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**UNIVERSIDADE ESTADUAL DE CAMPINAS**
**FACULDADE DE ODONTOLOGIA DE PIRACICABA**

**MARIANA BARBOSA CÂMARA DE SOUZA**

# FORÇA E TAMANHO DA LÍNGUA, FUNÇÃO SENSORIAL ORAL E MASTIGATÓRIA, QUALIDADE DO SONO E DE VIDA, E EFEITO DE DISPOSITIVOS INTRAORAIS EM BRUXISTAS

# TONGUE PRESSURE AND VOLUME, ORAL SENSORY AND MASTICATORY FUNCTION, QUALITY OF LIFE AND SLEEP, AND EFFECT OF INTRAORAL APPLIANCES IN BRUXERS

PIRACICABA
2017

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Dissertação apresentada à Faculdade de Odontologia de Piracicaba da Universidade Estadual de Campinas como parte dos requisitos exigidos para obtenção do título de Mestra em Clínica Odontológica, na Área de Prótese Dental.

Dissertation presented to the Piracicaba Dental School of the University of Campinas in partial fulfillment of the requirements for the degree of Master, in the area of Dental Prostheses.

Orientadora: Profª. Drª. Renata Cunha Matheus Rodrigues Garcia

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## RESUMO

O bruxismo do sono (BS) apresenta origem multifatorial e efeito deletério, podendo causar desgaste dental, presença de dor muscular e ferimentos e endentações na língua, dentre outros. Este estudo investigou a força máxima da língua (FML), tamanho da língua (TL), função sensorial oral, função mastigatória, dor, qualidade do sono e qualidade de vida relacionada à saúde bucal (QVRSB) de pacientes bruxistas antes e após o uso de dispositivos intraorais. Também foi avaliada a relação entre a dimensão da arcada dentária e o TL com a força da mesma. Sessenta voluntários foram recrutados na Faculdade de Odontologia de Piracicaba - UNICAMP, e divididos em dois grupos: portadores de bruxismo do sono (Experimental) e com ausência de bruxismo do sono (Controle). O BS foi diagnosticado por meio de exames clínico e por um dispositivo de eletromiografia/eletrocardiografia utilizado em ambiente doméstico, denominado Bruxoff®. Após, foram avaliadas as seguintes variáveis: FML (por meio de sensores de pressão), função sensorial oral (estereognose oral), parâmetros da função mastigatória como o limiar de deglutição e eficiência mastigatória (método de fracionamento das peneiras), TL (ultrassonografia), dor (Escala Visual Analógica), qualidade do sono (Índice de Qualidade de Sono de Pittsburgh – IQSP, e Escala de Sono de Epworth - ESE), o impacto da condição oral sobre a qualidade de vida dos voluntários (OHIP-14), e, finalmente, a dimensão da arcada dentária inferior (distância entre molares inferiores). Posteriormente, metade dos voluntários do Grupo Experimental receberam placas oclusais estabilizadoras (POE) como terapia para o BS (n=15); e a outra metade recebeu placas palatinas (PP) sem cobertura oclusal, como placebo (n=15). Todas as placas foram utilizadas durante a noite, e após 30 e 60 dias de uso todas as variáveis supracitadas foram reavaliadas. Após a coleta de dados, os mesmos foram submetidos à análise exploratória e testes estatísticos adequados foram aplicados. Os dados dos questionários OHIP-14, IQSP e ESE foram analisados pelo teste de Wilcoxon, e o teste ANOVA de um fator foi utilizado para comparar os dados da função mastigatória e estereognose oral entre os voluntários com e sem bruxismo do sono. Após a instalação dos dispositivos intraorais foi realizada a comparação entre grupos e tempo pelo teste ANOVA dois fatores e post-hoc teste de Tukey. A correlação entre a FL e o TL foi obtida pela correlação de Pearson. Todas as análises estatísticas foram realizadas com nível de significância de 5%. Os voluntários com BS apresentaram um maior impacto da QVRSB ($p = 0,003$), indicando uma pior qualidade de vida. Ainda, os bruxistas apresentaram as maiores pontuações no IQSP ($p = 0,0009$) e sonolência excessiva diurna ($p = 0,023$), avaliada pela ESE. A função mastigatória foi similar em ambos os grupos ($p > 0,05$),

assim como a função sensorial oral (p = 0,241). Após o uso dos dispositivos intraorais, todos os voluntários apresentaram redução na FML e no nível de dor (p < 0,0001), além de significativa melhora na QVRSB e qualidade do sono (p < 0,001). No entanto, o TL não sofreu alterações com o passar do tempo (p = 0,464) e não foram encontradas correlações entre a FML e o TL (p = 0,326), nem entre a FML e a relação entre TL e DAD (p = 0,121). Assim, foi possível concluir que o BS afeta a QVRSB, reduz a qualidade do sono, trazendo prejuízos às atividades diárias, embora não tenha sido observado impacto sobre a função mastigatória nem sobre a FSO. Ainda, a terapia por meio da utilização de dispositivos intraorais com ou sem cobertura oclusal reduz a FML e auto relato de dor, além de proporcionar melhora na QVRSB e qualidade do sono em pacientes bruxistas.

**Palavras-chave:** Bruxismo do sono, língua, estereognose, sono, qualidade de vida, mastigação.

## ABSTRACT

Sleep bruxism (SB) has multifactorial etiology and deleterious effects that may lead to tooth wear, muscular pain, tongue injuries, and others. This study investigated maximum tongue pressure (MTP), tongue size (TS), oral sensory function (OSF), masticatory function, pain, sleep quality and oral health-related quality of life (OHRQoL) in bruxers before and after splint therapy. Also, TS and dental arch size (DAS) were evaluated in relation to MTP. Sixty volunteers were selected at Piracicaba Dental School – University of Campinas (FOP/UNICAMP) and divided into two groups: subjects with (experimental) and without (control) SB. Sleep bruxers were chosen based on clinical evaluation and home recording electromyography/electrocardiography, called Bruxoff®. Then, the following variables were evaluated: MTP (measured by pressure sensors), TS (ultrasonography), OSF (oral stereognosis), masticatory function parameters (swallowing threshold and masticatory efficiency by sieve fractionation method), DAS (measured from mandibular first molar from right to left), pain (Visual Analogue Scale), sleep quality (Pittsburgh Sleep Quality Index – PSQI; Epworth Sleepiness Scale - ESS) and the improvement in oral health-related quality of life (OHIP-14). Then, half of the Experimental Group volunteers received stabilization splint (SS) therapy as SB management (n=15), and the other half received palatal splints (PS) as placebo (n=15). All participants used the splints at night and after thirty and sixty days of usage, all variables were re-evaluated. After data collection, an exploratory analyzes was applied and appropriate statistical tests were applied. Data from OHIP, PSQI and ESS were analyzed by Wilcoxon signed rank test. One-way ANOVA was used to compare data from masticatory function parameters and OSF means between bruxers and health subjects. After splints therapy, comparisons between groups and time were carried out with two-way ANOVA and Tukey post-hoc, and the correlation between MTP, TS the ratio TS/DAS was analyzed by Peason's test. Participants with SB showed greater values of OHRQoL than controls ($p = 0.003$), indicating that their quality of life was worst. Also, bruxers presented the highest PSQI scores ($p = 0.0009$), and excessive daytime sleepiness ($p = 0.023$), as accessed by ESS. Masticatory function parameters were similar in both groups ($p > 0.05$), as well as OSF ($p = 0.241$). After wearing both splints, MTP and pain levels were reduced ($p < 0.0001$). Besides, OHRQoL and sleep quality were improved after SS and PS wearing ($p < 0.001$), while TS did not alter after 30 nor 60 days of usage ($p = 0.464$). Likewise, a weak and not significant correlation was found between MTP and TS ($p = 0.326$) and between MTP and ratio TS/DAS ($p = 121$). Thus, it might be concluded that SB impairs OHRQoL and sleep

quality without affecting mastication and OSF. In addition, splint therapy reduces MTP and self-reported pain, also improving OHRQoL and sleep in bruxers.

**Key-words:** Sleep bruxism, tongue, stereognosis, sleep, quality of life, mastication.

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## 1 INTRODUÇÃO

O bruxismo é uma atividade repetitiva e involuntária dos músculos mastigatórios que se caracteriza pelo apertar e/ou ranger dos dentes (Raphael et al., 2012; Gumüs et al., 2013; Lobbezoo et al., 2013). Esta parafunção acomete cerca de 7,4% da população adulta (Maluly et al., 2013), com ocorrência semelhante entre os gêneros (Manfredini et al., 2013). Em adição, possui a tendência de diminuir com o avanço da idade, apresentando prevalência de 3% na população idosa acima de 65 anos (Ohayon et al., 2001).

O bruxismo apresenta duas manifestações circadianas, podendo ocorrer durante o sono (bruxismo do sono) ou vigília (Lobbezoo et al., 2013). O bruxismo do sono (BS) é definido como movimento estereotipado que ocorre durante o sono, caracterizado pela atividade rítmica dos músculos mastigatórios, onde aproximadamente 90% dos episódios são de movimentos excêntricos de ranger de dentes (Ohayon et al., 2001; Deregibus et al., 2014). A etiologia e o mecanismo neurológico que geram os episódios de BS ainda não são bem entendidos. Evidências sugerem que o BS é induzido pelo sistema nervoso central e está associado com fenômenos de microdespertares durante o sono (Lavigne et al., 2003; Lavigne et al., 2007). Além disso, o sistema nervoso autônomo é ativado e inúmeras manifestações autonômicas ocorrem antes do episódio de BS, em particular o aumento da frequência cardíaca (Lavigne et al., 2007). Em contraste, o bruxismo que ocorre durante a vigília deve ser diferenciado do BS porque são condições que ocorrem em diferentes circunstâncias. O bruxismo de vigília é composto basicamente do apertamento dental e é um comportamento adquirido associado com o estresse e ansiedade da vida moderna (Lavigne et al., 2005).

Considerado como a atividade parafuncional mais destrutiva do sistema estomatognático, o BS é responsável por desgastes dentais, lesões periodontais, danos musculares (Winocur et al., 2003) e/ou articulares, e dores de cabeça (Lavigne et al., 2005). Em acréscimo, o BS pode gerar sucção de lábios, protrusão da língua e consequentemente causar endentações e/ou ulcerações na mesma (Lavigne et al., 2003; Lavigne et al., 2007; Yanagisawa et al., 2007; Clark et al., 2012; Manieri et al., 2012; Castroflorio et al., 2013). As endentações e/ou ulcerações ocorrem devido à pressão que a língua exerce contra os dentes, o que provoca grande desconforto ao paciente e prejudica as funções de deglutição, mastigação, e fala, além de interferir na qualidade de vida dos indivíduos (Meirelles e Rodrigues Garcia, 2016).

