

# The Role of Yoga in Treating Stress-Related Symptoms in Dental Hygiene Students

## Abstract

**Context:** Research has provided evidence for yoga's effectiveness in the prevention and treatment of pain and stress, both of which have been implicated as significant negative moderators of student performance and experience. **Aims:** This study investigated the feasibility and preliminary impact of a 10-week yoga intervention with dental hygiene students to reduce perceptions of stress and stress-related symptoms. **Settings and Design:** Students self-selected into a yoga treatment versus control condition. They completed stress and pain measures at four time points during and after the intervention or control period of 10-weeks. **Methods:** Participants were students enrolled in a dental hygiene program. All 77 participants completed a 10-week study, self-selecting into an intervention or control group. They completed three self-report questionnaires assessing pain and stress, administered at baseline, mid-point, postintervention, and two follow-ups. The 10-week yoga intervention consisted of 10 90-min yoga sessions that provided check-ins, breathing exercises, sequences of postures, relaxation exercises, and closing meditations. **Statistical Analysis Used:** Independent samples *t*-tests were used to compare perceived stress levels of participants in the control versus treatment groups. Paired *t*-test was used to assess differences in stress-related symptom levels across time. **Results:** Results suggested that a yoga intervention is feasible for this group and that active yoga practice can lower perceived stress across multiple domains and across time. **Conclusions:** A specially adapted and designed 10-week yoga protocol appears to be an accessible option for dental hygiene programs that seek to support their students in improving overall wellbeing.

**Keywords:** Dental professionals, musculoskeletal pain, stress, yoga

## Introduction

Dental professionals experience a wide range of occupational hazards. Perhaps most common among these are stress-related illnesses, including acute and chronic pain.<sup>[1-3]</sup> Yoga has been identified as an evidence-based treatment for such illnesses in a variety of contexts. However, little research has explored the impact of yoga with a sample of dental hygienists.

### Stress and pain among dental students and professionals

Dentistry is a high-stress academic path and profession<sup>[4-7]</sup> due to long work hours, financial concerns, insufficient relaxation, inadequate family time, fear of mistakes, and chronic physical pain due to awkward positioning while working.<sup>[7-9]</sup> These stressors lead to mental health outcomes such anxiety, depression, sleep difficulties, burnout, and suicidality.<sup>[10-15]</sup> Physical health impacts

include postural disturbances, pain, and breathing insufficiencies.<sup>[7,16,17]</sup> It is well documented that chronic stress leads to poor health outcomes<sup>[18,19]</sup> and that efficient, easy-to-access coping techniques are crucial to ameliorate negative psychological and physical effects of prolonged stress.<sup>[7,20]</sup> Professional stressors are already experienced by dental students during training<sup>[21-25]</sup> and predisposes them to psychological problems, including exhaustion, burnout, and anxiety.<sup>[26-28]</sup> These, in turn, may negatively affect academic and clinical performance.<sup>[21,29]</sup> In addition, research also identified nonacademic stressors that affect dental students' lives,<sup>[30,31]</sup> including socioeconomics, age, gender, social support, distractions, time constraints, and insufficient coping.

### Mindfulness and yoga for work-related stress symptoms

Mindfulness<sup>[32]</sup> and meditation<sup>[33-39]</sup> have been shown to promote health among

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working professionals via overall reduction of distress, rumination, and negative affect, as well as enhancement of physical health and vitality. Positive impacts of yoga on physical health are equally well documented.<sup>[40-45]</sup> Yoga can provide measurable health benefits for healthy individuals as well as for those who already suffer.<sup>[46]</sup> Yoga is particularly effective in treating musculoskeletal pain,<sup>[47-49]</sup> back pain,<sup>[50,51]</sup> and chronic pain,<sup>[52]</sup> mediated by yoga's positive impact on strength, flexibility, balance, and range of motion.<sup>[52,53]</sup> Yogic breathing is an effective way to increase pain control and tolerance,<sup>[52]</sup> contributing to yoga's effective in reducing somatic symptoms.<sup>[54-56]</sup>

