Effect of Physical Therapy in Bruxism Treatment: A Systematic Review

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Abstract

Objective: The aim of this literature review was to examine the effect of physical therapy in bruxism treatment.
Methods: The data sources used were Medline, Excerpta Medica Database, Cumulative Index of Nursing and Allied Health Literature, Physiotherapy Evidence Database, SPORTDiscus, Scientific Electronic Library Online, Web of Science, Cochrane Library, Scopus, and Literatura Latino-Americana e do Caribe em Ciências da Saúde. We included randomized and nonrandomized and controlled and noncontrolled clinical trials and interventions focused on physical therapy as treatment for sleep bruxism or awake bruxism. Two reviewers independently screened the records, examined full-text reports for compliance with the eligibility criteria, and extracted data.
Results: The present review found 1296 articles. We excluded 766 duplicated articles and 461 irrelevant articles and selected 69 titles to read. Forty-five of these were excluded, leading to a total of 24 that met the eligibility criteria and were included in our analysis. The articles were grouped into 7 treatment methods used in physical therapy. The treatment methods were electrotherapeutic (14 articles), cognitive-behavioral therapy (3 articles), therapeutic exercises (2 articles), acupuncture (2 articles), postural awareness (1 article), muscular relaxation (1 article), and massage (1 article). Results and conclusions, methodological quality, and quality of evidence of each study were reported.
Conclusions: These results suggest very low-quality evidence that diverse methods used in physical therapy improve muscle pain and activity, mouth opening, oral health, anxiety, stress, depression, temporomandibular disorder, and head posture in individuals with bruxism. This finding is mainly a result of the poor methodological quality of most of the studies. (J Manipulative Physiol Ther 2018;41:389-404)

Key Indexing Terms: *Bruxism; Physical Therapy Modalities; Clinical Trial*

Introduction

The International Classification of Sleep Disorders of the American Academy of Sleep Medicine defines sleep bruxism (SB) as a sleep-related movement disorder characterized by grinding or clenching of teeth during sleep. Awake bruxism (AB), however, is a semivoluntary teeth clenching activity that is rarely audible. The prevalence of SB and AB in adults is 8% and 20%, respectively; studies indicate that 85% to 90% of the general population experience episodes of bruxism during their lives.[1-7] Thus, it is important to find an effective bruxism treatment. Bruxism affects millions of people throughout the world and is considered one of the most harmful activities for the stomatognathic system, mainly because of the associated morphologic, pathophysiologic, and psychosocial features and clinical consequences.[8,9] Because of the muscle pain, muscle activity alterations, limitation of mouth opening, anxiety, stress, depression, poor sleep and oral health quality, temporomandibular disorder (TMD), and postural alterations, treatment using an interdisciplinary professional team composed of dentists and physiotherapists is important.[2,3,5,10]

Thus, it is still recommended that bruxism management be provided, with caution, within the framework of a conservative "multiple-P" approach (ie, physiotherapy, plates, pep talk, pills, psychology).[11] Systematic reviews have been performed that examined the effects of bruxism treatment in children and individuals with developmental disabilities using management protocols such as pharmacotherapy, occlusal splint (OS), botulinum toxin, biofeedback (BF), and cognitive behavioral therapy (CBT).[3-5,11-14] However, what represents the most effective treatment is still unclear, and there is no conclusive evidence of effectiveness.[15,16]

Treatment methods used in physical therapy include electrotherapy, therapeutic exercises, muscle relaxation, postural awareness, acupuncture, manual therapy, and CBT. Studies of CBT particularly demonstrate that its use

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by physical therapists in clinical practice is substantial; studies encourage the integration of physical and psychological interventions by these health professionals. There is increasing recognition of the benefits of applying the biopsychosocial model of health via the incorporation of interventions that combine exercise and psychological treatment (most commonly those based on principles of CBT) within a physical therapy practice. Studies have investigated the use of combined interventions by trained physical therapists for several musculoskeletal conditions, such as low back pain, neck pain, knee osteoarthritis, musculoskeletal pain, and cancer.[17,18] However, the effectiveness of CBT for treatment of the signs and symptoms of bruxism is still questionable and continues to be studied. Furthermore, the effect of BF indicated a lack of scientific evidence to support CBT's effectiveness in treating SB.[11,19,20] Therefore, the increased number of studies on physical therapy as a treatment for bruxism and the lack of systematic review make reviews a relevant and indispensable tool for synthesizing evidence, assessing study quality, and summarizing results.[19-26]

The objective of this systematic review of clinical trials was to assess the effect of physical therapy in individuals with bruxism for treatment of muscle pain and activity, mouth opening, anxiety, stress, sleep, oral health, TMD, and head posture.

Methods

This systematic review employed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis[27] as a supporting tool for the quality of the textual presentation.

Data Sources

A systematized bibliographic search identified studies in the following databases: Medline, Excerpta Medica Database, Cumulative Index of Nursing and Allied Health Literature, Physiotherapy Evidence Database, SPORTDiscus, Scientific Electronic Library Online, Web of Science, Cochrane Library, Scopus, and Literatura Latino-Americana e do Caribe em Ciências da Saúde. We carried out search expansion by checking for potential additional papers in the Google Scholar database, in the reference lists of relevant papers, and in personal databases and institutional libraries. We included studies published in English, Spanish, or Portuguese between January 1990 and September 2015.

The following English language descriptors were used: bruxism and physical therapy modalities, rehabilitation, physical medicine or rehabilitation, exercise therapy, muscle stretching exercises, massage, muscle relaxation, relaxation therapy, imagination, imagery, cognitive therapy, behavioral therapy, acupuncture, complementary therapy, and electric stimulation therapy. The Medline search strategy is shown in Appendix 1 of the supplementary data (available online only).

