t-test,
20 $p < 0.05$.
21
22
23
24
25
26
27
28

29 **Ethics and dissemination**

30
31 The study protocol has been approved by the Committee for Scientific Research Ethics, Medical
32 University-Plovdiv, Bulgaria (Reference number P-2839, Protocol of approval No. 3/30.04.2015)
33 and registered on a publicly accessible database. This research received institutional funding from
34 the Medical University–Plovdiv, Bulgaria. The results will be presented through peer-reviewed
35 publications and conference presentations.
36
37
38
39
40

41 **Trial registration:** ClinicalTrials.gov (Registration number: NCT04924452).
42

43 **Keywords:** Er:YAG laser, anxiety, management technique, pediatric dentistry
44
45

46 **Article Summary**

47 48 **Strengths and limitations of this study**

- 49
50 • The study focuses on the implementation of a known BMT in the alternative caries treatment
51 method
52
- 53 • A key strength of this study is that all participants meeting eligibility criteria will receive active
54 treatment.
55
56
57

- Both subjective and objective tools are used to assess dental anxiety in this study.
- A limitation of this study is that it is not a split-mouth design whose advantage is the reduction of the outcome variability estimation

1. Introduction

1.1. Background and rationale

When providing dental care to children with a high level of dental anxiety, most pediatric dentists find the conventional rotary treatment method inefficient and uncomfortable. According to the principles of behavioral dentistry, as part of pediatric postgraduate education, the so-called '4S' principle must be adapted and modified to the individual clinical situation to provide adequate dental care to anxious pediatric patients [1]. The range of approaches can be divided into two sections – behavior management techniques, on one hand, and alternative methods for caries removal, on the other hand. In an attempt to reduce dental anxiety, they can be mixed and matched in accordance with the dentists' choice.

As it has been found for more than 20 years that lasers are effective for caries excavation, Laser pediatric dentistry has been rapidly developed. It offers total innovation and changes the conventional restorative treatment in pedodontics [2]. Owing to the promoted advantages such as minimal intervention and prevention, safety due to the low penetration depth of the laser beam, selective removal of caries lesion, lack of thermal damage, no pain perception and use of local anesthesia, a significant decrease of patient discomfort and dental anxiety and increase of subjective acceptance and tolerance of laser therapy in children, Er:YAG laser turns into an ideal laser for hard dental tissue therapy in anxious pediatric patients [2,3,4].

Based on the concepts of Minimal Invasive Dentistry (MID), the use of BMTs during the treatment of anxious children to reduce their anxiety is required [5]. Several specific BMTs are not part of the regular curricula of dental students and have been used by pediatric dentists only [4,6,7]. Such a psychological technique is Latent inhibition also known as Gradual exposure [8,9]. It involves a series of several positive non-painful – check-ups and preventive procedures, before any invasive or painful dental manipulations. Step by step the child is exposed to potential anxiety-provoking procedures or instruments, resulting in an acquaintance with the dental setting and personnel, as well as being accustomed to dental treatment. Despite the specific indications, required preparation and higher time consumption, the use of this technique is very rewarding as the pediatric patient

1
2
3 eventually becomes comfortable with the dental procedure and creates a feeling of ability to cope
4 within the child [6,7,10].

5
6 Over the recent years, dentists advance in using alternative methods for caries removal as part of
7 their everyday practice. Therefore, the investigation of this synergetic effect of laser caries removal
8 and the different BMTs is crucial for the present and future development of pediatric dentistry and
9 will improve the quality of dental care.

13 1.2. Objectives

14
15
16 The aim of the study is to assess the efficacy of a modified version of the BMT Latent inhibition
17 in combination with Er:YAG laser for achieving a reduction of dental anxiety in paediatric dental
18 patients. The main objectives are to compare dental anxiety felt during the laser and conventional
19 dental treatment. The outcomes will be dental anxiety assessment by self-reported anxiety scale
20 during treatment in both groups as well as the measurement of heart rate dynamics during the
21 procedures.
22
23
24
25

27 1.3. Trial design

26
27
28
29 The research is designed as a randomized parallel-group controlled clinical study. Table 1 presents
30 the recruiting, allocation, interventions, monitoring, and analysis of the research in accordance with
31 the Standard Protocol Items: Recommendations for Interventional Trials recommendations [11]. In
32 accordance with the Latent inhibition technique patients will have two visits to the dental office –
33 a preventive procedure, the first one, and treatment of caries lesion, the second one. Two groups
34 will be compared. In the experimental group the enamel conditioning of the occlusal surfaces of
35 the permanent molars before sealant application as well as the standardized caries treatment will
36 be performed with Er:YAG laser, whereas in the control group the conventional rotary instruments
37 - high-speed and low-speed dental handpieces, will be used for the caries treatment.
38
39
40
41
42
43
44
45
46
47
48
49
50
51

52
53 Table 1. Trial design. The table summarises the enrolment, allocation, interventions, and
54 assessments in the trail
55
56
57
58
59
60

	STUDY PERIOD				
	Enrolment	Allocation	Post-allocation		
	-t ₁	0	t ₁	t ₂	t ₃
TIMEPOINT*					
ENROLMENT					
Eligibility screening	×				
Informed consent	×				
Allocation		×			
INTERVENTIONS					
Experimental group (BMT + Laser treatment of dental caries)				×	
Control group (BMT + Caries treatment with conventional rotary instruments)				×	
ASSESSMENTS					
Self-reported dental anxiety			×		×
Heart rate			←————→		

*Post-allocation time frame: t₁ - before the start of the treatment; t₂ - during laser or conventional treatment; t₃ – end of the treatment, before leaving the dental chair.