Somatic symptoms are closely correlated with psychological distress, another place where yoga intervention is useful.<sup>[45,57-61]</sup> Yoga addresses mind and body responses to stress, calming the nervous system, refining and clarifying consciousness, and easing tension.<sup>[62]</sup> Regular yoga practice (from postures to mindfulness to meditation) improves perceptions of stress, back pain, psychological wellbeing, and productivity in workplace settings.<sup>[63-69]</sup> Specific to dental professionals, among a sample of dentists, 34.5% of whom reported pain, yoga was more effective than other methods of physical activity in ameliorating pain. For example, 89% of dentists who practiced yoga were free of pain, compared to 78% using other methods of exercise.<sup>[56]</sup> Relatedly, yoga is a popular stress management modality for college students<sup>[70,71]</sup> with positive effects on mind and body.<sup>[40,72-74]</sup> Comparing yoga to meditation and body scanning, college students improved in rumination, self-compassion, and psychological wellbeing with all modalities, but yoga produced larger improvements.<sup>[75,76]</sup>

### Purpose of the study

The largest challenge in feasibility of yoga with college student populations is ease of access. Many barriers hinder access to this useful practice,<sup>[77,78]</sup> including income,<sup>[79]</sup> lack of recreational facilities,<sup>[80]</sup> minimal time for relaxation,<sup>[81]</sup> lack of social activity,<sup>[82]</sup> and long work hours.<sup>[83]</sup> These factors have been shown to prevent dental hygiene students from engaging in self-care.<sup>[84]</sup>

Given the many reported barriers to access and despite evidence for yoga's therapeutic effects,<sup>[46,85]</sup> further examination of yoga's clinical feasibility and relevance for work-related injury and stress is indicated for dental professionals. The current study examines feasibility and preliminary impact of regular yoga practice in dental hygiene programs. A self-selected case-control design was utilized to evaluate feasibility and preliminary treatment effects.

## Methods

### Participants

Participants were students at dental schools in California and Oregon, recruited by dental hygiene faculty.

Sample size comprised 98 participants; data from 77 were analyzable. The sample was predominately female (90.9%) versus male (9.1%). Participants identified as Caucasian (48.1%), Asian-American (20.8%), Hispanic (16.9%), Pacific Islander (5.2%), Mixed (5.2%), and African-American (2.6%). Ages ranged from 19 to 46 years ( $M = 25.64$ ). Eleven participants reported a regular yoga practice; 66 reported no yoga practice.

### Instrumentation

A demographics questionnaire inquired about education level, yoga practice, employment status, marital status, race, ethnicity, age, mental and physical illnesses, and gender. Several self-report questionnaires were also completed:

#### *Perceived Stress Scale*<sup>[86]</sup>

The original Perceived Stress Scale (PSS) was a 14-item self-report measure assessing degree to which situations are appraised as stressful. Items are scored on a 5-point Likert scale, ranging from 0 (never) to 4 (very often). Total scores are obtained by summing (after reverse-scoring negatively-phrased) item ratings. Test-retest and internal consistency are adequate. A 10-item PSS version (used in this study) was developed via factor analysis with comparable psychometrics.<sup>[87]</sup> A normative total score is 15.5 (standard deviation [SD] = 7.4) for men and 16.1 (SD = 7.6) for women.<sup>[88]</sup>

#### *Psychological and Physical Stress Indicator*<sup>[73]</sup>

The Psychological and Physical Stress Indicator (PPSI) measures 26 stress-related psychological and physical symptoms. Participants indicate how often they experienced each symptom over a defined time period, choosing a percentage from 0% to 100%. An overall stress symptom score is obtained by averaging all responses. Four symptom cluster are calculated by averaging responses across content-related items: Physical (eight items), Emotional (10 items), Substance Use (three items), and Behavioral (five items).

### Procedures

Upon IRB approval, recruitment began. Volunteers completed the informed consent form and self-selected into the yoga versus control condition. Three groups of dental hygiene students self-selected to participate in yoga treatment, two in Oregon in Spring 2017 ( $n = 11$ ) and Fall 2018 ( $n = 9$ ), and one in California in Spring 2017 ( $n = 12$ ). Control groups for each trial had 27, 26, and 12 participants. All participants completed all measures at baseline, midpoint, posttest, and follow-up. Administration happened via Qualtrix, using personal computing devices, during course time in their dental hygiene programs.