A força da língua apresenta diferentes valores quando avaliada em diferentes posições na cavidade bucal (Zeng et al., 2015). Estudo experimental realizado em humanos indicam maiores valores de força de língua nas regiões dos dentes molares (Chiba et al., 2003). Em

contraste, outros experimentos (Makihara et al., 2005; Lenius et al., 2009) verificaram que a maior força de língua ocorre na região anterior. Chiba et al. (2003) concluíram que a língua exerce a força mínima quando em contato com o palato duro, correspondente à região dos segundos pré-molares; e máxima na região dos segundos molares, ou seja, a região mais posterior seria o local de maior força (Chiba et al.,2003). Verifica-se desta forma que a força da língua difere segundo sua posição, entretanto controvérsias ainda persistem, expondo a importância do tema em questão. Em acréscimo, sabe-se que durante a atividade funcional normal a força de contato entre os dentes está em torno de 6.419,76 Kg/dia, e que durante o BS o valor desta força é elevado para 14.332,48 Kg/dia (Okesson, 2000). Portanto, é razoável se supor que durante os episódios de BS a força exercida pela língua contra os dentes também seja elevada, podendo então ser a responsável pelos traumas e ulcerações na língua e mucosa jugal. Apenas um estudo (Meirelles e Rodrigues Garcia, 2016) constatou maior pressão da língua contra os dentes em pacientes bruxistas, contudo a ausência da mensuração de fatores que também podem influenciar a força da língua, como o tamanho da mesma e a dimensão da arcada dentária dos pacientes (Yanagisawa et al., 2007) limitam seus achados e apontam para necessidade da realização de estudos mais completos.

A língua é um órgão dinâmico formada por músculos intrínsecos e extrínsecos (McKee et al., 2013) que modificam constantemente sua forma para aprimorar as funções de mastigação, deglutição, respiração e fala (Hayashi et al., 2013). Sabe-se que a força da língua é alterada quando da realização das funções orais (Chiba et al., 2003; Makihara et al., 2005; Lenius et al., 2009), e que pacientes com macroglossia são mais susceptíveis à formação de endentações e ulcerações no órgão, uma vez que o aumento do volume lingual pode levar ao recobrimento dentário, ocasionando o trauma (Teixeira et al., 2010). Também é estabelecido que a relação entre o tamanho da arcada dentária e volume da língua podem ser fatores determinantes para a formação de endentações ou traumas na língua (Yanagisawa et al., 2007), que podem alterar a mastigação (Teixeira et al., 2010).

Durante a função mastigatória, receptores sensoriais devem perceber as características físicas dos alimentos, para então dar início a coordenação oral motora para preparar o bolo alimentar para deglutição (Santos et al., 2014). Assim, pode-se hipotetizar que as endentações e/ou ulcerações presentes na superfície da língua de indivíduos bruxistas alterem a função sensorial oral, e consequentemente a mastigação e deglutição de tais indivíduos. A função ou habilidade oral sensorial e motora tem sido avaliada por meio do teste de estereognose oral, que verificam a habilidade de cada indivíduo em reconhecer formas e tamanhos de objetos

por meio da exploração oral (Hirano et al., 2004; Ladha et al., 2011). Contudo, não foram encontrados estudos sobre estereognose oral de pacientes bruxistas.

Diversas são as terapias propostas para o controle dos episódios de BS (Bader et al., 2000; Reddy et al., 2014). Dentre elas, destaca-se a instalação de placas oclusais estabilizadoras, que evitam o desgaste dental, reduzem as atividades musculares e dores miofasciais, proporcionam estabilidade articular, além de serem consideradas um método não invasivo e totalmente reversível (Dao et al., 1994; Gümüs et al., 2013). Portanto, também é importante o estudo sobre a influência deste tipo de tratamento sobre a força que a língua exerce sobre os dentes e na função sensorial e motora da língua.

Diante das controvérsias acima expostas sobre o BS, a força da língua e possíveis associações com seu tamanho e dimensão da cavidade oral, este estudo tem como objetivo geral comparar força máxima e tamanho da língua, função sensorial oral e função mastigatória, qualidade do sono e de vida de pacientes portadores de bruxismo e aqueles com ausência deste hábito, antes e após instalação da placa oclusal estabilizadora. Como objetivos específicos, o presente estudo avaliou: *1)* A qualidade de vida relacionada à saúde bucal e qualidade do sono, e função sensorial oral e mastigatória de voluntários com e sem BS *2)* Força e tamanho da língua, qualidade de vida relacionada à saúde bucal, qualidade do sono e dor em bruxistas, após uso de dispositivos interoclusais.

## 2 ARTIGOS

Este trabalho foi realizado no formato alternativo, conforme a Informação CCPG/001/2015, da Comissão Central de Pós-Graduação (CCPG) da Universidade Estadual de Campinas.

O artigo 1, intitulado “Sleep bruxism influences quality of life and sleep without impairing mastication and oral sensory function”, foi submetido à publicação no periódico Clinical Oral Investigations (Anexo 1).

O artigo 2, intitulado “Effect of splint therapy on tongue pressure and size, oral health related quality of life, sleep, and pain in bruxers”, será submetido à publicação no periódico Journal of Oral Rehabilitation.

**ARTIGO 1**

# Sleep bruxism influences quality of life and sleep without impairing mastication and oral sensory function.

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Abstract

*Objectives:* To compare the oral health–related quality of life (OHRQoL), sleep quality, mastication, and oral sensory function (OSF) of subjects with and without sleep bruxism (SB).

*Materials and Methods:* Participants of both genders were assigned as bruxers ($n$ = 30, age, 21–45 years) and non-bruxers ($n$ = 30, age, 21–37 years). SB was clinically diagnosed and confirmed with an electromyography/electrocardiograph portable device (Bruxoff). The OHRQoL was assessed using the Oral Health Impact Profile (OHIP-14); sleep quality was determined using the Pittsburg Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). Mastication was evaluated by swallowing threshold (ST) and masticatory efficiency (ME). The ST was determined from the median particle size ($X_{50}$) of artificial material comminution obtained after an individualized number of masticatory cycles determined by chewing a portion of peanuts; ME was estimated by the sieving method. The oral stereognosis test was used to determine the OSF. OHIP-14, PSQI, and ESS data were analyzed by Wilcoxon signed rank test. The mean $X_{50}$, ME, and OSF were compared using one-way analysis of variance, considering a significance level of 5%.

*Results:* Bruxers had worse OHRQoL ($p$ = 0.0034), the highest PSQI scores ($p$ = 0.0009), and excessive daytime sleepiness ($p$ = 0.0238). Both groups had similar $X_{50}$, ME, and OSF values ($p > 0.05$).

*Conclusions:* SB impairs OHRQoL and sleep quality without affecting mastication and OSF.

*Clinical relevance:* Determining that SB affects OHRQoL and sleep quality is important for dental professionals for establishing proper multifactorial management, and understanding patient-related psychosocial aspects.

Keywords Sleep bruxism, Quality of life, Sleep, Mastication, Stereognosis.

Introduction

Bruxism is a repetitive and involuntary jaw muscle activity characterized by the clenching and/or grinding of the teeth [1]. It presents two circadian manifestations, which may occur during sleep (termed sleep bruxism [SB]) or wakefulness (termed awake bruxism [AB]) [1]. AB is currently associated with psychosocial factors and/or motor disorders [2, 3], while SB etiology is still not well understood. Some studies have shown that SB is induced by the central nervous system, being associated with micro-arousal [4, 5] and rhythmic masticatory muscle activity [5].

SB is considered a common health problem, being prevalent in 7.4% of the adult population [6]. It can cause tooth wear, implant and/or tooth fracture, myofascial muscle pain, morning headaches, and is considered a predisposing and/or perpetuator factor of temporomandibular disorder (TMD) [7]. The gold-standard management for preventing the symptoms of SB is occlusal splint therapy, which inhibits tooth wear and reduces teeth grinding sounds and pain [8].

The overload in the masticatory muscles may compromise the neuromuscular system, affecting chewing [9]. During mastication, periodontal and mucosal mechanoreceptors perceive the physical characteristics of the food [10], while the tongue plays a major role in coordinating the bolus for subsequent swallowing [11]. Thus, considering that SB can cause indentations and/or ulcerations on bruxers' tongues [12, 13], it is reasonable to suggest that SB may also alter oral sensory function (OSF), with consequent impairment of mastication, and ultimately, nutrient intake. However, there are no reports on OSF in bruxers. Furthermore, the physical effects of SB [9] may also compromise some psychological aspects [14], affecting the individual's quality of life and sleep.

SB is one of the most frequent parasomnias experienced by adults [15]. Repeated arousal during sleep, associated with increased anxiety and stress [16], are considered the main cause of poor sleep quality. These parameters influence the discharge of chemical mediators, which activate catecholamine release, altering the initiation and maintenance of wakefulness and sleep [17]. In addition, the sleep pattern alterations may exacerbate pain in patients with SB [18], which directly influences well-being.

Despite SB definition [1], etiology [4], prevalence [19], and relationship with TMD [7] having been highly explored, some features of this parafunction remain unclear. In addition to the absence of studies on OSF in bruxers, studies on quality of life are limited to that on children [20, 21]; likewise, reports on sleep quality [6, 22] and masticatory function

are scarce [9, 23, 24]. Thus, this study aimed to evaluate the oral health–related quality of life (OHRQoL), sleep quality, masticatory function, and OSF in individuals with and without SB.

## Materials and methods

### *Subjects*

This cross-sectional study evaluated variables related to the OHRQoL, sleep quality, mastication, and OSF in adults with (experimental, $n = 30$) and without SB (control, $n = 30$). Participants were selected from among people who answered advertisements placed around Piracicaba City (churches, bus stations, parks, universities) that invited the participation of people with self-perceived teeth grinding during the night. The inclusion criteria were age between 20 and 45 years, complete dentition (excluding third molars), body mass index (BMI) between 18.5 and 24.9 kg/m$^2$, and good general health. In addition, all bruxers must present tongue indentations and/or ulcerations. Subjects under medical treatment, with daily ingestion of drugs acting on the central nervous system, wearing any type of prosthesis or orthodontic appliance, and/or those who had received any therapy for SB in the past 12 months were excluded. Table 1 describes the sociodemographic characteristics of the sample.

The research protocol (#085/2015) was approved by the Ethics Committee of Piracicaba Dental School, University of Campinas. This study was also registered in the Brazilian Registry of Clinical Trial database (No. RBR-2vv3gm), which is linked to the International Clinical Trials Registration Platform (ICTRP/World Health Organization). All volunteers signed an informed consent form to participate in the study.

### *SB diagnosis*

Each subject was classified as bruxer or non-bruxer by an expert clinician based on the clinical diagnostic criteria for SB, as described by the American Academy of Sleep Medicine [25]. According to these criteria, SB was diagnosed if the participant reported or was aware of teeth grinding sounds or teeth clenching during sleep. Moreover, one or more of the following signs must be present: (1) abnormal tooth wear; (2) transient jaw muscle pain in the morning; (3) muscle fatigue at awakening; and (4) masseter hypertrophy.