2. Methods and analyses

2.1. Study setting

The study setting of this research includes the Department of Paediatric Dentistry and the Laser Centre of the Faculty of Dental medicine, Medical University – Plovdiv, Bulgaria.

2.2. Eligibility

2.2.1. Inclusion criteria

1. Participants in the study are children aged 6-9 years, compliant with the cognitive development of the child;
2. Children, requiring conservative treatment of occlusal carious lesions on a second primary molar, without spontaneous unprovoked pain, percussion or palpation pain or other symptoms, indicating pulp involvement or periodontal pathology. Lesions are classified as

a distinct cavity with visible dentin without prior restoration or sealants by the International Caries Detection and Assessment System (ICDAS) with code 05 [12,13,14]. Included are caries lesions only on vital teeth.

3. Children with one or more permanent molars giving indications for pit and fissure sealing;
4. Patients without previous experience with laser treatment of carious lesions;
5. Children who are not considered medically compromised or medically complex patients;
6. Verbal assent from the child willing to comply with all study procedures and protocol;
7. Obtained written informed consent by the patient's parent/guardian for participation in the study (see supplementary data file S1 'Patient consent form' and S2 'Information leaflet').

2.2.2. Exclusion criteria

1. Patients who were undergoing therapy with neurological, sedative, analgesic, and/or anti-inflammatory drugs 7 days prior to treatment that might affect heart rate;
2. Children, who were first-time dental patients;
3. Children with systemic diseases or physiological development delays;
4. Children with mental or cognitive problems;
5. Active infectious diseases such as influenza, scarlet fever, etc.
6. Excluded are molars which are affected by disturbances in the development of dental structures (hypoplasia, hypomineralization, fluorosis)

2.2.3. Interventions

Patients will be divided into 2 groups (41 per group) – experimental and control groups. All treatments will be carried out by the same operator (MS), without anesthesia. A baseline dental self-reported anxiety will be recorded using a Faces anxiety scale as well as the dynamics of heart rate, measured with a mobile pulse oximeter.

Er:YAG laser therapy protocol (experimental group):

Er:YAG laser (LiteTouch, Light Instruments LTD), emission wavelength 2940 nm will be used for enamel conditioning of the occlusal surfaces of the permanent molars before sealant application as well as the standardized caries treatment. Chosen protocol parameters are modified based on previously conducted studies [2,3,4,15,16]:

- preventive procedure – sealant application:

- a low-speed rubber cup and pumice paste (CleanPolish, Kerr) will be used for 30 seconds for cleaning and polishing of the occlusal surface of the chosen permanent molar;
 - tooth surface will be washed for debris and organic residue removal and dried with air spray;
 - isolation with rubber dam;
 - laser conditioning of the occlusal enamel surface. The parameter settings used will be: tip-to-tissue distance 1.5mm from the tooth surface; tip diameter 600 μm ; laser energy 70 mJ; pulse frequency 10 Hz; water spray level 8; average power 0.7 W; energy density 67 J/cm²;
 - tooth surface will be etched with 35% phosphoric acid gel (Etching gel, DMP Ltd) for 30 seconds and rinsed for the same time;
 - tooth surface will be dried with air spray for 15s;
 - fissure sealant application (Pit&Fissure Sealant, DMP Ltd);
 - light cured for 20 seconds.
- caries removal – parameters: enamel removal – energy 100-200mJ; density 9.84-13.03 J/cm², pulse frequency 20Hz; tip diameter 800 μm ; water spray level 8; tip-to-tissue distance 0.5÷1 mm from the tooth surface; dentin removal - energy 100mJ; density 9.84 J/cm², pulse frequency 20Hz; tip diameter 800 μm ; water spray level 8; tip-to-tissue distance 0.5÷1 mm from the tooth surface. Restoration with compomer. Time for caries removal procedure – max 8 minutes [17,18,19,20].

Conventional therapy protocol (control group):

- preventive procedure – sealant application
- a low-speed rubber cup and pumice paste (CleanPolish, Kerr) will be used for 30 seconds for cleaning and polishing of the occlusal surface of the chosen permanent molar;
- tooth surface will be washed for debris and organic residue removal and dried with air spray;
- isolation with rubber dam;
- tooth surface will be etched with 35% phosphoric acid gel (Etching gel, DMP Ltd) for 30 seconds and rinsed for the same time;
- tooth surface will be dried with air spray for 15s;
- fissure sealant application (Pit&Fissure Sealant, DMP Ltd);
- light cured for 20 seconds.
- caries removal – conventional rotary instruments will be used - high-speed and low-speed dental handpieces. For the bur preparation 1.2 mm diameter diamond round bur Drendel &

Zweiling No. 801.314. and Komet Steel round bur 016, Komet Dental Gebr were used. A new bur was used for each preparation. Restoration with compomer. Time for caries removal procedure – max 4 minutes.