Once baseline data had been collected, intervention began, meeting weekly for 10 weeks at a clinic conveniently to dental hygiene classrooms. Rooms were stocked with

supportive yoga props, including mats, blocks, straps, foam rollers, headstand supports, wedges, therabands, eye pillows, and blankets. During implementation, rooms were kept private with “Do Not Disturb” signs and white noise machines.

### Yoga intervention description

The study adapted an original protocol<sup>[73]</sup> to the physical needs of dental hygiene students. The original and adapted protocols comprised ten 90-min sessions shown to be feasible and effective in addressing stress and stress-related pain among college students and faculty. All sessions focus on mindful-based practice and have a similar format to promote cognitive and physiologically-mediated learning: (a) yoga psychology (e.g., layers of self, emotional reactivity, mind states, habit), (b) breathing (e.g., diaphragmatic, alternate nostril), (c) postures (warm up, main poses, peak pose, cooldown), (d) relaxation, and (e) meditation. Sessions increase in difficulty across time progresses, building upon previous material. For this study, at the beginning of class, participants had opportunity to check in and connect with one another. Participants then engaged with yoga psychology and its applications to stress-based symptoms. Didactic presentations were adapted to address specific needs of dental hygiene student (e.g., how to integrate into the busy schedules of a dental student, use of academic planners when distracted, value of cultivating sympathetic joy for others). Following the didactics, participants were guided through breathing and posture practices, involving carefully sequenced postures. Modifications for dental hygiene student included providing additional props and multiple variations to ameliorate wrist, hand, neck, shoulder, back, hips, or experienced chronic pain. For example, downward dog was taught with options of using a wedge, chair, wall, bent knees, and more. Yoga teachers provided one-on-one attention and guidance. Posture practice ended with relaxation and guided meditation. After each session, participants assisted with tidying the yoga space and could approach teachers with questions or concerns. Table 1 shows an overview of the generic outline of each session.

Yoga classes were taught by certified yoga teachers with extensive teaching experience who had been trained to the protocol and its adaptations. They were supported by assistant teachers, all of whom had significant yoga teacher training. All yoga instructors were trained via a rigorous process to implement the original and adapted yoga protocols. As this study required adaptations specifically focused on dental hygiene students, training included commensurate changes to the original protocol. For example, trainees developed and learned about modifications to reduce strain on vulnerable areas, such as wrists, shoulders, and neck.

## Results

### Feasibility

Engagement in yoga practice was demonstrated via strong adherence: dropout rate of 0% and average attendance of 95.15%. Mean number of sessions attended at the Oregon site was 9.52 (range: 7–10). At the California site, 100% of participants attended all sessions.

### Impact: Baseline comparison

Participants self-selected into intervention and control groups, potentially introducing lack of baseline equivalence. Table 2 shows PSS perceived stress did not differ between yoga and control conditions ( $t(75) = -2.25, P = 0.44$ ). It also shows that individuals in the yoga intervention endorsed higher stress-related symptom levels than those in the control group ( $t(75) = -2.79, P = 0.007$ ). This finding suggests results of stress-related symptom measures be interpreted with caution as control and intervention groups did not endorse comparable symptom levels at baseline.

### Impact: Preliminary findings

Table 3 shows within-group comparisons of PSS and PPSI results at baseline, midpoint, posttest, and follow-up. No significant differences were observed in either yoga or control conditions on PSS perceived stress scores. For the control group no significant changes in PPSI scores were noted across time on any scales. PPSI scores for the yoga condition indicated a significant decrease in total stress symptoms from baseline to midpoint ( $t = 3.77, P = 0.001$ ), and baseline to posttest ( $t = 5.71, P < 0.001$ ). PPSI physical subscale scores indicated significant decreases in physical stress symptoms from baseline to posttest ( $t = 3.225, P = 0.006$ ). PPSI emotional subscale scores indicated significant decreases in emotional stress from baseline to midpoint ( $t = 4.254, P < 0.001$ ), baseline to posttest ( $t = 6.534, P < 0.001$ ), and baseline to follow-up ( $t = -1.271, P = 0.233$ ). PPSI behavioral subscale scores indicated significant decreases in behavioral stress from baseline to midpoint ( $t = 2.946, P = 0.007$ ), and baseline to posttest ( $t = 4.046, P = 0.001$ ). No significant differences were observed among yoga participants on PPSI substance-use related subscale. In reviewing results, it must be noted that posttest data were mistakenly not collected for one subgroup, reducing sample size.