In addition to the clinical examination, SB was diagnosed using the Bruxoff portable electromyography and electrocardiography device (Spes Medica, Battipaglia, Italy) [26]. This device is designed for use at night in the domestic environment, and measures the number of SB episodes per hour, differentiating the type of muscle contraction (phasic, tonic, or mixed).

According to Castroflorio et al. [27], the reliability and reproducibility of the Bruxoff are similar to that of polysomnography, considered the gold standard for diagnosing SB [28].

Thus, after the clinical examination, all participants in the experimental group were instructed to use the Bruxoff at home for 2 consecutive nights. The first night was to familiarize the participant with the device; only data from the second night were registered. The participants were not to consume alcohol or caffeine, or even smoke during the evaluation period. Prior to using the Bruxoff, the participants received a clear and detailed explanation regarding the device, according to the manufacturer guide [27, 29]. Muscle electromyography was obtained by two concentric electrodes fixed bilaterally on the masseter muscles, and the electrocardiogram was assessed by a third electrode fixed just below the left pectoral muscle. A "chest belt" in the Bruxoff kit was wrapped around the thorax, near the pectoralis muscle, and the Bruxoff device was placed inside the belt overnight. Before sleep, participants activated the Bruxoff by performing three instances of maximum voluntary clenching (MVC), lasting 3 seconds each, with 10 seconds of rest between each MVC. A true bruxism episode was considered when masseter electromyography values were greater than 10% of MVC, immediately preceded (1–5 seconds) by a heart rate increase of 20% with respect to the mean heart rate [27]. Bruxmeter software (OT Bioelettronica, Torino, Italy) was used for automated evaluation of SB; participants presenting more than two episodes of SB per hour were deemed bruxers.

*Subjective evaluations*

The OHRQoL was evaluated by using the Portuguese version of the Oral Health Impact Profile (OHIP-14) questionnaire [30, 31]. OHIP-14 comprises 14 items distributed in seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. All participants were instructed to rate the frequency they experienced the impact of dental/mouth problems for each OHIP item. A five-point Likert-like scale was used, and the answers "very often", "fairly often", "occasionally", "hardly ever", and "never" were scored from 4 to 0, respectively. The sum of all 14 items ranges from 0 (very good) to 56 (very poor).

The Portuguese versions of the Pittsburgh Sleep Quality Index (PSQI) [32] and Epworth Sleepiness Scale (ESS) [33] were used to evaluate sleep quality. The PSQI consists of 19 self-reporting questions, comprising seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction [34]. Each component is scored between 0 and 3;

higher scores indicate worse sleep quality. A PSQI total score was obtained by summing the component scores. The total score ranges from 0 to 21, and is used to discriminate individuals as “good” or “poor” sleepers [30]. Scores higher than 5 indicate poorer sleep quality.

The ESS evaluates the possibility of dozing off while performing daily activities [33, 35]. The participants evaluated how likely they would have a nap or fall asleep in eight different typical situations. For each question, the answers were “would never doze”, “slight chance of dozing”, “moderate chance of dozing”, and “high chance of dozing”, which had scores of 0–3, respectively. The items were summed to calculate a total score that ranged from 0 to 24. Scores higher than 10 indicated excessive daytime sleepiness [35].

*Objective evaluations*

The swallowing threshold (ST) was determined in two steps. First, the personalized number of masticatory cycles needed to swallow 3.4 g of non-salted peanuts was determined. Participants were instructed to chew the peanuts in their usual manner until they felt like swallowing them. During this time, a trained researcher visually recorded the number of chewing cycles [36]. Subsequently, participants chewed a portion with 17 cubes of Optosil polydimethylsiloxane putty (Optosil Comfort, Heraeus Kulzer) [37], measuring 5.6mm at each edge and total weigh of 3.4g [38], for the same number of cycles determined with the peanuts. The comminuted Optosil particles were then spit onto a paper filter, and the participants rinsed their mouths with 200 mL water to complete cleansing.

The triturated Optosil particles were recovered and air-dried for 7 days. Then, the particles were sieved in a sieving machine (Bertel Indústria Metalúrgica) through a stack of up to 10 sieves for 20 minutes, using mesh sizes gradually decreasing from 5.6 mm to 0.5 mm [39]. The particles retained on each sieve and in the bottom pans were weighed on a 0.001-g analytical balance (Mark, BEL Engineering), and the ST was expressed as the median Optosil particle size ($X_{50}$) calculated by the Rosin-Rammler cumulative function [39]. High $X_{50}$ values indicate more difficulty grinding the test food material, indicating impaired chewing function. The number of masticatory cycles needed until the peanuts were swallowed was recorded for both groups. In addition, masticatory efficiency (ME) was calculated as the percentage weight of the comminuted material that passed through the 2.8-mm sieve [39].

The OSF was evaluated using the oral stereognosis test proposed by Hirano et al. [40]. We used only six small test pieces (8 × 8 × 2 mm) and grouped them in three pairs of related forms, e.g., circle and ellipse, square and rectangle, and triangle and semicircle. The test pieces were made from raw carrots to allow free oral manipulation without fear of swallowing

foreign objects. Before the test, participants were seated in a quiet environment and the procedure was explained with the aid of a chart showing the enlarged forms of the test pieces, which was used as an identification aid.

Each test piece was placed on the subject's tongue in random order, and the same order was used for all participants. Participants freely manipulated the test piece in their mouths without time limitations. Upon identifying the shape of the test piece, the participant pointed at the corresponding picture on the chart. A three-point scale was used to score each answer. Correct, partly correct, and incorrect answers received 2 points, 1 point, and 0 points, respectively. An answer was considered partly correct if it was not correct but was within the group shape [40]. The total score ranged 0–12 points; higher scores indicated better OSF.

*Statistical analyses*

Statistical analysis was performed by calculating the means and standard deviations. OHIP-14, PSQI, and ESS data showed non-parametric distribution and were analyzed by Wilcoxon signed rank test to identify group differences. The mean $X_{50}$, ME, and OSF from both groups were compared using one-way analysis of variance. All analyses were performed using SAS version 9.3 (SAS Institute, Inc., Cary, NC, USA), with a significance level of 5%.

Results

The sociodemographic characteristics were similar between the groups (Table 1).

Table 1. Sociodemographic characteristic of bruxers and health subjects, tested by Likelihood ratio chi-square.

| Parameter | With SB (n=30) | Without SB (n=30) | p-values |
|---|---|---|---|
| Gender (%) | | | - |
| Male | 43.33 | 43.33 | |
| Female | 56.67 | 56.67 | |
| Age (years) | 30.5 ± 6.0 | 26.6 ± 3.3 | - |
| Monthly income (real minimum wage) (%) | | | 0.0824 |
| 1 – 3 | 50.0 | 66.67 | |
| 3 – 6 | 40.0 | 30.0 | |
| 6 – 10 | 10.0 | 3.33 | |
| Educational level (%) | | | 0.076 |

| | | | |
|---|---|---|---|
| Basic Education | 3.33 | 0.0 | |
| High school | 33.33 | 10.0 | |
| College | 26.66 | 33.33 | |
| Postgraduate | 36.67 | 56.67 | |
| Employment Status (%) | | | 0.6394 |
| Employed | 93.33 | 90.0 | |
| Unemployed | 6.67 | 10.0 | |
| Alcohol intake (%) | 56.6 | 50.0 | 0.6046 |
| Tobacco consumption (%) | 6.67 | 3.33 | 0.550 |
| BMI | 23.2 ± 1.8 | 22.3 ± 1.9 | - |

* Data represent frequency (%) or mean ± standard deviation. SB, sleep bruxism; BMI, body mass index.

Compared with the controls, bruxers had higher total OHIP-14 scores and the highest scores in all its domains (Table 2), revealing the negative impact of oral health on the quality of life of participants with SB.

Table 2. Mean and median values of OHIP-14 domains obtained from subjects with and without SB.

| | With SB (n=30) | | Without SB (n=30) | | |
|---|---|---|---|---|---|
| | Mean | Median (quartile range) | Mean | Median (quartile range) | p-value |
| Functional Limitation | 1.20 | 0.5 (0-2) | 0.13 | 0 (0-0) | 0.0004 |
| Physical Pain | 4.17 | 4 (3-5.75) | 0.67 | 0 (0-1) | <.0001 |
| Psychological Discomfort | 4.43 | 4 (3-6) | 1.27 | 0 (0-1.75) | <.0001 |
| Physical Limitation | 1.30 | 1 (0-2) | 0.43 | 0 (0-0) | 0.0069 |
| Psychological Limitation | 2.20 | 2 (1-3) | 0.70 | 0 (0-0) | <.0001 |
| Social Limitation | 1.60 | 1 (0-3.75) | 0.67 | 0 (0-0) | 0.0083 |
| Disability | 1.53 | 1 (0-2) | 0.20 | 0 (0-0) | <.0001 |
| Total OHIP-14 | 16.43 | 14.5 (8-22.75) | 4.07 | 0 (0-7.5) | 0.0034 |

SB, Sleep bruxism; OHIP-14, Oral Health Impact Profile short form.

Table 3 contains the mean value comparisons of the PSQI and ESS total scores and the values of each PSQI questionnaire component for bruxers and non-bruxers. Bruxers had poorer sleep quality (PSQI, $p < 0.001$) and excessive daytime sleepiness (ESS, $p < 0.05$).

Table 3**.** Mean and median values of PSQI domains and ESS in subjects with and without SB.

| | With SB (n=30) | | Without SB (n=30) | | |
|---|---|---|---|---|---|
| | Mean | Median (quartile range) | Mean | Median (quartile range) | p-value |
| PSQI total score | 7.07 | 7 (5-7.75) | 4.67 | 4 (3-6) | 0.0009 |
| Subjective sleep quality | 1.37 | 1 (1-2) | 0.73 | 1 (0-1) | 0.0011 |
| Sleep latency | 1.23 | 1 (1-2) | 1.03 | 1 (0-2) | 0.3633 |
| Sleep duration | 0.93 | 1 (1-1) | 0.63 | 1 (0-1) | 0.0882 |
| Sleep efficiency | 0.47 | 0 (0-1) | 0.17 | 0 (0-0) | 0.2577 |
| Sleep disturbance | 1.63 | 2 (1-2) | 1.03 | 1 (1-1) | <.0001 |
| Use of medication | 0.23 | 0 (0-0) | 0.00 | 0 (0-0) | 0.0402 |
| Daytime sleep dysfunction | 1.20 | 1 (1-2) | 1.07 | 1 (1-1.75) | 0.4743 |
| ESS score | 10.33 | 9.5 (7.25-13.75) | 7.80 | 8 (5-9.75) | 0.0238 |

SB, Sleep bruxism; PSQI, Pittsburgh Sleep Quality Index; ESS, Epworth Sleepiness Scale.

Table 4 presents the mean number of masticatory cycles needed to swallow the peanuts during the first phase of ST evaluation, as well as the mean $X_{50}$ and ME of both groups. Comparisons between groups revealed no significant difference ($p > 0.05$) for these variables.