2.2.4. Clinical protocol

First visit:

1. Parents/guardians are informed about the protocol of the study and the laser technique. They sign the informed consent form (see Supplementary data files S1 and S2). Verbal assent from the child is obtained.
2. Oral examination and sealant application are performed according to the assigned intervention.
3. Patient`s self-report of dental anxiety before leaving the dental chair.

Second visit:

1. Patients will be asked to report their dental anxiety, pointing to the face or choose the number which most closely depicted its state of anxiety using a modified version of the self-report Faces Scale by LeBaron et al. [21] (see Supplementary data file S3)
2. Pulse-oximeter is connected to the patient`s index finger. The start of heart rate monitoring and recording will be 5 minutes prior to treatment. Time frame: at least 5 minutes after the dental treatment, before leaving the dental chair.
3. Caries treatment is performed according to the assigned intervention.
4. Patient`s self-report of dental anxiety before leaving the dental chair.

2.3. Outcomes

2.3.1. Primary outcome measures

The primary outcome will be the dental anxiety before and after the treatment session, reported by the patient on a modified version of the self-report Faces Scale by LeBaron et al.. The scale comprises a row of five faces ranging from `relaxed` to `very worried` in combination with a visual analog scale of 0 – 10. Each child was asked to point to the face or choose the number which most closely depicted its state of anxiety.

2.3.2. Secondary outcome measures

The secondary outcome will be the dynamics of heart rate, registered during the treatment session measured with a mobile pulse oximeter (CMS50F, CONTEC), placed on the index finger of the left hand [22]. Throughout the whole procedure of each dental visit, data were recorded and

analyzed by a specially developed digital processing and graphic visualization software SPO2 Review V1.2 rel.

2.3.3. Participant's timeline

Each eligible patient undergoes two visits. The first appointment includes screening, consenting and assenting, recording of dental anxiety, sealant application according to the assigned interventions for each group. The second appointment at the one-week recall includes a recording of dental anxiety and treatment of a carious lesion according to the assigned interventions for each group. The manipulations will be performed by one operator.

2.3.4. Sample size calculation

The sample size calculation is performed based on data from a pilot study with 20 subjects. To estimate sample size for the primary outcome—self-reported anxiety felt, according to the Faces Scale by LeBaron—a t-test for paired groups has been used (G* Power software V.3.1,6 since we have two groups). The effect size was determined using the formula

$$ES = \frac{Control - Treated}{SD_{pooled}} = \frac{2.33 - 0.33}{3.25} = 0.62$$

where SD is the pooled SD, an average of the SD of the experimental and control groups. The sample size is calculated to assure a test power greater than 95% and a significant level of $\alpha = 0.05$. We estimated a sample size of 41 patients per group to detect significant differences. Thus, the final sample size for this study will be 82 patients.

2.4. Recruitment

The patients at the Department of Paediatric Dentistry of the Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, who meet the inclusion criteria, will be screened for eligibility. Once identified, patients will be informed about this research project and will receive information about the possibility of potential study participation. Patient recruitment starts obtaining the full quota of participants within a one-year time frame. It begins in September 2021 with an estimated enrollment capacity of 5 patients per month.

2.5. Participating centers

1
2
3 The patients are randomly selected from the visitors in the Department of Paediatric Dentistry of
4 the Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria, and treated in the Laser
5 Centre of the same university.
6
7

8 9 2.6. Assignment of the intervention

10 11 2.6.1. Sequence generation

12
13 The patients will be randomly allocated to either the control group or the experimental group (41
14 patients in each group) according to the enrolment number in the trial. The randomization will
15 be created using a computerized random generator.
16
17

18 19 2.6.2. Allocation concealment mechanism and implementation

20
21 A randomization list will be created by a random generator before the start of the treatment and
22 kept in a locked drawer. Assignments will be kept in separate, closed opaque, sequentially
23 numbered envelopes, enabling the sequence to be concealed until the intervention is assigned.
24
25
26

27 28 2.6.3. Blinding

29
30 The randomisation will be independent, that is, the patients and parents/guardians will remain
31 blinded to group status. The operator will get acquainted with the procedure to be performed prior
32 to the first session. The operator is selected to be the only one performing the manipulation to
33 prevent bias. The statistician will be blinded to treatment assignment as data will be masked before
34 the analysis without giving the statistician the key.
35
36
37
38

39 40 2.6.4. Data collection, confidentiality, storage, and monitoring of the study documents

41
42 Collection, coding, storage, and evaluation of personal data within the project will be carried out
43 in accordance with The General Data Protection Regulation (EU) 2016/679 (GDPR). A
44 prerequisite for data collection will be the voluntary written informed consent of the patient's
45 parent or guardian. Confidentiality will be guaranteed by a coded ID number, access will be granted
46 exclusively to the study investigators. The information from the paper forms will be exported to a
47 database file and stored on a password-protected computer. Only the investigators and statistician
48 will have access to the final data set. All data collected will be stored in sealed containers in areas
49 of the Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University –
50 Plovdiv, Bulgaria with limited access.
51
52
53
54
55
56
57
58
59
60

3. Statistical methods

The obtained data will be recorded, tabulated, processed, and analyzed using SPSS (Statistical Package for Social Science software) version 21.0 (IBM, USA). In all tests, the significance level of 5% probability or the corresponding *P*-value will be adopted. Descriptive statistics will be calculated. Discrete variables will be summarised by frequencies or proportions. Continuous variables will be presented as means and standard deviations. We will compare anxiety mean scores according to the Faces Scale by LeBaron as well as heart rate mean score. Comparisons among groups will be performed by using the Independent sample t-test and paired t-test.