## Discussion

This study investigated feasibility and preliminary impact of a 10-week yoga intervention with dental hygiene students to reduce perceptions of stress and stress-related symptoms. Results suggested yoga is feasible and successful as a stress-related symptom management practice, especially among individuals who present with significant symptoms of stress-related illness at enrolment. Participants in the yoga intervention showed significant improvement on emotional,

**Table 1: Overview of the generic outline of each session**

Session module	Purpose	Brief summary or examples by session <sup>#1-10</sup>
Check-In ~5-10 min	Giving students a chance to share their life with one another Allowing students to bring in real life experience Helping students learn to apply yoga principles in daily life - off the mat Building group cohesion and mutual support Engaging students on a more personal level	S1: Identify student stressors S2: Explore how students balance multiple roles S3: Check in about how students incorporated yoga principles in daily life S4: Explore how yoga principles can be used to manage work stress on site S5: Identify ways to bring yoga principles into family relationships S6: Explore habitual response to student stressors S7: Explore how yoga principles can be applied to work with patients S8: Check in about changes to mindful awareness S9: Identify valuable life connections S10: Closing thoughts and remarks
Didactic presentation ~10 min	Present the theme for the class, outlining it in terms of yoga psychology and modern neuroscience Explain how today's theme applies to dental professions in particular Themes: Koshas, 8 limbs of yoga Principles learning off the mat and during dental work Specific benefits of certain movements for the unique context of dental students	S1: Koshas S2: Yamas S3: Niyamas S4: Gunas S5: Kleshas S6: Vrittis S7: Fives states of mind S8: Karma S9: Brahma viharas S10: Eight limbs of yoga
Pranayama	Breath as the link between body, mind, wisdom, and spirit Breathe to bring awareness Find present centeredness in the breath Breathe mindfully and introspectively as a way of recognizing sensation and calming physiological and mental reactions	S1: Diaphragmatic breath S2: Ujjayi breath S3: Sama vritti pranayama S4: Nadi shodhana S5: Sama vritti rechaka kumbhaka S6: Viloma II S7: Dirga pranayama S8: Nadi shodhana S9: Sama vritti with antara kumbhaka S10: Kapalabhati
Asana sequence: Class 1	Asanas focused on physical needs of dental professionals and student populations Physical and mental engagement in asana Postures accessible off-the-mat and to can be used in dental student context Grounding and expansion in postures Discussing the specific benefits of certain movements for dental student context Promoting emotional regulation through asana Using modifications for postures that inherently may strain the risk areas for dental student population	Warm-up sequence Wrists (i.e., wrist rolls, wrist stretches) Hands (i.e., press-through hands, open-to-fist movements) Fingers (i.e., gentle self-massages, press fingers together) Neck (i.e., ear-to-shoulder, chin-to-shoulder movements) Shoulders (i.e., shoulder rolls, shoulder shrugs) Main theme/peak pose Tadasana Urdhva hastasana Uttanasana Utkatasana

*Contd...*

Table 3: Contd...

Session module	Purpose	Brief summary or examples by session#
		Virabhadrasana II Utthita Trikonasana Adho mukha svanasana Cool-down Side Balasana Utkatasana Side Balasana Bharadvajasana Ardha jathara parivartanasana Supta matsyendrasana variation Viparita Karani Closure Savasana
Posture cuing focus	Providing adaptations to relieve pressure on hands, wrist, shoulders, neck, and back Encouraging proper alignment and muscle engagement during seated postures Giving additional reminders for participants to engage in proprioception during posture practice Promoting mindful movement to encourage compassionate, safe posture practice	Giving additional verbal cuing to support proper alignment, especially if challenges were noted and for high risk body regions E.g., Relax the shoulders E.g., Breathe into back tension E.g., Release the jaws E.g., Strengthen core muscles Regularly used cues focused on awareness to body sensations E.g., bring Awareness to the shoulders E.g., Explore what is happening in the wrists E.g., Note how the low back is responding E.g., Direct caring attention to the hands E.g., Notice sensations in the neck
Meditation	Encouraging proper relaxation Focusing the mind to remember mindfulness in day-to-day life Integrating experience Body scanning to promote body awareness Promoting interoception Withdrawing the senses	Body scan Guided imagery Stillness Open-heart integration