Table 4. Mean values (standard deviation) of $X_{50}$ and ME for subjects with and without SB.

| | With SB (n=30) | Without SB (n=30) | p-value |
|---|---|---|---|
| Masticatory Cycles to swallow peanuts | 37.07 (12.09) | 38.90 (11.66) | 0.556 |
| $X_{50}$ | 3.94 (1.10) | 3.59 (1.07) | 0.195 |
| ME | 27.61 (17.61) | 35.67 (19.66) | 0.794 |

SB, Sleep bruxism; $X_{50}$, Median particle size; ME, Masticatory efficiency.

Table 5 presents the oral stereognosis test results for both groups. The individual and total scores, and the time needed to recognize each test shape were similar ($p > 0.05$) for the bruxers and non-bruxers.

Table 5. Oral stereognoses scores and time spent (seconds) to identify each shape for subjects with and without SB.

| | Score | | p-value | Time response (s) | | p-value |
|---|---|---|---|---|---|---|
| | With SB | Without SB | | With SB | Without SB | |
| Rectangle | 1.40 (0.93) | 1.40 (0.93) | 1.000 | 11.53(6.56) | 10.85 (5.53) | 0.641 |
| Triangle | 2.00 (0.00) | 2.00 (0.00) | 1.000 | 6.68 (3.71) | 6.09 (3.19) | 0.466 |
| Square | 1.87 (0.51) | 1.93 (0.37) | 0.556 | 9.72 (10.75) | 8.27 (6.55) | 0.611 |
| Circle | 1.47 (0.90) | 1.60 (0.81) | 0.544 | 12.57 (8.36) | 13.30 (10.22) | 0.932 |
| Semicircle | 1.67 (0.76) | 1.90 (0.40) | 0.207 | 9.55 (6.69) | 12.95 (11.73) | 0.269 |
| Ellipse | 1.67 (0.76) | 1.93 (0.37) | 0.087 | 17.81 (14.01) | 17.76 (20.59) | 0.684 |
| Total | 10.07 (2.07) | 10.77 (1.43) | 0.241 | 67.54 (38.33) | 68.13 (34.87) | 0.8864 |

* Data represent mean (standard deviation). SB, Sleep bruxism.

## Discussion

The authors compared the subjective and objective outcomes between bruxer and control subjects, and found that bruxers had worse OHRQoL and sleep quality. However, bruxers and non-bruxers had similar mastication and OSF.

There was homogeneous distribution of genders between the groups, and the mean age was around 30 years. The participants had high education levels, where the majority had college degrees. In addition, over 90% of the subjects were employed, and their monthly earnings were more than twice the average Brazilian income [41]. Although the advertisements were circulated in areas with high foot traffic with individuals from all social levels, the respondents were mainly highly educated people. This finding was unexpected and might be considered random. Furthermore, both bruxers and non-bruxers had similar alcohol intake and low tobacco consumption. Moreover, the groups were matched for BMI values, which were lower than 24 $kg/m^2$, and considered normal. This standardization avoids the risk of bias, as worse masticatory performance and lower frequency of SB events have been reported in obese individuals [6, 42].

All domains and the total scores of the OHIP-14 indicated that SB has a negative impact on OHRQoL, when compared with control group. It is likely that the multifactorial etiology of bruxism [43], which includes psychosocial and pathophysiological factors associated with symptoms such as pain in the masticatory muscles, can affect OHIP-14 domains. Despite the absence of studies on OHRQoL in adults with SB, our findings are in contrast with that of other authors who explored this theme in children [20, 21] and who found no differences between infants with and without SB. Obviously, this discordance may be due to the different populations, mainly because the factors determining children's responses to global ratings are unclear [44], and parents/caregivers may underestimate the impact of oral problems on the child's quality of life [44].

Another finding was that participants with SB have poor sleep quality and excessive daytime sleepiness. Considering that bruxers have high sensitivity to psychological stress [45] and that psychophysiological insomnia is characterized by response to stress [6, 46], this might explain the loss of sleep quality in the bruxers in our study. Similar to our results, in which 80% of the sample had poor sleep quality, Dias et al. [47] observed that 75.6% of bruxers were poor sleepers regardless of the type of bruxism (centric, eccentric, or both).

Despite our study revealing the influence of SB on biopsychosocial parameters, masticatory function as evaluated by ST and ME was not impaired by this parafunction. The $X_{50}$ were similar for bruxers and non-bruxers. Similarly, ME did not differ between groups. Rodrigues Garcia et al. [24] also found no difference in $X_{50}$ between bruxers and non-bruxers. In contrast, other authors have reported that the presence of muscular pain, jaw stiffness, and occlusal changes due to tooth wear reduces chewing ability in bruxers [9]. These contradictory findings may be due to the different methods used to measure the masticatory function. While the previous study [9] subjectively evaluated chewing via questionnaires, we assessed the ST and ME by the sieving method, which is an objective and consolidated procedure for measuring the capability to triturate hard foods or firm materials [37-39]. Furthermore, the mean number of masticatory cycles required to triturate peanuts until swallowed was not different between groups in our study. Thus, as the bruxers and non-bruxers in our study triturated the Optosil for a similar number of masticatory cycles, this could contribute to explaining our $X_{50}$ and ST results.

Our findings concerning OSF also showed similar oral stereognosis data for both groups. Oral stereognosis involves the interaction of test pieces with the lips, tongue, and teeth [48]. However, we did not confirm the assumption that tongue indentations and/or ulcerations caused by SB modify oral stereognosis. Thus, injuries on the lateral edge of

the tongue do not appear to play a substantial role in oral sensorial perception. As the sensory and motor nerves, such as the lingual nerve, chorda tympani, and glossopharyngeal nerve, are found in the dorsal region of the tongue, tongue injuries caused by SB do not affect oral sensory ability.

The present study did not classify the severity of SB and tooth wear, which may have influenced the results. Therefore, future investigations that distinguish the levels of SB and classify tooth wear are important. As a final remark, this study highlights the strong influence of SB on sleep patterns and OHRQoL.

## Conclusion

SB impairs the OHRQoL and sleep quality of adults. However, it does not affect masticatory function negatively, and bruxers and non-bruxers have similar OSF.

## Compliance with Ethical Standards

*Funding:* This study was supported by São Paulo Research Foundation (FAPESP, grant numbers 2015/14662-0 and 2015/21704-1), Brazil.

*Conflicts of Interest***:** The authors declare that they have no conflict of interest.

*Ethical Approval:* All procedures in this research were performed in accordance with the ethical standards of the Ethics Committee of Piracicaba dental School, University of Campinas, and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

*Informed consent:* Informed consent was obtained from all individual participants included in the study.

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**ARTIGO 2**

Research Article

Effect of splint therapy on tongue pressure and size, oral health related quality of life, sleep, and pain in bruxers.

Tongue pressure, pain and quality of life and sleep after bruxism therapy.

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**Abstract**

**Background:** Tongue pressure against teeth may promote tongue injuries, which cause pain and may impair its function and influence the oral health-related quality of life (OHRQoL). However, it is not clear how splint therapy (ST) may act on those variables. **Objective***:* To evaluate the influence of ST on maximum tongue pressure (MTP), tongue size (TS), OHRQoL, sleep quality and pain in subjects with sleep bruxism (SB). Correlation between MTP, TS and TS/Dental arch size (DAS) ratio was also assessed. **Methods:** SB was diagnosed by clinical exam and electromyography/electrocardiography. Thirty bruxers were divided into two groups: receiving stabilization splints (mean age = 29.0±5.07), or palatal splint (controls, mean age = 32±6.70). MTP was measured by pressure sensors, and TS by ultrasonography. The Oral Health Impact Profile (OHIP-14) and Pittsburg Sleep Quality Index questionnaires were used to evaluate the OHRQoL and sleep quality, respectively. Pain was assessed by a Visual Analogue Scale. After baseline measurements, participants used the splints at night and after thirty and sixty days, all variables were re-evaluated. Comparisons between groups and time point were carried out with two-way ANOVA and Tukey post-hoc tests. Correlation between MTP, TS and TS/DAS ratio was analyzed by Pearson's test. **Results***:* Both splints reduced MTP ($P < 0.0001$), while TS did not alter after splints usage. OHRQoL, sleep quality ($P < 0.01$) and pain ($P < 0.0001$) were also improved after both splints therapy. However, no correlation was found between MTP, TS and TS/DAS ratio ($p>0.05$). **Conclusion:** Splint therapy reduces tongue pressure and self-reported pain, improving OHRQoL and sleep quality in bruxers.

**Keywords:** Sleep bruxism, splint, tongue pressure, tongue indentation, pain, quality of life.

**Background**

Sleep bruxism (SB) is considered a sleep-related movement disorder (1), presenting non-functional and repetitive jaw-muscle activity. This phenomenon is characterized by clenching or grinding of the teeth and by bracing or thrusting of the jaw (2, 3). SB may be associated with abnormal tooth wear and pain in the masticatory muscles and temporomandibular joint (4, 5). In addition, soft tissue pressure against teeth, such as cheek and tongue pressure, promotes buccal mucosa ridging and tongue indentation and/or ulcerations (6), which are considered common clinical signs in bruxers. Such characteristics may lead to discomfort and compromise phonation, swallowing and chewing ability (7, 8). These injuries are also related to pain reports with negative consequences for daily activities, which may impact the individual's quality of life.

Current SB therapies are aimed at limiting and preventing physical damages of tooth grinding. The most common interventions are occlusal splints, pharmacotherapy, biofeedback, sleep hygiene, botulinum toxin and physiotherapy (9, 10). Despite these several techniques, stabilization device therapy is the most established, because it is considered as non-invasive and reversible bruxism therapy.

Stabilization splints (SS) therapy is commonly used to prevent the consequences of SB (11), reducing the number of episodes and bursts per hour (12), as well as decreasing muscular activity and pain (13). However, little is known regarding its effects on tongue pressure or in the reduction of tongue injuries (14). To our knowledge, only a single study has found higher tongue pressure against teeth in bruxers compared to non-bruxers patients (14). In addition, the referred study (14) found that both SS and palatal splints (PS) therapy significantly reduced tongue pressure. However, possible confounding variables, such as tongue muscle hypertrophy (6) or tongue/dental arch size ratio were not evaluated.

Beyond consequences on tongue, bruxism can also reduce the sleep efficiency and patients usually present greater sleep latency and wake time after sleep onset (15). During sleep, various SB episodes are associated with micro-arousals (16), which may compromise the sleep quality (17). Likewise, the association between tooth grinding and poor sleep nights may exacerbate pain in the masticatory muscles (18). Thus, sleep disturbances may affect functional ability, decrease pain thresholds (19), impair immune function (20), and consequently contribute to associated morbidities (21). Despite of several studies on the impact of occlusal devices on SB episodes and masticatory muscles pain (refe), little is known regarding the impact of SS on sleep quality or its consequences for oral health-related quality of life (OHRQoL). Therefore, the present study investigated the effect of SS therapy on

maximum tongue pressure (MTP), tongue size (TS), dental arch size (DAS), OHRQoL, sleep quality and the orofacial pain sensitivity in bruxers.