Study Selection

The methodological characteristics of the selected studies were summarized according to a format that enabled a structured summary of the articles in relation to 4 main issues: P: population; I: intervention; C: comparison; and O: outcome.[28] According to the eligibility criteria, the study population (P) addressed individuals with SB or AB without specifying age or sex. Intervention (I) focused on physical therapy as a treatment for clinically identified SB or AB using polysomnography or electromyography (EMG). The comparison criterion (C) included control conditions, and the study outcomes (O) included muscle pain and activity, mouth opening, anxiety, stress, depression, sleep and oral health quality, TMD, or head posture assessed immediately after treatment or at any follow-up period.[28]

Two independent reviewers (C.S.M.A. and M.S.) identified articles as published and indexed, nonpublished and nonindexed, or published and undergoing indexing trials. In case of disagreement between the 2 reviewers, a third reviewer (A.P.M.) made the final judgment. After a reading of the titles, duplicated and irrelevant articles were excluded, and the remaining studies were separated and their abstracts read. Finally, the reviewers read the full text of the selected articles. From these articles, those that met the eligibility criteria were included.

Data Extraction

The following data were extracted using a standardized form: author and country of publication; type of study (randomized or nonrandomized, controlled or noncontrolled clinical trial); description of the participants with SB or AB (study size [n], sex, and age); intervention based on physical therapy (number, duration, and frequency of sessions); outcomes (muscle pain and activity, mouth opening, anxiety, stress, depression, sleep and oral health quality, TMD, or head posture); assessment tool and observation points (baseline, end of treatment, and follow-up); and methodological quality score, results, and conclusions.

Quality Assessment

The methodological quality studies included in this systematic review were reviewed and assigned according to the Physiotherapy Evidence Database (PEDro) and Jadad scales.[29]

The validated and reliable PEDro scale is directed toward physical therapy and rehabilitation and has 8 items related to methodological quality (random allocation, concealed allocation, baseline comparability, blinded participants, blinded therapists, blinded assessors, adequate follow-up, and intention-to-treat analysis), 2 items related to statistical reporting (between-group comparisons and point estimates and variability), and 1 item (eligibility criteria) that is not considered in the total score because it is related to external validity. The total PEDro score ranges from 0 to

10 points; higher scores mean greater methodological quality.[30,31]

Otherwise, the previously validated 5-point Jadad scale[32] was used to assess the completeness, quality, and potential bias in each trial. This widely used scale focuses on 3 dimensions of internal validity (quality of randomization, double blinding, and withdrawals) and is the only published instrument created according to psychometric principles. A score is assigned from 0 to 5, with higher scores indicating higher quality in the conduct or reporting of the trial. A trial score of at least 3 out of 5 is considered to indicate good quality. Trial scores below 3 are considered indicative of weak methodology.[32]

Data Synthesis

Studies were grouped according to the physical therapy treatment methods applied. Narrative analyses for each physical therapy treatment method were performed to describe electrotherapeutic resources, CBT, therapeutic exercises, acupuncture, postural awareness, muscle relaxation, and massage therapy.

Because quality of evidence is important in this review to direct the physical therapist and other professionals working in the clinic, studies were also descripted according to the quality of evidence (high, moderate, low, and very low) using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

High-quality evidence refers to consistent findings among at least 75% of the participants from studies with a low risk of bias; consistent, direct, and precise data; and no known or suspected publication biases. Further research is unlikely to change either the estimate of or confidence in the results. Moderate-quality evidence occurs when 1 of these domains is not met; further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate. Low-quality evidence occurs when 2 of the domains are not met; further research is very likely to have an important effect on confidence in the estimate of effect and is likely to change the estimate. Very low quality evidence occurs when 3 of the domains are not met and the results are very uncertain. No randomized trials were identified that addressed this outcome.[31,33]

Single studies that presented a small sample size ($n < 300$) and a PEDro score <6 or a Jadad score <3 (high risk of bias or weak methodological quality) were considered "very low quality" or "low-quality" evidence by GRADE.[29-32]

Results

The present review found 1296 articles. After reading the titles, we excluded 766 duplicated articles and 461 irrelevant articles; 69 articles were selected and we read their titles. Next, 45 more articles were excluded because 27 were not clinical trials, 10 did not encompass the population of interest, and 8 did not include physical therapy as an intervention. Finally, we chose and read 24 articles that met the eligibility criteria, and these were included in the analysis (Fig 1).

The studies were grouped into the following 7 treatment methods used in physical therapy: electrotherapeutic resources (14 articles),[6,34-46] CBT (3 articles),[23,47,48] therapeutic exercises (2 articles),[49,50] acupuncture (2 articles),[21,51] massage therapy (1 article),[15] postural awareness (1 article),[25] and muscle relaxation (1 article).[26] Three articles compared or combined 2 methods: electrotherapeutic resource and muscle relaxation,[26] CBT and BF,[23] or exercises and CBT.[50] Specifically, electrotherapy encompassed the BF method with visuals, audible sound, and electrical and labial stimuli,[6,35-40,42-46] as well as transcutaneous electrical nerve stimulation (TENS)[34] and microcurrent electrical nerve stimulation (MENS).[41] The physical therapy treatment also approached postural awareness through movement,[25] muscular awareness relaxation training (MART),[26] acupuncture,[21,51] and massage therapy.[15] The CBT used guided and progressive muscle relaxation,[23,47,48] and therapeutic exercises included jaw movement exercises with and without an exerciser.[49,50] The characteristics of the included articles are summarized in Table 1.

A total of 578 individuals were identified with bruxism. Of these, 519 were adults and 59 were children. Based on the 20 studies in which the sex of the participants was mentioned, 266 were female and 186 were male. In the 10 studies in which such data were specified, the average age of the adults was 35 years, and the average age of the children was 5 years. Eight studies did not specify the type of bruxism. Sleep bruxism and AB were identified in 11 and 4 studies, respectively, and 1 study examined both bruxism types. The most common method used was clinical assessment, followed by EMG and polysomnography. Muscle activity was assessed in 19 studies: muscle pain (11); mouth opening (6); depression (3); sleep (3); TMD (6); oral health (2); and anxiety, stress, and head posture (1 each).