4. Patient and public involvement

The development of the research question and outcome measures will be based on the review of available evidence in this research area. Patients will not be involved in the development of the study protocol. However, their questions and concerns will be addressed during patient recruitment and study implementation. During the conduction of the study, patients will not be informed about the results of the ongoing trial since there is no planned interim analysis. The results will be disseminated to the study participants through email and routine follow-up dental check-ups.

5. Ethics and dissemination

The clinical study will be conducted in accordance with the conditions and principles of the Declaration of Helsinki, the existing EU Clinical Trial Directive (EC) No. 2001/20/EC, the recommendations of the Ethical Committee at the Medical University of Plovdiv, Bulgaria and the international ethical and scientific quality standard for designing, recording and reporting trials that involve the participation of human subjects - Good Clinical Practices (GCP).

5.1. Research ethics approval

The study was approved by the Committee for Scientific Research Ethics, Medical University - Plovdiv, Bulgaria (Reference number P-2839, Protocol of approval No.3/30.04.2015) and registered on a publicly accessible database ClinicalTrials.gov (Registration number: NCT04924452). Ethical approval for the study protocol and the written informed consent for all subjects' parents/guardians was granted by the Ethics Committee of the Medical University, Plovdiv, Bulgaria.

5.2. Consent

The operators will obtain written consent from patients' parents/guardians willing to participate in the trial. Additional information will be provided for all parents for the study. Completed informed consent will be collected at the Department of Pediatric Dentistry, Medical University - Plovdiv by the study investigators. A copy of the signed consent form will be handed over to the participating child's parent/guardian. After providing age-appropriate information about the study, verbal assent will be obtained as an affirmative agreement for participation from children

5.3. Confidentiality

The information of the participants collected during the study will be kept strictly confidential and will not be disclosed to third parties. Confidentiality will be guaranteed by a coded ID number, access will be granted exclusively to the study investigators.

5.4. Conflict of interests

The investigators have no conflicts of interest to declare. They agree with the protocol and the informed consent of the study and there is no financial interest to report.

5.5. Access to data

All data collected will be stored in sealed containers in areas of the Department of Paediatric Dentistry, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria with limited access. The information from the paper forms will be exported to a database file and stored on a password-protected computer. Only the investigators and statistician will have access to the final data set.

5.6. Dissemination policy

The results of the trial will be presented through peer-reviewed publications and conference presentations. In addition, our results will be disseminated to clinicians, as well as key stakeholders, including scientific directors of postgraduate programs "Master of Science in Lasers in Dentistry", academic courses in Pedodontics and Preventive dentistry. The principle investigator (MS) and the scientific expert (AB) will write the first draft of the manuscript without the use of professional writers.

Trial status

1
2
3 The trial is not yet recruiting patients. The process will start in September 2021 and will continue
4 until September 2022.
5

6
7 **Word count:** 3705
8

9 **Acknowledgements**

10
11 The authors would like to show their gratitude to Assoc. Prof. Georgi Tomov, PhD for the fruitful
12 discussion. Assistance with the Laser Center of the Faculty of Dental Medicine, Medical University
13 of Plovdiv, Bulgaria was greatly appreciated. The authors are also thankful to Prof. Nonka Mateva,
14 PhD for the statistical consultancy expertise in the planning of this clinical trial.
15
16
17

18 **Author Contributions**

19
20 We declare that all authors have made substantial contributions. MS and AB conceive the ideas.
21
22 AB trained MS. MS will be the primary operator, outcomes assessor, and data collector. All authors
23 will participate in the analysis and reporting of the results. Writing will be led by MS. The design
24 and protocol for this study were developed by AB and MS. All authors contributed to refining the
25 study protocol and approving the final manuscript.
26
27
28
29

30 **Funding**

31
32 This research received institutional funding from the Medical University – Plovdiv, Bulgaria.
33
34
35

36 **Competing interests**

37
38 None declared.
39
40

41 **Patient consent for publication**

42
43 (see Supplementary data file S1 `Patient consent form`)
44
45

46 **References**

- 47
48 1. Walsh LJ. Anxiety prevention: implementing the 4S principle in conservative dentistry.
49 Auxilliary. 2007; 17; 24-26.
50
51 2. Pagano S, Lombardo G, Orso M, Abraha I, Capobianco B, Cianetti S. Lasers to prevent dental
52 caries: a systematic review. BMJ Open. 2020 Oct 28;10(10):e038638. doi: 10.1136/bmjopen-
53 2020-038638.
54
55
56
57
58
59
60