## Methods

*Sample*

This prospective study comprised a convenience sample of bruxers seeking treatment for orofacial pain and tooth wear at Piracicaba Dental School, University of Campinas. To be included in this study, besides bruxism, subjects must present complete dentition (except third molars), age ranging from 21 to 45 years, body mass index (BMI) from 18.5 to 24.9 Kg/m², tongue indentations and/or ulcerations, and good general health. Exclusion criteria were the presence of severe periodontal disease, usage of fixed or removable prosthesis, wearing orthodontics appliance, and therapy to SB in the past 12 months.

Initially, 78 volunteers were screened for eligibility, however only 37 met the inclusion/exclusion criteria and were invited to participate. During the research development, seven participants were excluded due to missing more than three appointments, which characterizes lack of interest. The final sample comprised 30 individuals, which were divided into two groups: *(1)* bruxers who received stabilization splint (SS) therapy (experimental group; mean age = 29.0 ± 5.07; 6 men, 9 women), and *(2)* bruxers who received palatal splints (PS), as placebo (controls; mean age = 32 ± 6.70; 7 men, 8 women).

A sample size calculation based in a previous study (14), indicated that 30 participants would yield a power $\beta = 0.7$ and $\alpha = 0.05$, with a difference of 2 points between groups on MTP values. The research protocol was approved by the Ethics Committee of Piracicaba Dental School, University of Campinas (protocol #085/2015), which complies with the Helsinki Declaration. The study was also included in the Brazilian Registry of Clinical Trial database (No. RBR-2vv3gm), and linked to the International Clinical Trials Registration Platform (ICTRP/World Health Organization). Study participation was voluntary and all participants signed an informed consent form,

*Bruxism Diagnosis*

Subjects were first submitted to clinical examination for signs and symptoms of SB, as stated by the American Academy of Sleep Medicine (1). To be considered as bruxers, subjects must present tooth wear and at least one or more SB symptoms, such as morning headache, masseter muscle hypertrophy, orofacial jaw muscle fatigue and/or pain, and self-report or

report by a sleep partner of tooth grinding sounds during the night. In addition, all volunteers must present tongue indentations and/or ulcerations.

After clinical examination, bruxers were also identified by using an ambulatory electromyography and electrocardiograph device (Bruxoff®, Spes Medical, Italy), that reports the number of bruxism events per night and per hour. This device also shows the type of muscle contraction (phasic, tonic or mixed contractions) occurred during the night. It has an excellent agreement with polysomnography exam (22), being the last considered as the gold standard for bruxism diagnosis.

All individuals were instructed to place the Bruxoff® electrodes just before bed, following the manufacturer's instructions: two concentric electrodes were fixed bilaterally on the masseter muscle, and a third electrode was fixed just below the left pectoral muscle. To standardize the placement of electrodes in masseter muscles, a transparent sheet containing the facial contour of each patient was elaborated and the correct position of electrodes was demarcated. Then, the volunteer wore the Bruxoff chest belt around the torax, near to pectoralis muscle, in which the Bruxoff® device was stored overnight. To activate the device, all volunteers were asked to perform three maximum voluntary clenching, for 3 seconds, with 10 seconds of rest between each clenching. Values greater than 10% of maximum voluntary clenching, immediately preceded by a heart rate increase of 20% with respect to the mean heart rate, were considered a bruxism episode (23). Evaluations were automatically performed by the software Bruxmeter® (OT Bioelettronica, Italy) and individuals with more than 2 bruxism episodes per hour were included in this study.

After selection, all bruxers were submitted to a baseline assessment of MTP, TS, OHRQoL, sleep quality and pain sensitivity level. Subsequently, bruxers from experimental group received the SS as therapy for SB; and bruxers from control group received a PS without occlusal coverage, as a placebo. To prevent bias in relation to the splints' design, it was explained to the volunteers that both splints had been reported to be beneficial (12) and that the aim of this study was to evaluate their effects on tongue. Then, all participants were instructed to use the splints at night during sleep, and after 30 and 60 days all variables were re-assessed.

*MTP*

MTP was evaluated according to previous study (14), by using pressure sensors fixed on an intraoral device. Therefore, impressions of the lower dental arches were obtained by using irreversible hydrocolloid (Hydrogum 5, Zhermack SpA, Italy), and type III dental stone

(Asfer Indústria Química, Brazil) was used to get a cast model of each volunteer. Intraoral appliances with 1.5 mm thick were processed using autopolymerized acrylic resin (Vipi Flash Incolor, Vipi Produtos Odontológicos, Brazil) (14). Three pressure sensors (Standard FSR 400, Interlink Eletronics, USA) were fixed in the intraoral device, being two in the lingual region of the first molars and one in the lingual region of central incisors. The set was inserted in the subject's mouth and adjusted to show no interference in the maximum intercuspal position (14). Then, participants were instructed to occlude in the maximum intercuspal position and requested to press their tongue as strong as possible against the lingual surface of all teeth during 14 seconds.

Signals captured by the three sensors were amplified, recorded e analyzed through Quantum X MX840A (Hottinger Baldwin Messtechnik GmbH, Germany), and software Catman Easy (version 3.5.1; Hottinger Baldwin Messtechnik GmbH, Germany). This procedure was repeated three times, with a rest interval of 5 minutes. The MTP was considered as the highest sum of the anterior and posterior sensors, expressed in Newton (N).

*TS*

The TS was measured by ultrasound (Just Vision Toshiba ™, Japão), using a linear probe of 56 mm, in the frequency of 8 MHz. The exam was performed in a darkened room with the volunteer seated in an upright position with the Frankfort plane parallel to the ground, looking at a fixed point on the wall. All subjects were instructed to lay the tongue on the mouth floor and the transducer was placed in the submental region using ultrasound conductor gel (Ultragel, Multigel Indústria e Comércio, Brazil), avoiding excessive pressure on the tissue. TS was measured by transverse scans obtained in the midsection of the tongue in the rest position. A single calibrated operator performed the test twice, with an interval of 5 minutes. The TS at rest was represented by the mean values of the two measurements.

*DAS*

The lower DAS was evaluated as proposed by Yanagisawa et al. (6), using the cast model previously obtained for the manufacture of the intraoral device used to measure MTP. The size of the lower dental arch was calculated through the distance between the first right and left lower molars (6). With this purpose, a point located in the center of lingual surface of both molars was marked in cast model, and the distance between them was measured using a digital caliper. Since the DAS is not modified over time, it was measured only once, before splints insertion.

*Oral Health-Related Quality of Life*

The Portuguese version the Oral Health Impact Profile short-form (OHIP-14) was adopted to evaluate the OHRQoL (24, 25). This questionnaire consists of 14 items across seven domains: functional limitation; physical pain; psychological discomfort; physical disability; psychological disability; social disability; and handicap. Subjects were instructed to rate the frequency that they had experienced each OHIP item a five-point Likert-like scale. The answers "very often", "fairly often", "occasionally", "hardly ever", and "never" were punctuated from 4 to 0, respectively. The sum of all 14 items may range from 0 (very good) to 56 (very poor).

*Sleep Quality*

Sleep quality was evaluated by the Pittsburgh Sleep Quality Index (PSQI) questionnaire (26). The PSQI was used to measure the patient's sleep quality and disturbances over the prior month, and to discriminate between "good" and "poor" sleepers. It consists of 19 self-report questions regarding seven sleep components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction (26). Each of the seven components received scores from 0 to 3, and a PSQI global (total) score was obtained by summing all of the component scores. The total score ranges from 0 to 21, with scores higher than 5 indicating poorer sleep quality (26).

*Orofacial Pain Sensitivity*

Subjects were instructed to rate their pain on a visual analogue scale (VAS). The VAS consisted of a straight line with 100 mm, anchored by the words "no pain" and "worst pain imaginable." Each volunteer indicated any point between 0 (left) and 100 mm (right), according to the intensity of pain felt at the moment. Then, the researchers measured, in millimeters, the distance between the zero point and that marked by the patient, which represented the intensity of the patient's pain at the time of the evaluation.

*Splint therapy*

After baseline assessment, subjects first received general dental treatment according to their individual needs. Then, subjects from experimental group received full arch maxillary SS with palatal coverage. All SS were made on dental casts mounted on an adjustable articulator

(Bio-Art Equipamento Dental Ltda, Brazil) using a facebow at maximum intercuspal position. They were waxed with 1.5 to 2 mm thickness in the posterior and palatal area and processed with thermopolymerized acrylic resin (Clássico, Clássico Artigos Odontológicos Ltda, Brazil). After processing, all SS were fitted in the subject's mouth and adjusted to achieve a bilateral posterior occlusal contacts at intercuspal position.

PS were similarly processed, however without the occlusal coverage, being the splint limited to the cervical contour the upper teeth. The PS was retained in mouth by two clasps placed in second molars regions, without any interference in the occlusion. The same clinician provided the treatments, and all subjects received the same instructions. Once all analyzes were conducted and data collection was completed, bruxers from control group had their PS replaced by SS, as SB therapy.

*Statistical analysis*

Results were evaluated using SAS 9.3 (SAS Institute Inc., SAS Campus Drive, Cary, North Carolina, USA) with a significance level of 5%. Data were first analyzed using Shapiro-Wilk to test for normal distribution. For each group, data were compared by analysis of variance in a generalized linear mixed model with two factors, being the time treated as a repeated measure, and Tukey post-hoc test. Pearson correlation was performed to verify the presence of correlation between MTP, TS and TS/DAS ratio.

**Results**

Tongue pressure was modified after ST, since anterior and posterior MTP presented a significant reduction ($p < 0.01$) (Table 1). Similarly, independent of receiving OS or PS, all volunteers experienced a decrease in total MTP (N), as illustrated in Figure 1. However, TS did not change over time ($p = 0.46$) (Table 1) and the mean DAS was 34.36 (± 3.01), generating a ration between TS and DAS of 0.88.

**Table 1.** Maximum tongue pressure and tongue size data obtained from patients with sleep bruxism, independent of receiving stabilization or palatal splints.

| | **Baseline** | **30 days** | **60 days** |
|---|---|---|---|
| **Anterior MTP** | 5.89 (± 2.23) A | 3.61 (± 1.56) B | 3.21 (± 1.22) B |
| **Posterior MTP** | 3.42 (± 2.60) A | 2.62 (± 1.76) AB | 1.73 (± 0.58) B |
| **TS** | 30.31 (± 2.48) A | 30.14 (± 2.35) A | 29.80 (± 1.78) A |

* Data represent mean (± standard deviation). Distinct uppercase letters indicate differences before and after the therapy with occlusal or palatal splints ($p < 0.05$). MTP, Maximum tongue pressure; TS, Tongue size.