Methodological Quality, Results, and Conclusions of Studies

The methodological quality is presented in Table 2. The total PEDro score ranged from 0 to 7, with a mean of 3.4. The total Jadad score ranged from 0 to 4, with a mean of 0.9.

The results and conclusions of the 24 included articles are presented in Table 3.

Electrotherapeutic Resources

Fourteen studies examined electrotherapeutic resources used to treat 265 participants with bruxism.[6,34-46] Among them, TENS did not show any higher effect compared with the use of OS,[34] MENS,[41] visual BF,[46] or MART.[26] Likewise, OS did not display any effect in the improvement of muscle pain.[34] On the other hand, both TENS and MENS improved

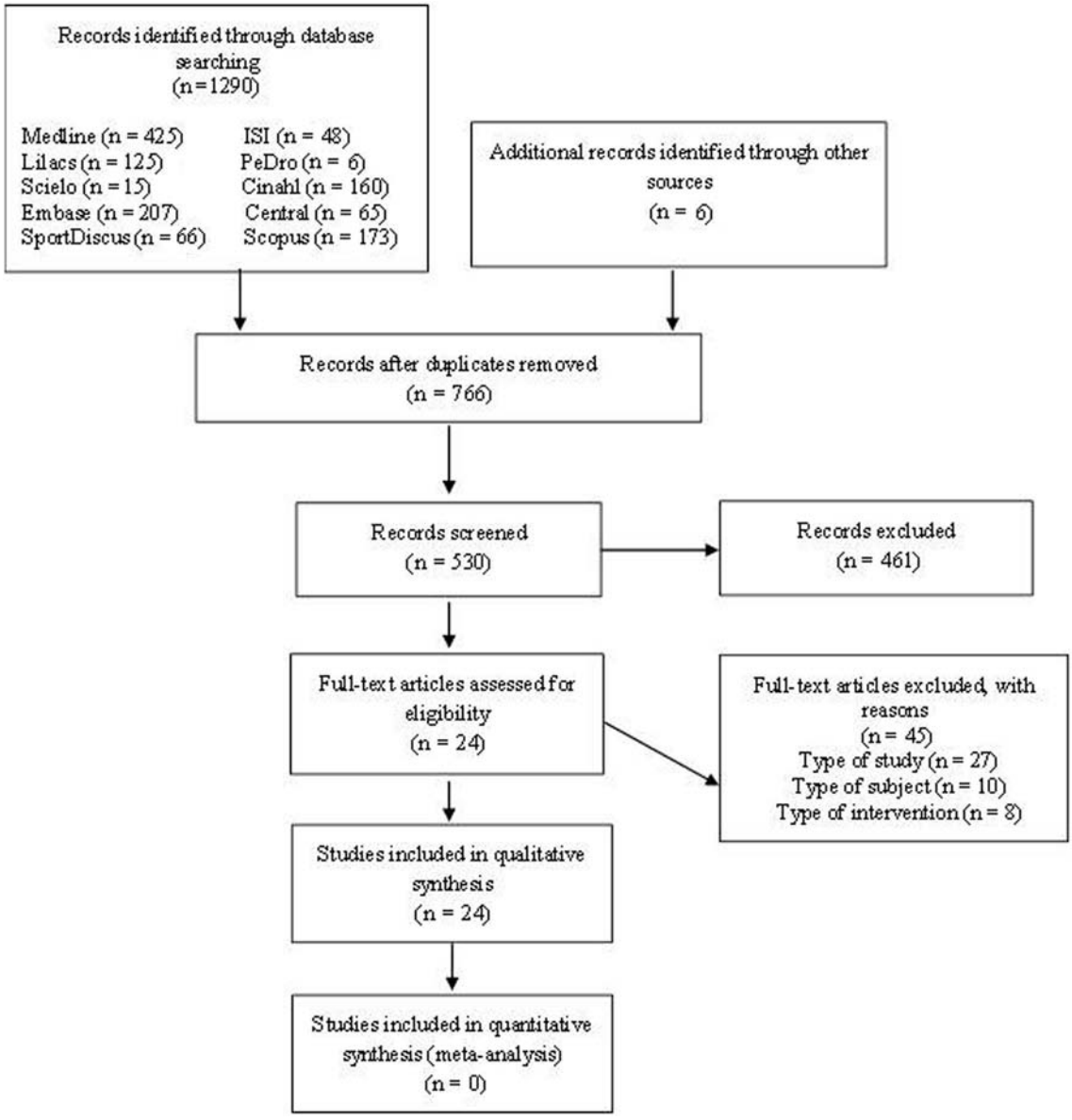

Fig 1. *Flow diagram.*

muscle pain and generated local muscle relaxation similar to visual BF.[41,46] Additionally, labial BF seemed to be a promising method for the temporary control of SB; 1 of the studies showed a statistically significant decrease in bruxism event duration.[40] After BF treatment, another study observed a reduction in the number of AB events.[45] Similarly, when BF was used in the daytime, the number of AB and SB tonic EMG events decreased significantly both during and after the BF treatment session.[43] Further, studies suggest that BF is an effective treatment method when compared with OS, and it can be used to suppress SB.[36,44]

However, most of the studies that encompassed BF treatment for SB focused on GrindCare (Sunstar Suisse SA, Etoy, Switzerland), a portable stimulation device employed in instances of excessive contraction of the temporal muscle. Five out of 6 studies showed a decrease in muscle activity; however, in some cases, there was no association with pain reduction and no improvement in TMD signs. In other cases, the reduction was associated with improvement of pain and enhancement of oral health quality, which suggests its effectiveness for SB with no sleep interruption.[6,35,37-39,42]

Although 2 of the 14 trials using BF presented Jadad scores of 3[39] and 4[38] with regard to short-term reduction of muscle activity in individuals with SB,[38,39] only 1 of these studies[38] also presented a PEDro score of 6,[38] but there were no short-term follow-up effects on sleep, muscle pain, oral health, mouth opening, depression, and TMD. Thus, the majority of studies[6,34-37,40-46] on electrotherapy