3. Galui S, Pal S, Mahata S, Saha S, Sarkar S. Laser and its use in pediatric dentistry: A review of literature and a recent update. *Int J Ped Reh* 2019;4(1):1-5. DOI: 10.4103/ijpr.ijpr_17_18
4. American Academy of Pediatric Dentistry. Policy on the use of lasers for pediatric dental patients. *The Reference Manual of Pediatric Dentistry*. Chicago, Ill.: American Academy of Pediatric Dentistry; 2020:116-8.
5. Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, Eden E. Minimal intervention dentistry for managing dental caries - a review: report of a FDI task group. *Int Dent J*. 2012 Oct;62(5):223-43. doi: 10.1111/idj.12007.
6. Buldur B. Behavior Management in Pediatric Dentistry: An Overview and Interpretation. *PBOCI* 2019;19(1):e4649. DOI: 10.4034/PBOCI.2019.191.ed1
7. Khandelwal M, Shetty RM, Rath S. Effectiveness of Distraction Techniques in Managing Pediatric Dental Patients. *Int J Clin Pediatr Dent*. 2019 Jan-Feb;12(1):18-24. doi: 10.5005/jp-journals-10005-1582.
8. Gunasekaran G, Ramakrishnan M. Evaluation of factors affecting the behaviour of uncooperative pedodontic patients. *PJAE* 2020;17(7), 2027- 2038. ISSN 1567-214x.
9. Subramaniam P, Haq M, Gupta M. Assessment of trait and state anxiety in 3-6-year old children during sequential phases of dental treatment. *Contemp Pediatr Dent* 2020;1(1):22-32. DOI: 10.51463/cpd.2020.10
10. Tajadura-Jimenez A, Grehl S, Tsakiris M. The other in me: Interpersonal multisensory stimulation changes the mental representation of the self. *PLoS ONE*. 2012;7.
11. Chan AW, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, Hróbjartsson A, Mann H, Dickersin K, Berlin JA, Doré CJ, Parulekar WR, Summerskill WS, Groves T, Schulz KF, Sox HC, Rockhold FW, Rennie D, Moher D. SPIRIT 2013 statement: defining standard protocol items for clinical trials. *Ann Intern Med*. 2013 Feb 5;158(3):200-207. doi: 10.7326/0003-4819-158-3-201302050-00583. PMID: 23295957; PMCID: PMC5114123.
12. Ismail AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H, Pitts NB. The International Caries Detection and Assessment System (ICDAS): an integrated system for measuring dental caries. *Community Dent Oral Epidemiol*. 2007 Jun;35(3):170-8. doi: 10.1111/j.1600-0528.2007.00347.x.

13. International Caries Detection and Assessment System (ICDAS) Coordinating Committee. Rationale and Evidence for the International Caries Detection and Assessment System (ICDAS II). 2011 Sept. Available from: <http://www.icdas.org>.
14. Pitts N. "Pitts N. "ICDAS"--an international system for caries detection and assessment being developed to facilitate caries epidemiology, research and appropriate clinical management. *Community Dent Health*. 2004 Sep;21(3):193-8. PMID: 15470828.
15. Yilmaz H, Keles S. The effect of the Er: YAG laser on the clinical success of hydrophilic fissure sealant: a randomized clinical trial. *Eur Oral Res*. 2020;54(3):148-153. doi:10.26650/eor.20200029
16. Rattanacharoenthum A, Na-Lamphun P, Kantrong N. Altered adhesion of dental sealant to tooth enamel microscopically modified by Er:YAG laser irradiation: An in vitro study. *Laser Ther*. 2019;28(1):19-25. doi:10.5978/islsm.28_19-OR-02
17. Sarmadi R, Andersson EV, Lingström P, Gabre P. A Randomized Controlled Trial Comparing Er:YAG Laser and Rotary Bur in the Excavation of Caries - Patients' Experiences and the Quality of Composite Restoration. *Open Dent J* 2018;12:443-454. doi:10.2174/1874210601812010443.
18. Li T, Zhang X, Shi H, Ma Z, Lv B, Xie M. Er:YAG laser application in caries removal and cavity preparation in children: a meta-analysis. *Lasers Med Sci* 2018. doi:10.1007/s10103-018-2582-x
19. Johar S, Goswami M, Kumar G, Dhillon JK. Caries removal by Er,Cr:YSGG laser and Air-rotor handpiece comparison in primary teeth treatment: an *in vivo* study. *Laser Ther*. 2019;28(2):116-122. doi:10.5978/islsm.19-OR-08.
20. Montedori A, Abraha I, Orso M, D'Errico PG, Pagano S, Lombardo G. Lasers for caries removal in deciduous and permanent teeth. *Cochrane Database Syst Rev* 2016;9(9):CD010229. doi:10.1002/14651858.CD010229.pub2
21. LeBaron S, Zeltzer L. Assessment of acute pain and anxiety in children and adolescents by self-reports, observer reports, and a behavior checklist. *J Consult Clin Psychol* 1984; 52:729-38. DOI: 10.1037//0022-006x.52.5.729
22. Song JS, Chung HC, Sohn S, Kim YJ. Effects of psychological behaviour management programme on dental fear and anxiety in children: A randomised controlled clinical trial. *Eur J Paediatr Dent*. 2020 Dec;21(4):287-291. doi: 10.23804/ejpd.2020.21.04.6.