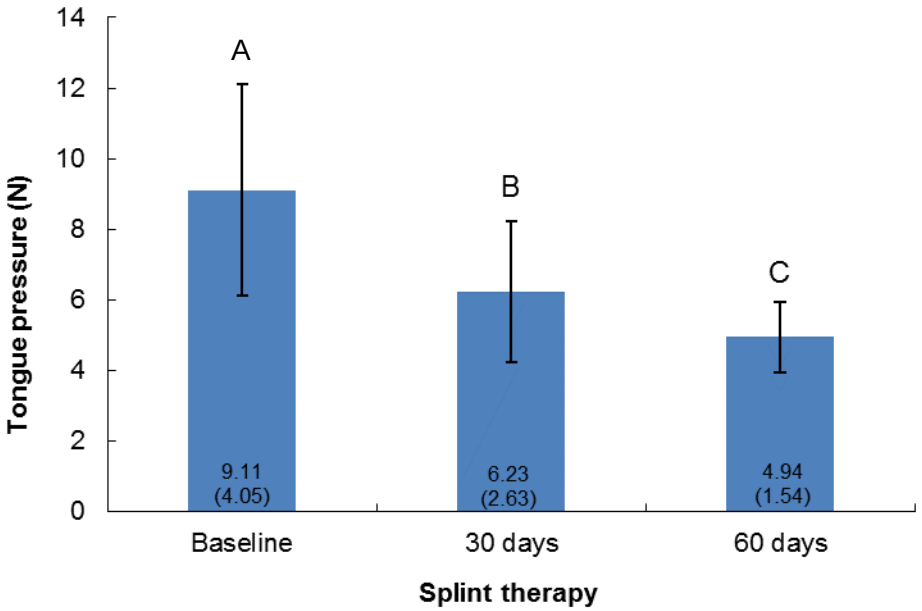


**Figure 1.** Mean values (SD) of maximum tongue pressure before and after 30 and 60 days of using splint therapy ($p < 0.0001$). Distinct uppercase letters indicate differences before and after the therapy with occlusal or palatal splints.

Furthermore, OHRQoL significantly improved after SB management, for both total score ($p < 0.0001$) and each domain ($p < 0.01$), except 'functional limitation' ($p = 0.07$). Regardless the splint design, the quality of sleep also enhanced 30 days after therapy (Table 2)

**Table 2.** Mean values (± standard deviation) of the Oral Health Impact Profile domains and Pittsburgh Sleep Quality Index obtained from experimental and control groups at baseline and after splints therapy.

| | Time | Experimental | Control |
|---|---|---|---|
| **Functional Limitation** | Baseline | 1.07 (± 1.03) Aa | 1.33 (± 1.99) Aa |
| | 30 days | 0.67 (± 1.18) Aa | 0.80 (± 1.08) Aa |
| | 60 days | 0.60 (± 1.06) Aa | 0.93 (± 1.16) Aa |
| **Physical Pain** | Baseline | 3.93 (± 1.94) Aa | 4.40 (± 1.96) Aa |
| | 30 days | 2.27 (± 1.58) Ab | 2.00 (± 1.41) Ab |
| | 60 days | 2.00 (± 1.85) Ab | 1.67 (± 1.54) Ab |
| **Psychological Discomfort** | Baseline | 4.60 (± 1.92) Aa | 4.27 (± 2.05) Aa |
| | 30 days | 2.40 (± 2.35) Ab | 2.00 (± 1.73) Ab |
| | 60 days | 2.13 (± 2.07) Ab | 1.60 (± 2.13) Ab |
| **Physical Limitation** | Baseline | 1.40 (± 1.72) Aa | 1.20 (± 1.52) Aa |
| | 30 days | 0.67 (± 1.18) Ab | 0.33 (± 0.90) Ab |
| | 60 days | 0.60 (± 1.18) Ab | 0.27 (± 0.59) Ab |
| **Psychological Limitation** | Baseline | 2.20 (± 1.42) Aa | 2.20 (± 2.57) Aa |
| | 30 days | 1.20 (b± 1.26) Ab | 1.07 (± 1.03) Ab |
| | 60 days | 1.00 (± 1.25) Ab | 0.93 (± 1.28) Ab |
| **Social Limitation** | Baseline | 1.73 (± 1.83) Aa | 1.47 (± 1.85) Aa |
| | 30 days | 0.40 (± 0.63) Ab | 0.33 (± 0.62) Ab |
| | 60 days | 0.67 (± 1.11) Ab | 0.20 (± 0.56) Ab |

| | | | |
|---|---|---|---|
| **Disability** | Baseline | 1.93 (± 1.62) Aa | 1.13 (± 1.60) Aa |
| | 30 days | 0.13 (± 0.35) Ab | 0.40 (± 1.06) Ab |
| | 60 days | 0.47 (± 0.74) Ab | 0.07 (± 0.26) Ab |
| **Total OHIP-14** | Baseline | 16.87 (± 7.22) Aa | 16.00 (± 10.72) Aa |
| | 30 days | 7.73 (± 4.95) Ab | 6.93 (± 4.56) Ab |
| | 60 days | 7.47 (± 6.37) Ab | 5.67 (± 5.96) Ab |
| **Total PSQI** | Baseline | 7.13 (± 3.87) Aa | 7.00 (± 2.56) Aa |
| | 30 days | 6.60 (± 4.34) Ab | 5.27 (± 1.91) Ab |
| | 60 days | 5.87 (± 3.23) Ab | 5.0 ± 2.62) Ab |

* Distinct uppercase letters indicate differences between groups with occlusal or palatal splints ($p < 0.05$). Distinct lowercase letters indicate differences among time points ($p < 0.05$). OHIP-14, Oral Health Impact Profile-Short form; PSQI, Pittsburgh Sleep Quality Index.

The participants with SB exhibited a significant reduction in pain levels after splint therapy ($p < 0.0001$), as demonstrated in Figure 2

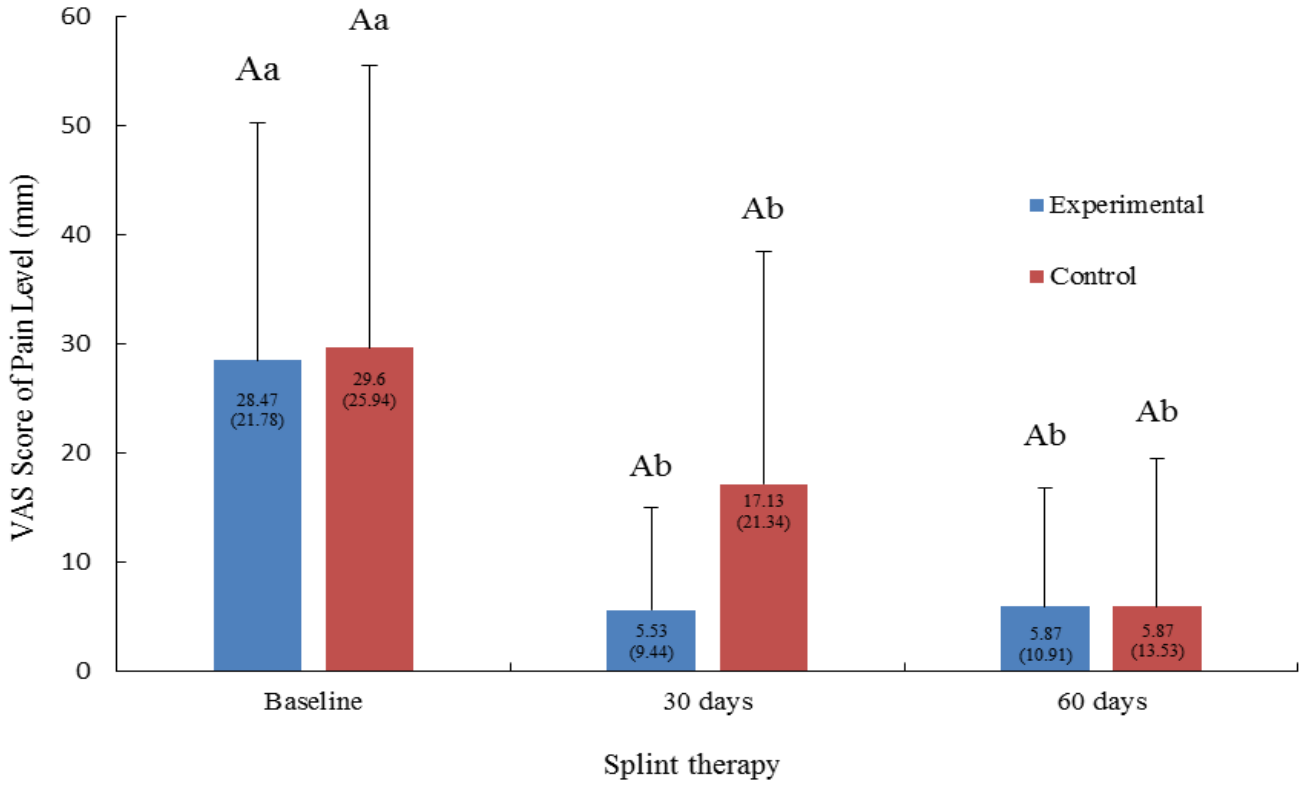

**Figure 2.** Pain levels measured by visual analog scale (mm) before and after splints therapy. Significant reduction of pain level was observed after treatment. Distinct uppercase letters indicate differences between groups with occlusal or palatal splints ($p < 0.05$). Distinct lowercase letters indicate differences among time points ($p < 0.05$).

Pearson correlation between MTP and TS found a coefficient of $r = -0.129$ with significance level of $p = 0.326$, meaning weak negative correlation. Similarly, the correlation between MTP and TS/DAS ratio found $r = -0.203$, without statistical significance ($p = 0.121$).

**Discussion**

This study aimed to access the improvement of objective and subjective variables after the therapy with occlusal splints in patients with SB. Our results demonstrated that MTP was reduced after wearing SS or PS for the management of SB. Both anterior and posterior MTP showed a significant decrease after 30 days compared to baseline, and when considering total MTP there was also a substantial decrease after the second month. This results are consistent with the only previous study evaluating these characteristics in bruxers (14), and may be explained by a reduction in tongue muscles activity due the modification in tongue position during sleep, promoted by the palatal thickness of the oral splints (12, 14).

Regarding TS, considering that it is an organ formed by skeletal muscle (28), and that ST reduces its pressure (14), it could be hypothesized that SS could also decrease the tongue muscle volume, as may occur in masseter and temporalis muscles (29). However, no differences were found on the TS, either between groups, nor between the times evaluated. Thus, it might be suggested that constant physiological activities, such as swallowing, talking and eating, stimulate and maintains a constant muscle tone.

In addition, a weak and not significant correlation was found between MTP and TS, likewise between MTP and the ratio of TS and DAS, contradicting to the only previous study (6) correlating MTP and TS. This suggests that the increased MTP in bruxers does not occur due tongue's hypertrophy or an insufficient space for the organ in dental arch. Probably, this contradictory finding may be due to different methods used to measure the tongue and dental arch sizes. While the previous study (6) had used a silicone impression of the tongue and dental arch, we accessed tongue size by ultrasound, which is a precise and non-invasive method to gauge body's muscles.