Table 1. *Summary of Included Studies (n = 24)*

Author	Country	Type of Study	Participants n; Sex (F:M); Age (y)	Interventions (Number; Duration; Frequency Sessions)	Outcomes and Assessment Tools Observation Points
Alvarez-Arenal, et al[34]	Spain	Blind RCT	24; 9:15; 36.5	G1 (TENS): 15 sessions; 45-60 min each; every 2 d; G2 (OS): 45 d, 24 h/d	TMJ pain and mm pain: masseter; temporal, medial, and lateral pterygoid; digastric; SCM; trapezium (palpation) mouth opening (ruler); TMD severity (Pantographic Reproducibility Index: Pantronic) Before and after treatment
Rajpurohit, et al[41]	India	RCT	60; 24:36; range: 19-60	G1 (TENS) and G2 (MENS): 7 sessions; 20 min each	Masseter mm pain at affected side (VAS) Pain threshold (algometer) Before and after treatment
Raphael, et al[42]	USA	Clinical trial	14; 14:0; 34.9 ± 11.5	G1 (BF: GrindCare): 6 wk; every night	E/m (GrindCare); spontaneous pain (VRS); number of painful mm (palpation-RDC/TMD); perception of symptom changes (PCS) EMG: Before (2 wk), during (6 wk), and after (2 wk); Spontaneous pain and pain at palpation: week 1, 5, 8, 10; symptoms: week 10
Nishigawa, et al[40]	USA	Pilot study: clinical trial	7; 2:5; 32.4 ± 3.8	G1 (labial BF): 5 nights (first: no stimulus, second through fifth: stimulus every 1 h midway into sleep time)	Masseter mm activity (EMG) Before (2 wk) and after 5 nights
Wieselmann-Penkner, et al[46]	Austria	Pilot study: RCT	20, G1 (n: 10), G2 (n: 10); 13:7; range 22-58	G1 (visual BF) and G2 (TENS): 3 sessions; 20 min; once/w	Masseter and temporal mm activities (EMG) Before and after each session
Watanabe, et al[45]	Japan	RCT	20, G1 (n: 10), G2 (n: 10); 10:10; 30.9 ± 5.6	G1 (BF); G2 (control): 4 d for 5 h (days 1 and 4: EMG recording and days 2 and 3: BF-G1)	Masticatory mm pain (NPRS); anterior temporal mm activity (EMG) Before and after treatment
Conti, et al[35]	Brazil	Pilot study: blind RCT	15, G1 (n: 7), G2 (n: 8); 12:3, G1 (5:2), G2 (7:1); G1 (37.3 ± 8.9), G2 (31.9 ± 12.3)	G1 (BF-GrindCare); G2 (inactive): 10 nights	E/m (EMG); masticatory mm pain (VAS); pain threshold (algometer) Before and after (5 nights), after (10 nights), and after (5 nights)
Needham and Davies[6]	USA	Pilot study: clinical trial	19; 9:10; range 22.7-60.1	G1 (BF-GrindCare): 5 wk; every night	Anterior temporal mm activity (EMG); pain (VAS) Before and after sessions
Jadidi, et al[37]	Denmark	Blind RCT	14; 8:6; range 24-60	G1 (BF-GrindCare): 10 w: 3 active; 2 inactive; 3 active and 2 inactive; G2 (reversed sequence)	Temporal mm activity and e/m (EMG); TMD signals: number of painful mm and mouth opening (palpation and RDC/TMD); pain (CPI); depression (SAS-90); quality of pain (McGill); oral health (OHIP 49) Before and after treatment

(continued on next page)

Table 1. (*continued*)

Author	Country	Type of Study	Participants n; Sex (F:M); Age (y)	Interventions (Number; Duration; Frequency Sessions)	Outcomes and Assessment Tools Observation Points
Jadidi, et al[39]	Denmark	Clinical trial	14; 10:4; 32 ± 3	G1 (BF-GrindCare): 1 night (baseline); 1 night (inactive) and 1 night (active)	E/m (PSG); sleep, fatigue, and snoring (questionnaire: 1-20) Before (first adaptation night and second night with no stimulus) and after third night with stimulus
Jadidi, et al[38]	Denmark	Pilot study: double-blind RCT	11; 9:2; 37 ± 3	G1 (BF-GrindCare); G2 (inactive): 4 sessions	Mm activity and e/m (EMG); sleep, fatigue, and snoring (questionnaire: 1-20); quality of pain (McGill); oral health (OHIP 49); TMD: painful mm and mouth opening (palpation and RDC/TMD); pain (CPI); depression (SAS-90); daily pain (NPRS). Before, after, and 4 wk
Ommerborn, et al[23]	Germany	Blind RCT	57, G1 (n: 28), G2 (n: 29); 39:18; G1: 28.50 ± 0.96, G2: 29.41 ± 0	G1 (CBT and audible BF): 12 sessions; 1 h, 50 min; once/w and every night for 2 wk, respectively; G2 (OS): 12 wk	SB activity (Bruxcore): self-assessment of SB activity and associated symptoms (NS); psychological impact (depression) (SAS-90); strategies to cope with stress (SCQ-78) Before, after, and 6 months later
Treacy[26]	Sweden	Blind RCT	24, G1 (n: 8), G2 (n: 7), G3 (n: 8); 10:14; 25.1	G1 (MART); G2 (TENS); G3 (placebo): 20 sessions; 20-30 min; 2 times/wk	Mm pain and activity: pterygoid, masseter, temporal, trapezium, frontal (palpation and EMG); mouth opening (inspection) Before and after treatment
Quintero, et al[25]	Colombia	Blind randomized controlled clinical trial	26, G1 (n: 13), G2 (n: 13); 12:14; G1: 56.7 ± 7.2 m and G2: 55.3 ± 7.8 m	G1 (awareness through movement): 10 sessions; 3 h; once/wk at home; G2 (control)	Head posture (photograph and lateral cephalogram) Before and after treatment
Restrepo, et al[47]	Colombia	RCT	33, G1 (n: 20), G2 (n: 13); NA; range: 3-6	G1 and G2 (CBT): once/wk, every day at home and every wk at school for 6 mo	Anxiety (Conners Parent and Teacher Rating Scale) (0.75%-4%); TMD signals and mouth opening (clinical exam: 0-5) Before and after treatment
Makino, et al[50]	Japan	Clinical trial	39; NA; NA	G1 (TE + CBT); G2 (TE): 4 sessions; 10 min TE at home once a day, G3 (control)	Jaw movement (mouth opening) and craniocervical pain (NS) Before and after 14, 42, 70, and 98 d
Jardini, et al[49]	Brazil	Clinical trial	39, G1 (n: 13), G2 (n: 13), G3 (n: 13); NA; range: 23–48	G1 (B and use of PPFE): 1-3 series; 15-20 isotonic exercises and isometric exercises, 15 s, at home); G2 (B and no use of PPFE); and G3 (at B)	Masseter and buccinator mm activities (EMG); perception of symptoms (on a scale of 0-5) Before and 10 and 70 d after the use of PPFE