Consent form

For a patient's consent to publication of images and/or information about them in BMJ publications.

Name of patient:

Patient's parent/guardian:

Material – text (information about your child's oral health, level of dental anxiety and dynamics of heart rate):

Provisional title of article in which Material will be included:

Efficacy of Combined Er:YAG Laser Therapy and Behaviour Management Technique in Reducing Anxiety among Paediatric Dental Patients

CONSENT

I _____ [ENTER YOUR FULL NAME] give my consent for the Material about my child to appear in a BMJ publication.

I confirm that I: (please tick boxes to confirm)

- have seen the text or other material about my child**
 have read the article to be submitted to BMJ
 am legally entitled to give this consent.

I understand the following:

- (1) The Material will be published without my child's name attached, however I understand that complete anonymity cannot be guaranteed. It is possible that somebody somewhere may recognise my child.
- (2) The Material may show or include details of my child's medical condition or injury and any prognosis, treatment or surgery that I have/the patient has, had or may have in the future.
- (3) The article may be published in a journal which is distributed worldwide. BMJ's publications go mainly to doctors and other healthcare professionals but are also seen by many others including academics, students and journalists.
- (4) The article, including the Material, may be the subject of a press release, and may be linked to from social media and/or used in other promotional activities. Once published, the article will be placed on a BMJ website and may also be available on other websites.
- (5) The text of the article will be edited for style, grammar and consistency before publication.
- (6) I and my child will not receive any financial benefit from publication of the article.

Patient consent form 050419

- 1
2
3
4 (7) The article may also be used in full or in part in other publications and products published by BMJ
5 and/or by other publishers. This includes publication in English and in translation, in print, in digital
6 formats, and in any other formats that may be used by BMJ or other publishers now and in the
7 future. The article may appear in local editions of journals or other publications, published in the UK
8 and overseas.
9
- 10
11 (8) I can revoke my consent at any time before publication, but once the article has been committed to
12 publication (“gone to press”) it will not be possible to revoke the consent.
13
- 14 (9) This consent form will be retained securely and in confidence by BMJ in accordance with the law,
15 for no longer than necessary. Personal data provided in this form will be used and retained in
16 accordance with BMJ’s Privacy Policy available at <https://www.bmj.com/company/your-privacy/>.
17
18

19 *Signed:* _____ *Print name:* _____
20

21 *Address:* _____ *Email address:* _____
22

23 _____ *Telephone no:* _____
24

25 * *signing on behalf of the patient who is under the age of 18*

26 _____ *Date:* _____
27

28
29 **Corresponding author**

30 *Signed:* _____ *Author’s name:* Maria Shindova
31

32 *Position:* Senior Assistant Professor *Address:* 3 Hristo Botev Bulv., Plovdiv, Bulgaria
33

34 *Institution:* Department of Pediatric
35

36 *Dentistry, Faculty of Dental Medicine,*
37

38 *Medical University of Plovdiv*
39

40 *Email address:* _____ *Telephone no:* + 359 898 390 935
41

42 *mariya.shindova@gmail.com*

43 *Date:* _____
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

INFORMATION LEAFLET

**DEPARTMENT OF PAEDIATRIC DENTISTRY
LASER CENTER
FACULTY OF DENTAL MEDICINE,
MEDICAL UNIVERSITY OF PLOVDIV, BULGARIA**

EFFICIENCY OF ER:YAG LASER THERAPY IN COMBINATION WITH BEHAVIOUR MANAGEMENT TECHNIQUE IN REDUCING ANXIETY AMONG PAEDIATRIC DENTAL PATIENTS

DESCRIPTION: You and your child are invited to participate in a research study on the efficiency of Er:YAG laser therapy in combination with behavior management technique in reducing anxiety among pediatric dental patients.

PROCEDURES: With your permission, we would like to collect information about your children's dental anxiety before, during and after dental treatment of a caries lesion. This study does not involve any experiments, just preventive procedures and dental treatment, collection, and study of the required information.

RISKS AND BENEFITS: There are no anticipated risks associated with this study. You will not receive any direct benefit from participation.

TIME INVOLVEMENT: Your child's participation in this study will not require more time from you other than for the first visit including an explanation of the study, oral examination and a preventive procedure (sealant application). The second appointment at 7-day recall will include dental treatment.

PAYMENTS: You will not be paid to participate in this study. You will not pay for the treatment of your child in this study.

PARTICIPANT'S RIGHTS: If you have read this form and have decided your child to participate in this research, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

The results of this research study may be presented at scientific or professional meetings or published in scientific journals. However, your identity will not be disclosed.

Thank you for your time and attention!