~ about 5-10 minutes

Table 2: Results of independent samples t-test and descriptive statistics for Perceived Stress Scale and Psychological and Physical Stress Indicator total score

	Group				99.9% CI for mean difference	t	Df	P
	Yoga		Control					
	Mean (SD)	n	Mean (SD)	n				
PSS	18.75 (4.02)	32	16.49 (4.57)	45	-6.4-1.87	-2.25	75	0.440
PPSI	27.77 (12.23)	32	18.97 (14.59)	45	-19.62-2.02	-2.79	75	0.007

SD=Standard deviation, CI=Confidence interval, PSS=Perceived Stress Scale, PPSI=Psychological and Physical Stress Indicator

behavioral, and physical stress-related symptom levels whereas control group participants showed no changes.

### Feasibility

Recruitment and adherence data present yoga as a feasible practice for dental hygiene students. Students with higher

levels of stress-related symptoms self-selected into the yoga intervention group, indicating they believed yoga to be of potential benefit and that the demands of participation were not too high to make this commitment. The yoga intervention was implemented free of charge on campus following academic classes, improving accessibility.



**Table 3: Within-groups comparisons of Perceived Stress Scale and Psychological and Physical Stress Indicator across time**

Measure/subscale	Condition	Within-group comparison	Mean (SD)				n	t	p
			Time 1		Time 2				
PSS	Yoga	Baseline - Midpoint	18.63	4.27	17.26	4.09	27	1.537	0.136
		Baseline - Posttest	17.80	4.83	15.93	4.20	15	1.235	0.237
		Baseline - Follow-up	18.52	3.99	17.13	3.71	23	1.441	0.164
		Posttest - Follow-up	16.36	4.67	16.82	4.45	11	-0.602	0.561
	Control	Baseline - Midpoint	16.41	4.66	17.15	4.37	39	-1.106	0.276
		Baseline - Posttest	15.75	3.90	16.42	4.52	24	-0.725	0.476
		Baseline - Follow-up	16.49	4.76	17.00	4.48	37	-0.747	0.460
		Posttest - Follow-up	16.53	4.59	15.84	3.55	19	0.715	0.486
PPSI total	Yoga	Baseline - Midpoint	26.05	10.79	18.77	11.92	27	3.77	0.001
		Baseline - Posttest	26.95	10.63	14.03	10.82	15	5.71	<0.001
		Baseline - Follow-up	25.53	13.48	21.13	16.03	23	1.88	0.074
		Posttest - Follow-up	15.10	12.36	16.26	15.11	11	-0.56	0.587
	Control	Baseline - Midpoint	18.11	14.07	18.00	14.73	39	0.077	0.939
		Baseline - Posttest	14.44	12.00	13.19	13.89	24	0.399	0.694
		Baseline - Follow-up	18.83	15.85	17.79	16.35	37	0.860	0.396
		Posttest - Follow-up	13.26	14.29	11.82	15.60	19	1.035	0.314
PPSI physical	Yoga	Baseline - Midpoint	20.76	9.91	16.81	12.81	27	1.798	0.084
		Baseline - Posttest	21.08	10.61	13.42	14.19	15	3.225	0.006
		Baseline - Follow-up	19.48	9.18	19.65	14.83	23	-0.075	0.941
		Posttest - Follow-up	14.43	14.98	15.23	15.45	11	-0.295	0.774
	Control	Baseline - Midpoint	16.60	12.58	16.25	13.49	39	0.213	0.832
		Baseline - Posttest	13.01	12.12	12.71	13.04	24	0.184	0.856
		Baseline - Follow-up	17.53	14.11	17.40	16.28	37	0.099	0.921
		Posttest - Follow-up	12.37	13.47	12.04	13.98	19	0.251	0.805
PPSI emotional	Yoga	Baseline - Midpoint	36.44	17.21	25.50	17.63	27	4.254	<0.001
		Baseline - Posttest	35.87	16.13	18.27	13.62	15	6.534	<0.001
		Baseline - Follow-up	36.65	21.64	28.32	21.35	23	2.422	0.024
		Posttest - Follow-up	19.55	15.67	23.18	22.22	11	-1.271	0.233
	Control	Baseline - Midpoint	25.36	21.36	25.95	21.52	39	-0.238	0.813
		Baseline - Posttest	19.97	17.13	20.21	20.81	24	-0.112	0.912
		Baseline - Follow-up	26.14	23.14	23.49	22.67	37	1.354	0.184
		Posttest - Follow-up	19.53	21.14	16.32	22.26	19	1.385	0.183
PPSI substance-use	Yoga	Baseline - Midpoint	7.90	8.53	5.93	5.57	27	1.334	0.194
		Baseline - Posttest	11.11	9.73	7.11	5.76	15	2.103	0.054
		Baseline - Follow-up	10.14	14.37	6.81	8.90	23	1.725	0.099
		Posttest - Follow-up	7.27	6.11	4.24	6.51	11	1.456	0.176
	Control	Baseline - Midpoint	6.15	8.64	4.70	8.97	39	1.486	0.146
		Baseline - Posttest	6.81	8.26	5.22	7.02	23	1.270	0.217
		Baseline - Follow-up	7.66	12.57	5.50	11.90	37	1.743	0.090
		Posttest - Follow-up	3.33	4.58	2.28	2.34	19	1.555	0.137
PPSI behavioral	Yoga	Baseline - Midpoint	24.59	13.93	16.37	12.66	27	2.946	0.007
		Baseline - Posttest	28.00	14.48	10.67	9.96	15	4.046	0.001
		Baseline - Follow-up	22.17	14.99	17.65	18.94	23	1.369	0.185
		Posttest - Follow-up	12.00	11.03	11.27	13.33	11	0.369	0.719
	Control	Baseline - Midpoint	13.23	15.62	12.83	13.24	39	0.225	0.823
		Baseline - Posttest	9.65	10.53	8.52	11.29	23	0.874	0.392
		Baseline - Follow-up	13.03	16.55	14.58	18.24	37	-1.074	0.290
		Posttest - Follow-up	8.11	11.40	8.21	15.58	19	-0.076	0.940