Table 1. (*continued*)

Author	Country	Type of Study	Participants n; Sex (F:M); Age (y)	Interventions (Number; Duration; Frequency Sessions)	Outcomes and Assessment Tools Observation Points
Dallanora, et al[21]	Brazil	Clinical trial	15; NA; NA	G1 (acupuncture): 1 session; at least 30 min	Masseter and anterior temporal mm activities (EMG) Before; immediately after; and 12, 36, 60, 84, and 108 h later
De La Torre Vera, et al[51]	Brazil	Clinical trial	4; 4:0; range: 25-30	G1 (acupuncture): 1 session	Anterior temporal, superficial masseter, and bilateral trapezium mm pain (VAS); mm activity (EMG) Before; immediately after; and 24, 36, and 72 h later
Valiente Lopez, et al[48]	Netherlands	Randomized controlled clinical trial	16; 8:8; range 24-62	G1(sleep hygiene + PMR): 4 wk; 20 min each; G2 (control, information only)	Bilateral masseter activity (PSG) Before and after the 4-wk period
Gu, et al[36]	China	Pilot study: RCT	24; 19:5; range 20-40	G1 (mini wireless BF); G2 (OS): sleep, 8 h	Episodes and duration—SB (PSG) Before, 6, and 12 wk
Sato, et al[43]	Japan	RCT	13; 0:13; range: 22-31	G1 (portable audible BF); G2 (control—only EMG recordings): 2-day; 5 h recording periods during daytime and sleep time); 3 wk	AB and SB tonic EMG events—anterior temporalis mm—habitual masticatory side (EMG) Weeks 1, 2, 3
Sumiya, et al[44]	Japan	RCT	10; 4:6; 26.7 ± 3.5	G1 (masseter BF after heart rate increase): 3 nights (1 without stimuli and 2 with stimuli)	Unilateral masseter mm (EMG); Maxillofacial fatigue and sleep quality (VAS)
Gomes, et al[15]	Brazil	RCT	60; 50:10; 18-40	G1 (massage): 12 sessions; 30 min each; 3 times/wk; G2 (OS): 4 wk; G3 (massage + OS); G4 (SOS)	Bilateral masseter and anterior temporal muscles (EMG) TMD signs and symptoms

AB, awake bruxism; *B*, bruxism; *BF*, biofeedback; *CBT*, cognitive behavioral therapy; *CPI*, characteristic pain inventory (3 scales of 0-100); *e/m*, events/minute; *EMG*, electromyography; *G*, group; *MART*, muscular awareness relaxation training; *McGill*, pain questionnaire; *MENS*, microcurrent electrical nerve stimulation; *NPRS*, numeric pain rating scale; *NS*, numeric scale; *OHIP-49*, oral health impact profile of 49; *OS*, occlusal splint; *PCS*, perceived change scale (1-7); *PMR*, progressive muscle relaxation; *PPFE*, Pro-Phono facial exerciser; *PSG*, polysomnography; *RCT*, randomized clinical trial; *RDC*, research diagnostic criteria; *SAS-90*, symptom assessment scale; *SB*, sleep bruxism; *SCM*, sternocleidomastoid muscle; *SCQ-78*, stress coping questionnaire with 78 items and 13 subscales; *SOS*, silicone occlusal splint; *TENS*, transcutaneous electric nerve stimulation; *TE*, therapeutic exercises; *TMD*, temporomandibular disorder; *TMJ*, temporomandibular joint; *VAS*, visual analogical scale (0-100 mm); *VRS*, verbal rating scale.

Table 2. *Methodological Quality of Eligible Studies (n = 24)*

	PEDro Scale Items [a]											PEDro Score	Quality Score
Study	1 [b]	2	3	4	5	6	7	8	9	10	11	(0-10)	JADAD
Alvarez-Arenal, et al[34]	Y	Y	N	N	N	N	Y	N	N	Y	N	3	Jadad score: 1 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: yes
Rajpurohit, et al[41]	Y	Y	N	N	N	N	N	N	N	Y	N	2	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Raphael, et al[42]	N	N	N	N	N	N	N	N	N	N	Y	1	Jadad score: 1 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: yes
Nishigawa, et al[40]	Y	Y	N	N	N	N	N	N	N	N	Y	2	Jadad score: 1 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: yes
Wieselmann-Penkner, et al[46]	N	Y	N	N	N	N	N	Y	N	Y	Y	4	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Watanabe, et al[45]	Y	Y	N	N	N	N	N	N	N	Y	Y	3	Jadad score: 1 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: yes
Conti, et al[35]	Y	Y	N	Y	Y	N	N	N	N	Y	Y	5	Jadad score: 1 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: yes
Needham and Davies[6]	N	N	N	N	N	N	N	N	N	N	N	0	Jadad score: 0 Randomized: no / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Jadidi, et al[37]	N	Y	N	N	Y	N	N	N	N	Y	Y	4	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Jadidi, et al[39]	N	Y	Y	N	N	N	N	N	N	N	Y	3	Jadad score: 3 Randomized: yes / Described: yes / Double Blind: no Blinding Described: no / Withdrawals: yes
Jadidi, et al[38]	N	Y	Y	N	Y	N	Y	Y	N	Y	N	6	Jadad score: 4 Randomized: yes / Described: yes / Double Blind: yes Blinding Described: yes / Withdrawals: no
Ommerborn, et al[23]	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	7	Jadad score: 2 Randomized: yes / Described: yes / Double Blind: no Blinding Described: no / Withdrawals: no
Treacy[26]	Y	Y	N	N	N	N	Y	Y	N	Y	Y	5	Jadad score: 1 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: yes
Quintero, et al[25]	N	Y	N	N	N	N	Y	N	N	Y	Y	4	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Restrepo, et al[47]	N	N	N	N	N	N	N	Y	N	Y	N	2	Jadad score: 0 Randomized: no / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no