In respect to OHIP-14 data, ST led to a more positive impact on OHRQoL, as evaluated in previous studies (4). It is important to highlight that literature regarding the

improvement in OHRQoL comparing SS and PS is null, and our results may be explained by the decrease in SB episodes after the use of both splints as related in previous study (30), probably acting on pain levels reduction and, consequently, improving OHRQoL.

Concerning to sleep quality, irrespective of stabilization or palatal devices, a reduced score was obtained after ST, even though they do not achieve a sufficient score to be considered as "good sleepers", since the final mean score is higher than 5. Our results are in accordance with some studies (10, 11) relating sleep quality improvement after SB management by using occlusal devices. According to some authors (12, 30), OS or PS reduce the number of SB episodes and bursts per hour, which can possible lead to a better quality of sleep.

It has been related that subjects with SB does not necessarily suffer with myofascial pain and SB is not necessarily a treatment-demanding condition (31). However, our entire sample showed any degree of pain that significantly decreased after 30 days wearing SS and PS. This finding may be explained by the reduced masseter activities and unload over masticatory muscles and temporomandibular joint associated with the use of both splints (30), which may lead to pain relief.

It is relevant emphasize that this study selected volunteers presenting SB associated with miofascial pain at some degree. However, we did not stablish the minimum pain level for subjects' recruitment, which provided a heterogeneous sample regarding pain intensity. This could figure as a limitation of the present study, once volunteers without pain could present a better OHRQoL and sleep, and a higher tongue pressure (32). In addition, a group wearing intraoral devices without palatal coverage was not included in our experimental design. Since literature reports that palatal thickness of oral devices could alter tongue position during sleep (12), further studies are required to access palate influence on reducing MTP and, consequently, tongue injuries.

## Conclusions

Occlusal and palatal splints decreased tongue pressure against teeth in bruxers. In addition, those therapies promoted an improvement in quality of life and sleep, by reducing pain in all volunteers.

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## 3 DISCUSSÃO

O presente estudo propôs comparar a qualidade de vida relacionada à saúde bucal (QVRSB), qualidade do sono, função mastigatória e função sensorial oral (FSO) em pacientes com e sem bruxismo do sono (BS). Ainda, foi avaliada a influência da placa oclusal estabilizadora sobre a força e tamanho da língua, QVRSB, qualidade do sono e dor em pacientes bruxistas. Finalmente, um estudo de correlação foi realizado para verificar a associação entre a força e tamanho da língua, assim como com a relação língua/arcada dentária. Os resultados demonstraram que a percepção da QVRSB e da qualidade do sono dos indivíduos com BS foi mais negativa comparado a voluntários saudáveis, embora testes objetivos de função mastigatória e FSO não apresentaram diferenças entre os grupos. Além disso, a terapia com placas oclusais estabilizadoras (POE) ou palatinas (PP) proporcionou uma significativa melhora nas variáveis subjetivas supracitadas, e levou a uma redução da força de língua e dor após o seu uso noturno por trinta e sessenta dias.

Os voluntários com BS demonstraram um maior impacto negativo da QVRSB, avaliada pelo OHIP-14, apresentando uma QVRSB quatro vezes pior que os indivíduos sem o hábito. O achado contrasta com estudos realizados em crianças, onde não foram encontradas diferenças estatísticas na qualidade de vida em crianças com e sem o BS (Castelo et al., 2010; Antunes et al., 2016). Tal acontecimento pode ser explicado por diferenças metodológicas e populacionais dos estudos com crianças (Jokovic et al., 2005).

No presente estudo, houve uma redução significativa na qualidade do sono dos voluntários bruxistas, apesar de ambos os grupos relatarem apresentar um sono “ruim”. Este resultado pode ser justificado uma vez que indivíduos com BS apresentam alta sensibilidade ao estresse psicológico, como consequência ao limiar de estresse alterado, podendo apresentar episódios de insônia (Bonnet et al., 2010; Maluly et al., 2013) e micro-despertares noturnos (Lavigne et al., 2001), diminuindo a qualidade do sono nesses pacientes. Consonante a isso, os indivíduos relataram apresentar uma sonolência diurna excessiva ($p < 0,05$). Estes resultados então em acordo com os achados do estudo de Dias et al. (2015), no qual 75,6% dos bruxistas apresentavam um sono considerado “ruim”, independentemente do tipo de bruxismo (cêntrico, excêntrico ou ambos).

Diferentemente do que foi hipotetizado, o BS não apresentou comprometimento na função mastigatória. O tamanho mediano das partículas ($X_{50}$) obtidas através do teste de limiar de deglutição foram semelhantes para os dois grupos. Embora alguns estudos relatem que a dor muscular, rigidez da mandíbula e alterações oclusais mediante desgaste dentário podem afetar a capacidade de mastigação (Alves et al., 2013; Palinkas et al., 2016), Rodrigues

Garcia et al. (2005) não encontrou diferença significativa entre indivíduos com BS e saudáveis. De forma semelhante, quanto ao limiar de deglutição, não houve diferenças entre o número de ciclos necessários para triturar o material ou alimento entre os grupos, o que pode representar uma percepção sensorial semelhante entre eles.

Acompanhada do limiar de deglutição, a eficiência mastigatória não apresentou diferenças significativas entre os grupos, assim como a EO. Assim, uma vez que as edentações e/ou ulcerações geradas pelo hábito parafuncional não modificaram a função sensorial oral, a função mastigatória, consequentemente, também permaneceu inalterada (Hirano et al., 2004; Ikebe et al., 2007; Kumamoto et al., 2010). Isto pode ser justificado, uma vez que a função fisiológica da mastigação depende da integração do feedback sensorial e da resposta de neurônios motores (Meenakshi et al., 2014).

É importante ressaltar que não existem estudos investigando a EO em pacientes bruxistas. A estereognose oral envolveu a interação de pequenos pedaços de cenoura com lábios, língua e dentes (Meenakshi et al., 2014), e que uma adequada condição bucal proporciona maior capacidade de manipulação de objetos (Meenakshi et al., 2014). Em nosso estudo todos os voluntários apresentaram as mesmas características: adultos completamente dentados e sem prejuízo sensório-motor, o que pode levar a uma resposta semelhante. Deste modo, as edentações na língua e as ulcerações na sua borda lateral não parecem desempenhar um papel substancial na percepção oral, uma vez que os neuroreceptores motores, como os nervos lingual, corda tímpano e glossofaríngeo são encontrados na região dorsal da língua, a qual não é alterada.

Ainda neste estudo, após o uso de POE e PP pelos voluntários com bruxismo do sono, foi observado que a FML foi reduzida. De forma mais específica, tanto a FML anterior quanto a posterior mostraram uma redução significativa após 30 dias em relação à avaliação inicial, além de uma diminuição substancial após 60 dias considerando a FML total. Estes resultados confirmam um estudo anterior (Meirelles e Rodrigues Garcia, 2016), também avaliando a FML em pacientes com bruxismo, e pode ser explicada por uma redução na atividade dos músculos da língua devido à modificação na posição da língua durante o sono, promovida pela presença da cobertura do palato nos dispositivos intraorais (Dubé et al., 2004; Amorim et al., 2012).

Relacionado à largura da língua, não houve diferença entre os grupos ou entre os tempos avaliados. Sendo a língua um órgão formado pelo músculo estriado esquelético, e sabendo-se que a terapia com placas reduz a força da língua (Meirelles e Rodrigues Garcia, 2016), pode-se hipotetizar que a POE também poderia reduzir o volume da língua, como

ocorre nos músculos masseteres e temporais (Telkar et al., 2010). Assim, pode-se sugerir que as atividades fisiológicas cotidianas, como deglutição, fala e alimentação, estimulam e mantém uma tonicidade muscular constante da língua. Além disso, foi encontrada uma correlação fraca e não significativa entre FML e TL, bem como entre FML e a razão entre TL e DAD, se opondo ao único estudo prévio que correlacionou a FML e TL (Yanagisawa et al. 2007). Esta diferença pode ser justificada pela diferente metodologia de aferição, uma vez que no presente estudo, esta foi aferida por meio do ultrassom, um método preciso e não invasivo, enquanto na pesquisa anterior (Yanagisawa et al. 2007) foi realizada uma moldagem da língua e arco dental em silicone para realizar a correlação.

Em relação aos dados do OHIP-14, as terapias com placas promoveram um impacto positivo na QVRSB, em concordância com estudo prévio que verificou o impacto positivo da POE (Gomes et al. 2015). É importante ressaltar que não foram achados estudos na literatura comparando a QVRSB em pacientes que receberam o tratamento (POE) e placebo (PP). Este achado pode estar relacionado com a redução no número e intensidade dos episódios de bruxismo após o uso de ambas as placas (Harada et al., 2006), consequentemente reduzindo os níveis de dor, inferindo diretamente na qualidade de vida.

Embora os voluntários não tenham obtido uma pontuação suficiente para terem o sono considerado adequado (pontuação média superior a 5), os achados desta pesquisa evidenciam uma melhora subjetiva na qualidade do sono para os pacientes, independente do tipo de terapia recebida. Nossos resultados estão de acordo com alguns estudos que relataram a melhora no sono após o uso de POE (Singh et al., 2015; Solanki et al., 2017). Este resultado pode ser explicado pela redução do número e intensidade de episódios de BS por hora pela terapia com POE ou PP, o que possivelmente pode levar a uma melhor qualidade do sono (Dubé et al., 2004; Harada et al., 2006).

É importante ressaltar, que pacientes com BS não possuem obrigatoriamente dor miofascial, além do BS não ser necessariamente uma condição que exige tratamento (Manfredini et al., 2016). No entanto, toda amostra contemplada no estudo relatou dor em algum grau, e demonstrou redução na intensidade de dor após 30 dias, usando as POE e PP. Essas descobertas podem ser explicadas pela redução das atividades do masseter e, ainda, pela distribuição de cargas sobre os músculos mastigatórios e articulação temporomandibular através do uso da placa (Harada et al., 2006), levando ao alívio da dor.

Como limitação, o presente estudo não classificou os voluntários de acordo com a severidade de BS. Assim, pode-se supor que resultados diferentes poderiam ser obtidos ao avaliar voluntários com BS severo. Ainda, não houve um critério de inclusão estabelecendo

um grau mínimo de dor, o que proporcionou uma amostra heterogênea em relação à essa variável. Provavelmente, voluntários sem dor poderiam apresentar melhor QVRSB (Dao et al., 1994), qualidade do sono e força de língua. Além disso, um grupo utilizando POE sem cobertura do palato não foi incluído em nosso delineamento experimental, o que poderia explicar mais claramente a ação da placa na força máxima de língua. Deste modo, futuras investigações classificando a intensidade do BS, a presença de dor nos voluntários e avaliando a influência da cobertura do palato na redução da FML se fazem necessárias.