1
2
3 Name of parent/guardian

4
5 Signature of parent /guardian

6
7
8 Name of patient

9
10 Telephone number

11
12
13 Name of the dentist

14
15
16 Signature of the dentist

17
18
19 For additional information regarding the trial, you can contact us at the given address, emails, or
20 phone numbers.
21

22
23 **Researchers:**

24 Maria Shindova, DDS, MSc, PhD
25 Chief Assistant Professor
26 Department of Pediatric Dentistry
27 Faculty of Dental Medicine
28 Medical University – Plovdiv
29 3 Hristo Botev Blvd
30 4000 Plovdiv, Bulgaria
31 Mobile: + 359 898 390 935
32 mariya.shindova@gmail.com
33 Mariya.Shindova@mu-plovdiv.bg

Ani Belcheva, DDS, MSc, PhD
Professor
Department of Pediatric Dentistry
Faculty of Dental Medicine
Medical University - Plovdiv
3 Hristo Botev Blvd
4000 Plovdiv, Bulgaria
Mobile: + 359 889 528 932
abeltcheva@yahoo.com



94x24mm (150 x 150 DPI)

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
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Reporting checklist for protocol of a clinical trial.

Based on the SPIRIT guidelines.

		Reporting Item	Page Number
Administrative information			
Title	#1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	#2a	Trial identifier and registry name. If not yet registered, name of intended registry	2
Trial registration: data set	#2b	All items from the World Health Organization Trial Registration Data Set	2
Protocol version	#3	Date and version identifier	2
Funding	#4	Sources and types of financial, material, and other support	2,14
Roles and responsibilities: contributorship	#5a	Names, affiliations, and roles of protocol contributors	1

1	Roles and	#5b	Name and contact information for the trial sponsor	2
2				
3	responsibilities:			
4				
5	sponsor contact			
6				
7	information			
8				
9				
10				
11	Roles and	#5c	Role of study sponsor and funders, if any, in study design;	13
12				
13	responsibilities:		collection, management, analysis, and interpretation of data;	
14				
15	sponsor and funder		writing of the report; and the decision to submit the report for	
16				
17			publication, including whether they will have ultimate	
18			authority over any of these activities	
19				
20				
21				
22				
23	Roles and	#5d	Composition, roles, and responsibilities of the coordinating	n/a
24				
25	responsibilities:		centre, steering committee, endpoint adjudication	
26				
27	committees		committee, data management team, and other individuals or	
28				
29			groups overseeing the trial, if applicable (see Item 21a for	
30				
31			data monitoring committee)	
32				
33				
34				
35	Introduction			
36				
37				
38	Background and	#6a	Description of research question and justification for	3,4
39				
40	rationale		undertaking the trial, including summary of relevant studies	
41				
42			(published and unpublished) examining benefits and harms	
43				
44			for each intervention	
45				
46				
47				
48	Background and	#6b	Explanation for choice of comparators	3,4
49				
50	rationale: choice of			
51				
52	comparators			
53				
54				
55				
56	Objectives	#7	Specific objectives or hypotheses	4
57				
58				
59				
60				

1	Trial design	#8	Description of trial design including type of trial (eg, parallel	4
2			group, crossover, factorial, single group), allocation ratio,	
3			and framework (eg, superiority, equivalence, non-inferiority,	
4			exploratory)	
5				
6				
7				
8				
9				
10				
11	Methods:			
12				
13	Participants,			
14				
15	interventions, and			
16				
17	outcomes			
18				
19				
20				
21	Study setting	#9	Description of study settings (eg, community clinic,	5
22			academic hospital) and list of countries where data will be	
23			collected. Reference to where list of study sites can be	
24			obtained	
25				
26				
27				
28				
29				
30				
31	Eligibility criteria	#10	Inclusion and exclusion criteria for participants. If applicable,	5,6
32			eligibility criteria for study centres and individuals who will	
33			perform the interventions (eg, surgeons, psychotherapists)	
34				
35				
36				
37				
38				
39	Interventions:	#11a	Interventions for each group with sufficient detail to allow	5,6
40			replication, including how and when they will be	
41	description		administered	
42				
43				
44				
45				
46	Interventions:	#11b	Criteria for discontinuing or modifying allocated interventions	n/a
47			for a given trial participant (eg, drug dose change in	
48	modifications		response to harms, participant request, or improving /	
49			worsening disease)	
50				
51				
52				
53				
54				
55				
56	Interventions:	#11c	Strategies to improve adherence to intervention protocols,	n/a
57				
58				
59				
60				

1	adherence		and any procedures for monitoring adherence (eg, drug	
2			tablet return; laboratory tests)	
3				
4				
5				
6			Non-adherence interventions in the present study	
7				
8				
9	Interventions:	#11d	Relevant concomitant care and interventions that are	n/a
10				
11	concomitant care		permitted or prohibited during the trial	
12				
13				
14			No permitted or prohibited during the trial concomitant care	
15			and interventions	
16				
17				
18				
19	Outcomes	#12	Primary, secondary, and other outcomes, including the	8,9
20			specific measurement variable (eg, systolic blood pressure),	
21			analysis metric (eg, change from baseline, final value, time	
22			to event), method of aggregation (eg, median, proportion),	
23			and time point for each outcome. Explanation of the clinical	
24			relevance of chosen efficacy and harm outcomes is strongly	
25			recommended	
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36	Participant timeline	#13	Time schedule of enrolment, interventions (including any	9
37			run-ins and washouts), assessments, and visits for	
38			participants. A schematic diagram is highly recommended	
39			(see Table 1)	
40				
41				
42				
43				
44				
45				
46	Sample size	#14	Estimated number of participants needed to achieve study	9
47			objectives and how it was determined, including clinical and	
48			statistical assumptions supporting any sample size	
49			calculations	
50				
51				
52				
53				
54				
55				
56	Recruitment	#15	Strategies for achieving adequate participant enrolment to	9
57				
58				
59				
60				

reach target sample size

Methods:

**Assignment of
interventions (for
controlled trials)**

Allocation: sequence generation	#16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	10
Allocation concealment mechanism	#16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	10
Allocation: implementation	#16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	10
Blinding (masking)	#17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	10
Blinding (masking): emergency unblinding	#17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	n/a

1 open-label trial
2
3

4 **Methods: Data**

5
6 **collection,**

7
8 **management, and**

9
10 **analysis**

14 Data collection plan	#18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	10
31 Data collection plan: 32 retention	#18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	10,11
41 Data management	#19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	10,11
53 Statistics: outcomes	#20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	11

1	Statistics: additional	#20b	Methods for any additional analyses (eg, subgroup and	11
2				
3	analyses		adjusted analyses)	
4				
5				
6	Statistics: analysis	#20c	Definition of analysis population relating to protocol non-	11
7				
8	population and		adherence (eg, as randomised analysis), and any statistical	
9				
10	missing data		methods to handle missing data (eg, multiple imputation)	
11				
12				
13				
14	Methods: Monitoring			
15				
16				
17	Data monitoring:	#21a	Composition of data monitoring committee (DMC); summary	12
18				
19	formal committee		of its role and reporting structure; statement of whether it is	
20				
21			independent from the sponsor and competing interests; and	
22				
23			reference to where further details about its charter can be	
24				
25			found, if not in the protocol. Alternatively, an explanation of	
26				
27			why a DMC is not needed	
28				
29				
30				
31	Data monitoring:	#21b	Description of any interim analyses and stopping guidelines,	n/a
32				
33	interim analysis		including who will have access to these interim results and	
34				
35			make the final decision to terminate the trial	
36				
37				
38				
39	Harms	#22	Plans for collecting, assessing, reporting, and managing	n/a
40				
41			solicited and spontaneously reported adverse events and	
42				
43			other unintended effects of trial interventions or trial conduct	
44				
45				
46				
47	Auditing	#23	Frequency and procedures for auditing trial conduct, if any,	n/a
48				
49			and whether the process will be independent from	
50				
51			investigators and the sponsor	
52				
53				
54	Ethics and			
55				
56	dissemination			
57				
58				
59				
60				

1	Research ethics	#24	Plans for seeking research ethics committee / institutional	11,12
2				
3	approval		review board (REC / IRB) approval	
4				
5				
6	Protocol	#25	Plans for communicating important protocol modifications	11,12
7				
8	amendments		(eg, changes to eligibility criteria, outcomes, analyses) to	
9			relevant parties (eg, investigators, REC / IRBs, trial	
10			participants, trial registries, journals, regulators)	
11				
12				
13				
14				
15				
16	Consent or assent	#26a	Who will obtain informed consent or assent from potential	12
17			trial participants or authorised surrogates, and how (see	
18			Item 32)	
19				
20				
21				
22				
23				
24	Consent or assent:	#26b	Additional consent provisions for collection and use of	n/a
25			participant data and biological specimens in ancillary	
26	ancillary studies		studies, if applicable	
27				
28				
29				
30				
31				
32	Confidentiality	#27	How personal information about potential and enrolled	12
33			participants will be collected, shared, and maintained in	
34			order to protect confidentiality before, during, and after the	
35			trial	
36				
37				
38				
39				
40				
41				
42	Declaration of	#28	Financial and other competing interests for principal	12
43			investigators for the overall trial and each study site	
44	interests			
45				
46				
47	Data access	#29	Statement of who will have access to the final trial dataset,	12
48			and disclosure of contractual agreements that limit such	
49			access for investigators	
50				
51				
52				
53				
54				
55	Ancillary and post	#30	Provisions, if any, for ancillary and post-trial care, and for	n/a
56			compensation to those who suffer harm from trial	
57	trial care			
58				
59				
60				

1		participation	
2			
3			
4	Dissemination	#31a	Plans for investigators and sponsor to communicate trial
5			
6	policy: trial results		results to participants, healthcare professionals, the public,
7			
8			and other relevant groups (eg, via publication, reporting in
9			
10			results databases, or other data sharing arrangements),
11			
12			including any publication restrictions
13			
14			
15			
16	Dissemination	#31b	Authorship eligibility guidelines and any intended use of
17			
18	policy: authorship		professional writers
19			
20			
21	Dissemination	#31c	Plans, if any, for granting public access to the full protocol,
22			
23	policy: reproducible		participant-level dataset, and statistical code
24			
25	research		
26			
27			
28			
29	Appendices		
30			
31			
32	Informed consent	#32	Model consent form and other related documentation given
33			
34	materials		to participants and authorised surrogates
35			
36			
37			
38			
39			
40	Biological specimens	#33	Plans for collection, laboratory evaluation, and storage of
41			
42			biological specimens for genetic or molecular analysis in the
43			
44			current trial and for future use in ancillary studies, if
45			
46			applicable
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			