Table 2. (*continued*)

Study	PEDro Scale Items [a]											PEDro Score	Quality Score
	1 [b]	2	3	4	5	6	7	8	9	10	11	(0-10)	JADAD
Makino, et al[50]	Y	Y	N	Y	N	N	Y	N	N	Y	Y	5	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Jardini, et al[49]	Y	N	N	N	N	N	N	Y	N	N	N	1	Jadad score: 0 Randomized: no / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Dallanora, et al[21]	N	N	N	N	N	N	N	N	N	N	N	0	Jadad score: 0 Randomized: no / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
De La Torre Vera, et al[51]	Y	N	N	N	N	N	N	N	N	N	Y	1	Jadad score: 0 Randomized: no / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Valiente Lopez, et al[48]	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	7	Jadad score: 4 Randomized: yes / Described: yes / Double Blind: yes Blinding Described: yes / Withdrawals: no
Gu, et al[36]	Y	Y	N	N	N	N	N	Y	N	Y	Y	4	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Sato, et al[43]	Y	Y	N	N	N	N	N	Y	N	Y	Y	4	Jadad score: 0 Randomized: yes / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Sumiya, et al[44]	Y	Y	N	N	N	N	N	Y	N	N	Y	3	Jadad score: 0 Randomized: no / Described: no / Double Blind: no Blinding Described: no / Withdrawals: no
Gomes, et al[15]	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	6	Jadad score: 2 Randomized: yes / Described: yes / Double Blind: no / Blinding Described: no / Withdrawals: no

Y, yes; *N*, no.

[a] 1, eligibility criteria and source of participants; 2, random allocation; 3, concealed allocation; 4, baseline comparability; 5, blinded participants; 6, blinded therapists; 7, blinded assessors; 8, adequate follow-up; 9, intention-to-treat analysis; 10, between-group comparisons; 11, point estimates and variability.

[b] Item 1 does not contribute to the total score.

resources reported a high risk of bias, including those indicating a short-term positive effect of TENS and MENS[41] on muscle pain and BF on oral health.[37]

In general, total Jadad scores ranged from 0 to 4, with a mean of 0.9, and PEDro scores ranged from 0 to 6, with a mean of 3.1. Therefore, there is "very low-quality" evidence (GRADE) that electrotherapeutic resources decrease muscle activity and pain and improve oral health in individuals with bruxism.

Head Posture

One study involving 26 participants reported statistically significant reduction in forward head posture in children after treatment based on postural awareness through movement.[25] However, by the total Jadad and PEDro scores of 0 and 4, this single study has a high risk of bias, and therefore the evidence (GRADE) that postural awareness improves forward head posture was rated "very low quality."

Muscle Relaxation

One study with 24 participants reported greater efficacy of MART compared with TENS in treating bruxism, which suggests the relevance of muscular awareness relaxation training of the whole body and mind.[26] Nevertheless, Jadad and PEDro scores were 1 and 5, indicating weak methodological quality. Therefore, there is "very low quality" evidence (GRADE) that muscle relaxation decreases muscle activity and pain and improves oral health in individuals with bruxism.

Table 3. *Results and Conclusions of Studies*

Author	Results	Conclusions
Alvarez-Arenal, et al[34]	Differences were not statistically significant between TENS and OS in muscle pain, TMD, or mouth opening.	TENS and OS failed to improve the signs and symptoms of TMD in individuals with B.
Rajpurohit, et al[41]	Significant change in masseter muscle pain ($P \leq .0001$) and pain threshold ($P = .0495$) in MENS group compared to TENS group.	MENS and TENS could be effective pain relievers for masticatory muscle pain due to B.
Raphael, et al[42]	Significant reduction of EMG ($P = .02$) but not in pain ($P = .10$).	BF reduced EMG events.
Nishigawa, et al[40]	Number of B episodes during sleep was reduced but not significantly ($P = .107$). B event duration significantly reduced ($P = .038$).	BF reduced B events.
Wieselmann-Penkner, et al[46]	Significant between-group effect at pre- and post-treatment analysis of masseter and right temporalis muscle activity for both groups after the treatment sessions.	BF and TENS lead to local relaxation of masticatory muscle.
Watanabe, et al[45]	Significant decrease was found in the BF group ($P < .05$) in masseter and temporal muscle activity.	AB reduced in the short-term with BF.
Conti, et al[35]	BF active group had lower masticatory muscle activity when compared with baseline, but there were no differences in pain or pain threshold.	BF reduced masticatory muscle activity associated with SB, without alteration of pain.
Needham and Davies[6]	Fifty-eight percent of patients had reduced occurrence of pain and decreased muscle activity.	BF reduced muscle activity and improved pain associated with SB.
Jadidi, et al[37]	The number of EMG episodes per hour of sleep and oral health significantly reduced ($P < .001$).	BF reduced temporalis muscle activity and improved oral health.
Jadidi, et al[39]	Average number of EMG episodes per hour of sleep, fatigue, and snoring was not significantly different.	No significant difference.
Jadidi, et al[38]	The number of EMG episodes per hour of sleep was significantly reduced in the active sessions, but there were no significant differences in the secondary outcome, pain, or muscle tension scores.	BF demonstrated inhibitory effect on muscle activity during sleep.