## 4 CONCLUSÃO

Os dados coletados no presente estudo indicam que pacientes com bruxismo do sono apresentam uma percepção mais negativa de sua qualidade de vida relacionada à saúde bucal (QVRSB) e qualidade do sono que pacientes saudáveis. Contudo, este fenômeno não interfere na função sensorial oral e na mastigação destes indivíduos. Ainda, o tratamento com dispositivos intraorais (POE e PP) levam à redução do auto relato de dor, o que reflete em melhores índices da QVRSB e na qualidade do sono, além de reduzir força da língua contra os dentes.

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**ANEXOS**

**ANEXO 1 – Certificado de aprovação do Comitê de Ética em Pesquisa da Faculdade de Odontologia de Piracicaba.**

**COMITÊ DE ÉTICA EM PESQUISA**
**FACULDADE DE ODONTOLOGIA DE PIRACICABA**
**UNIVERSIDADE ESTADUAL DE CAMPINAS**

# CERTIFICADO

O Comitê de Ética em Pesquisa da FOP-UNICAMP certifica que o projeto de pesquisa **"Força máxima e volume da língua, função sensorial oral, qualidade do sono e de vida em pacientes portadores de bruxismo"**, protocolo nº 085/2015, dos pesquisadores Renata Cunha Matheus Rodrigues Garcia e Mariana Barbosa Câmara de Souza, satisfaz as exigências do Conselho Nacional de Saúde - Ministério da Saúde para as pesquisas em seres humanos e foi aprovado por este comitê em 30/07/2015.

The Ethics Committee in Research of the Piracicaba Dental School - University of Campinas, certify that the project **"Maximum tongue pressure and volume, oral sensory functions, sleep quality and quality of life in patients with bruxism"**, register number 085/2015, of Renata Cunha Matheus Rodrigues Garcia and Mariana Barbosa Câmara de Souza, comply with the recommendations of the National Health Council - Ministry of Health of Brazil for research in human subjects and therefore was approved by this committee on Jul 30, 2015.

**Profa. Dra. Fernanda Miori Pascon**
Secretária
CEP/FOP/UNICAMP

**Prof. Dr. Jacks Jorge Junior**
Coordenador
CEP/FOP/UNICAMP

Nota: O título do protocolo aparece como fornecido pelos pesquisadores, sem qualquer edição.
Notice: The title of the project appears as provided by the authors, without editing.

**ANEXO 2 – Ficha clínica de bruxismo do sono.**

**UNIVERSIDADE ESTADUAL DE CAMPINAS**
**FACULDADE DE ODONTOLOGIA DE PIRACICABA**

**FICHA CLÍNICA DE BRUXISMO**

Nome:_____ Data:___/___/___

1) Questionário para identificar presença de bruxismo:

a. Você acorda durante pela manhã ou durante a noite apertando ou rangendo os dentes?

( ) SIM ( ) NÃO

b. Você sente fadiga ou dor nos músculos mastigatórios ao acordar?

( ) SIM ( ) NÃO

c. Você acorda pela manhã ou durante a noite com a mandíbula travada?

( ) SIM ( ) NÃO

d. Você sente desconforte nos dentes ao acordar?

( ) SIM ( ) NÃO

e. Você tem história recente de deslocamento/desadaptação de restaurações permanentes ou provisórias?

( ) SIM ( ) NÃO

f. Você tem história recente (últimos 6 meses) de barulhos associados ao ranger de dentes durante a noite, reportado por um(a) companheiro(a) de quarto?

( ) SIM ( ) NÃO

**ANEXO 3 – Escala de sono de Epworth.**

**Escala do Sono de Epworth**

**Nome:**_____ **Idade:**_____ **Sexo:** (  )M (  )F

Neste pequeno questionário você responderá 08 perguntas objetivas sobre a possibilidade de "pegar no sono" ou cochilar durante o dia. Não existem respostas certas ou erradas, você deve responder o que realmente sente. Para isto, ao lado de cada sentença que descreve alguma situação cotidiana, você deve escrever o número que corresponde a sua probabilidade de cochilar, como listado abaixo:

**0 – Nenhuma chance de cochilar**

**1 – Pequena chance de cochilar**

**2 – Moderada chance de cochilar**

**3 – Alta chance de cochilar**

**Situações cotidianas:**

1. **Sentado e lendo _____**
2. **Assistindo TV _____**
3. **Sentado em um lugar público sem atividade (sala de espera, cinema, palestra) _____**
4. **Como passageiro de um trem, carro ou ônibus, andando 1h sem parar _____**
5. **Deitado para descansar a tarde, quando as circunstâncias permitem _____**
6. **Sentado e conversando com alguém _____**
7. **Sentado calmamente após almoço sem bebida alcoólica _____**
8. **Se estiver no carro, enquanto para por alguns minutos no trânsito intenso _____**

**Obrigada por sua cooperação!!!**

**ANEXO 4 – Índice de qualidade do sono de Pittsburgh (PSQI-BR).**

## ÍNDICE DE QUALIDADE DE SONO DE PITTSBURGH (PSQI-BR)

Nome:_____ Idade:_____ Data:_____

**Instruções:**
As seguintes perguntas são relativas aos seus hábitos de sono durante o **último mês somente.** Suas respostas devem indicar a lembrança mais exata da **maioria** dos dias e noites do último mês. Por favor, responda a todas as perguntas.

**1.** Durante o último mês, quando você geralmente foi para a cama à noite? Hora usual de deitar _____

**2.** Durante o último mês, quanto tempo (em minutos) você geralmente levou para dormir à noite?

Número de minutos _____

**3.** Durante o último mês, quando você geralmente levantou de manhã? Hora usual de levantar _____

**4.** Durante o último mês, quantas horas de sono você teve por noite? (Este pode ser diferente do número de
horas que você ficou na cama). Horas de sono por noite _____

Para cada uma das questões restantes, marque **a melhor** (**uma)** resposta. Por favor, responda a todas as questões.

**5**. Durante o último mês, com que freqüência você **teve dificuldade de dormir** porque você...

**(a)** Não conseguiu adormecer em até 30 minutos

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(b)** Acordou no meio da noite ou de manhã cedo

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(c)** Precisou levantar para ir ao banheiro

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(d)** Não conseguiu respirar confortavelmente

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(e)** Tossiu ou roncou forte

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(e)** Sentiu muito frio

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(f)** Sentiu muito calor

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(g)** Teve sonhos ruins

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(h)** Teve dor

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(i)** Outra(s) razão(ões), por favor descreva

_____

Com que freqüência, durante o último mês, você teve dificuldade para dormir devido a essa razão?

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**6**. Durante o último mês, como você classificaria a qualidade do seu sono de uma maneira geral?

Muito boa ( ) Boa( ) Ruim( ) Muito ruim( )

**7.** Durante o último mês, com que freqüência você tomou medicamento (prescrito ou "por conta própria") para

lhe ajudar a dormir?

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )

1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**8.** No último mês, com que frequência você teve dificuldade de ficar acordado enquanto dirigia, comia ou
participava de uma atividade social (festa, reunião de amigos, trabalho, estudo)?

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )
1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**9**. Durante o último mês, quão problemático foi para você manter o entusiasmo (ânimo) para fazer as coisas (suas atividades habituais)?

Nenhuma dificuldade ( ) Um problema leve ( )
Um problema razoável ( ) Um grande problema ( )

**10.** Você tem um (a) parceiro [esposo(a)] ou colega de quarto?

Não ( ) Parceiro ou colega, mas em outro quarto ( ) Parceiro no mesmo quarto, mas não na mesma cama ( ) Parceiro na mesma cama ( )

**Se você tem um parceiro ou colega de quarto, pergunte a ele/ela com que freqüência, no último mês, você teve ...**

**(a)** Ronco forte

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )
1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(b)** Longas paradas na respiração enquanto dormia

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )
1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(c)** Contrações ou puxões nas pernas enquanto você dormia

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )
1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(d)** Episódios de desorientação ou confusão durante o sono

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )
1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**(e)** Outras alterações (inquietações) enquanto você dorme; por favor, descreva

_____

Nenhuma no último mês ( ) Menos de 1 vez/ semana ( )
1 ou 2 vezes/ semana ( ) 3 ou mais vezes/ semana ( )

**ANEXO 5 – Questionário Oral Health Impact Profile (OHIP-14).**

**Questionário OHIP – 14**

**Nome:**_____ **Idade:**_____ **Sexo:** ( )M ( )F

Olá, neste pequeno questionário você responderá 14 perguntas objetivas sobre o impacto da saúde bucal na sua qualidade de vida. Não existem respostas certas ou erradas, você deve responder o que realmente sente.

**Por causa de problemas com seus dentes, sua boca ou dentadura:**
(Marque com um "X" a resposta mais adequada)

| | Nunca | Raramente | Às vezes | Repetidamente | Sempre |
|---|---|---|---|---|---|
| **1. Você teve problemas para falar alguma palavra?** | | | | | |
| **2. Sentiu que o sabor dos alimentos tem piorado?** | | | | | |
| **3. Você sentiu dores na sua boca ou nos seus dentes?** | | | | | |
| **4. Você se sentiu incomodado(a) ao comer algum alimento?** | | | | | |
| **5. Você ficou preocupado(a)?** | | | | | |
| **6. Você se sentiu nervoso(a)?** | | | | | |
| **7. Sua alimentação ficou prejudicada?** | | | | | |
| **8. Você teve que parar suas refeições?** | | | | | |
| **9. Você encontrou dificuldade para descansar?** | | | | | |
| **10. Você ficou com vergonha?** | | | | | |
| **11. Você ficou aborrecido(a) com as pessoas?** | | | | | |
| **12. Você teve dificuldade para fazer suas tarefas diárias?** | | | | | |
| **13. Você sentiu que sua vida piorou?** | | | | | |
| **14. Você não conseguiu fazer suas tarefas diárias?** | | | | | |

## Anexo 7 – Protocolo de submissão de artigo ao periódico *Clinical Oral Investigation*

**De:** "Clinical Oral Investigations" <em@editorialmanager.com>
**Assunto: CLOI: CLOI-D-17-00191 - Submission Confirmation for Sleep bruxism influences quality of life and sleep without impairing mastication and oral sensory function.**
**Data:** 16 de fevereiro de 2017 15:24:50 BRST
**Para:** "Renata Cunha Matheus Rodrigues Garcia" <regarcia@fop.unicamp.br>
**Responder A:** "Clinical Oral Investigations" <samuel.membrano@springer.com>

Dear Prof. Dr. Rodrigues Garcia,

Your submission entitled "Sleep bruxism influences quality of life and sleep without impairing mastication and oral sensory function." has been received by Clinical Oral Investigations

The submission id is: CLOI-D-17-00191
Please refer to this number in any future correspondence.

You will be able to check on the progress of your paper by logging on to Editorial Manager as an author. The URL is http://cloi.edmgr.com/. Alternatively, please call us at 001-630-468-7784 (outside the US)/(630)-468-7784 (within the US) anytime from Monday to Friday.

Your manuscript will be given a reference number once an Editor has been assigned.

Thank you for submitting your work to our journal.

Kind regards,

Editorial Office
Clinical Oral Investigations