Table 3. (*continued*)

Author	Results	Conclusions
Ommerborn, et al[23]	Significant reduction in SB activity, self-assessment of SB activity, and psychological impairment, as well as an increase of positive stress-coping strategies in both groups.	CBT and OS reduced SB activity, self-assessment of SB activity and associated symptoms, psychological impairment, and increased positive stress-coping strategies.
Treacy[26]	MART group had significantly increased mouth opening after treatment ($P < .01$) relative to control and TENS groups. This group also decreased the pterygoid, masseter, and frontalis activity ($P < .05$).	Higher decrease of pterygoid, masseter, and frontalis muscle activity and increased mouth opening of MART as compared with TENS and control groups.
Quintero, et al[25]	Awareness through movement group relative to control group showed statistically significant improvement in the natural head posture.	Awareness through movement improved forward head posture.
Restrepo, et al[47]	There was reduction of anxiety level, TMD signs, and mouth opening, with statistical significance ($P < .05$).	CBT reduced anxiety and TMD signs and symptoms associated with B in children with primary teeth.
Makino, et al[50]	Pain was significantly lower in the CBT with TE group compared with other groups ($P < .05$). Jaw movement improved 93% in this group.	CBT combined with TE improved craniocervical pain and jaw movement.
Jardini, et al[49]	B with PPFE group had deceased activity, with reduction in symptoms.	Reduction of masseter muscle activity with activation of buccinator muscle after the use of PPFE.
Dallanora, et al[21]	Improvement of muscle activity in 60%-86% of individuals.	Acupuncture reduced masseter and anterior temporal muscle activity.
De La Torre Vera, et al[51]	Bilateral temporal, masseter, and trapezium muscle pain improved in all periods, and there was reduction of muscle activity ($P < .05$) that stayed after 72 h.	Reduction of masticatory muscle activity and pain.
Valiente Lopez, et al[48]	Significant differences in masseter activity were not observed between groups.	No significant differences.

(continued on next page)

Table 3. (*continued*)

Author	Results	Conclusions
Gu, et al[36]	There was a significant decline in B episodes ($P = .001$) and duration ($P < .05$) in the BF group, showing significant differences relative to the OS group during these episodes ($P = .001$).	Episodes and duration—SB decreased remarkably, suggesting BF is effective when compared with OS.
Sato, et al[43]	EMG events decreased significantly both in daytime and during sleep in the BF group ($P < .05$).	Improving AB can also provide an effective approach for regulating SB.
Sumiya, et al[44]	Muscle masseter activity decreased significantly, but there were no significant differences in other outcomes.	Findings are suggestive of the effectiveness of such electrical stimuli in suppressing SB.
Gomes, et al[15]	Massage with occlusal splint group showed greater improvement in TMD signs and symptoms relative to other groups.	Massage and occlusal splint had no significant influence on EMG activity of the masseter or anterior temporal muscles. However, the combination of therapies decreased TMD signs and symptoms.

AB, awake bruxism; *B*, bruxism; *BF*, biofeedback; *CBT*, cognitive behavioral therapy; *EMG*, electromyography; *MART*, muscular awareness relaxation training; *MENS*, microcurrent electrical nerve stimulation; *OS*, occlusal splint; *PPFE*, Pro-Phono facial exerciser; *SB*, sleep bruxism; *TE*, therapeutic exercises; *TENS*, transcutaneous electric; *TMD*, temporomandibular disorder.

Cognitive Behavioral Therapy

The researchers identified 3 studies (106 participants) that assessed CBT for bruxism treatment in physical therapy.[23,47,48] Both competence reaction treatment and guided muscle relaxation generated a significant reduction in anxiety and an absence of TMD signs in children with bruxism.[47] For CBT based on progressive muscle relaxation, audible BF and OS significantly reduced the activity and self-assessment of SB and the psychological symptoms (depression) and increased coping strategies for stress both after the treatment and in follow-up processes.[23] Another study reported no effect of progressive muscle relaxation, in association with sleep hygiene measures, on SB.[48]

One study[48] presented strong methodological quality according to Jadad and PEDro scores of 4 and 7, and another study[23] had a PEDro score of 7. Despite this, total Jadad score ranged from 0 to 4 with a mean of 2, and PEDro scores ranged from 2 to 7 with a mean of 5.3. Because of this high risk of bias, the evidence (GRADE) that CBT reduces anxiety, TMD severity, muscle activity, depression, and stress was considered "very low quality."

Therapeutic Exercises

Mandibular therapeutic exercises combined with psychological interventions may be more effective than isolated exercises for improving craniocervical pain and jaw movement in individuals with AB.[50] Additionally, 1 paper reported that exercises performed with the Pro-Phono facial exerciser (Pró-Fono Produtos Especializados para Fonoaudiologia Ltda., Barueri, Sao Paulo, Brazil) are efficient in treating bruxism by significantly reducing both the symptoms and the range of the masseter muscle after activation of the buccinator muscles.[49]

However, both studies, which included 78 participants, presented Jadad and PEDro scores of 0 and <6, respectively.[49,50] This weak methodological quality shows that the use of exercise therapy to improve pain, jaw movement, and muscle masseter activity is also considered "very low quality" evidence (GRADE).

Acupuncture

One study indicated a significant reduction in the activity of different masticatory muscles in 60% to 86% of individuals with bruxism in several measurements after an acupuncture session.[21] In addition, another study reported a reduction in both activity and masticatory muscle pain in women with AB after several short-term assessment periods.[51] Nevertheless, these studies, with only 19 participants, were considered weak methodologically and therefore had "very low quality" evidence (GRADE).

Massage Therapy

Massage therapy and use of an OS did not lead to changes in activity of the masseter and anterior temporal muscles. However, the combination of therapies led to a reduction in the intensity of the signs and the symptoms of TMD among 60 individuals with SB,[15] with PEDro and

Jadad scores of 6 and 2. Thus, there is "very low quality" evidence (GRADE) that massage plus OS has a short-term effect on the signs and the symptoms of TMD in SB.

Discussion

With the aim of critically reviewing the effects of physical therapy in the treatment of bruxism, this systematic review found studies assessing the effect of methods used by physical therapists. Some studies assessed a single intervention, whereas others combined 2 or more interventions. Few studies had strong methodological quality in assessing electrotherapy resources, massage therapy, and CBT. Among the electrotherapy resources, GrindCare appeared to offer the greatest improvement in muscle activity.[38,39] Massage therapy plus OS reduced the signs and symptoms of TMD.[15] In addition, CBT, based on progressive muscle relaxation and sleep hygiene, had no effect on muscle activity in individuals with SB.[48] In particular, the items more frequently satisfied by the PEDro scale were related to random allocation, between-group comparisons, and point estimates and variability, and the dimensions of quality of randomization and withdrawal were most satisfied by the Jadad scale.

Regarding the finding of weak methodological quality by the PEDro scale, the criteria least satisfied were blinded therapists, intention-to-treat analysis, and concealed allocation. Moreover, reports of double blinding based on the Jadad scale were unclear in most of the included studies. Furthermore, it was possible to observe heterogeneity among included trials comprising a wide diversity of bruxism types, diagnostic criteria, physical therapy methods, and series of outcomes, with no distinction between primary and secondary observation points and tools employed. The lack of data and homogeneity for eligibility criteria and study outcomes prevented us from performing any meta-analysis of the data. Most of the studies were short term, and few provided sample size calculations or detected sample size effects. Additionally, a large proportion of the studies presented insufficient treatment periods, did not outline follow-up, and did not show any between-group comparisons.

Despite the weak methodological quality of most of the included studies, the physical therapeutic methods generally seemed to reduce the signs and symptoms of bruxism. Postural awareness through movement had beneficial effects on forward head posture in children with bruxism,[25] MART on pain reduction and mouth opening,[26] CBT on anxiety and TMD,[47] and muscle activity on other psychological symptoms, such as depression and stress.[23] Therapeutic exercises showed beneficial effects on pain, mouth opening, and muscle activity[49,50]; acupuncture on pain and muscle activity[21,51]; and other electrotherapy resources, such as TENS, MENS, and BF, on muscle pain and activity and oral health.[6,37,41,46] However, the evidence (GRADE) for all studies was considered very low quality, which means that further robust evidence with a low risk of bias is needed to change the estimates of the effects of physical therapy interventions in individuals with bruxism.

Consistent with the results of the present review, other studies have assessed the effects of BF in the treatment of SB by analyzing 7 studies with a moderate to high risk of bias. Wang et al[20] observed a confusing diversity among the compared groups, outcomes, and BF modalities, thus indicating the lack of scientific evidence to support the efficacy of this bruxism treatment method. In addition, a systematic review protocol was undertaken with the aim of providing a global, comprehensive view of the efficacy and acceptability of BF in the treatment of SB and AB in adults, as well as guiding clinical decision making for future research.[19]

Other systematic reviews focused on children and individuals with developmental disabilities and the use of OS, pharmacotherapy, botulinum toxin, and other treatments, indicating the importance of the need for new, more methodologically consistent, standardized, and delineated studies to establish sufficient and strong evidence for appropriate bruxism treatment.[4,11-14,52]

Therefore, based on the evidence and orientation of other health care professionals regarding the relevance of the services rendered by physiotherapists in treating bruxism, we would encourage high-quality, randomized, and controlled trials with defined and trustworthy conclusions and a uniform, rigorous methodology grounded in the accurate textual structures recommended by the Consolidated Standards of Reporting Trials in physiotherapeutic decision-making processes.[53] Data relating to trial registration, funding, sample size calculation, and nomination of a primary outcome are some items in the Consolidated Standards of Reporting Trials statement associated with better transparency and methodological quality.[31,53]

Currently, a randomized clinical trial protocol, with an aim of comparing 2 distinct physical therapy interventions—progressive muscle relaxation with imagination and massage with both muscle stretching exercises and dental treatment—for treating pain, mouth opening, sleep quality, anxiety, stress, depression, and oral health in individuals with bruxism, is underway. A total of 72 participants will be randomized into 1 of 3 groups, with sample sizes of 24 in each group. This trial should support the practice of evidence-based physical therapy for individuals with bruxism.[54]

Conclusion

The results of this systematic review support the hypothesis that, at present, there is very low-quality evidence that diverse and distinct methods of physical therapy interventions, such as electrotherapy, postural awareness, muscle relaxation, CBT, therapeutic exercises,

acupuncture, and massage therapy, improve muscle pain and activity, mouth opening, oral heath, anxiety, stress, depression, TMD, or head posture in individuals with bruxism. The low value of this evidence is mainly because of the poor methodological quality of most of the studies included in this review.

Therefore, there is a clear need for well-designed randomized controlled trials examining physical therapy interventions for bruxism. Trials should be large enough to be clinically meaningful and adequately powered. They should also include valid and reliable outcome measures and provide intermediary and long-term follow-up. Furthermore, attempts should be made to blind the assessors performing outcome measures and, when possible, the participants. Investigators should consider the findings of this systematic review when designing trials and attempt to overcome the limitations of the studies presented.

Practical Applications

- Physical therapy interventions can be effective for treatment of bruxism.
- These methods can improve diverse signs and symptoms related to bruxism.
- Most of the studies have poor methodological quality and, therefore, very low quality evidence.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jmpt.2017.10.014.

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Contributorship Information

Concept development (provided idea for the research): C.S.M.A., A.P.M.
Design (planned the methods to generate the results): C.S.M.A., A.P.M.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): A.P.M.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): C.S.M.A., A.S.E.S., M.S., A.P.M.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): C.S.M.A., A.S.E.S., M.S., A.P.M.
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Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): C.S.M.A., A.S.E.S., M.S., A.P.M.

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