PSS=Perceived Stress Scale, PPSI=Psychological and Physical Stress Indicator, SD=Standard deviation

Adherence data demonstrated excellent retention, with 100% of participants staying enrolled throughout the study. Engagement was high, with intervention participants presenting for 9.5 of 10 session; no participant missed more than three classes. These findings are important given dental students' significant stress while dealing with a heavy clinical and academic workload.<sup>[89]</sup> Offering students a feasible, efficacious intervention that can help them manage stress-related symptoms has the potential to enhance quality of education and experience of the academic journey.

Feasibility data suggest integrating yoga into a college setting provides dental hygiene students with such ready access to stress-management skills that they remain engaged despite time investment. The fact that 100% of participants were retained and average attendance was excellent compares well to other feasibility data.<sup>[77,78,90,91]</sup> Integrating yoga on campus likely removed barriers to yoga related to transportation, location, time, cost, and comradery.<sup>[77]</sup>

#### **Impact: Perceived stress**

Participants' quantitative data demonstrated significant levels of perceived stress throughout the study. This finding is consistent with a large body of literature indicating students in dental hygiene programs experience higher levels of perceived stress and related cognitive, physical, and emotional symptoms.<sup>[84,92]</sup> Data also revealed significant decreases in stress-related symptoms with regular yoga practice. This reduction in symptoms is particularly noteworthy as levels of perceived stress were not reduced during this time. In other words, participants reduced symptomatology without reducing their perception of stress exposure. Results indicated a positive symptom-reduction effect in behavioral, emotional, and physical realms of functioning. These findings are consistent with research demonstrating yoga positively affects individuals across multiple domains of wellness.<sup>[93]</sup> The lack of significant reduction of substance-use-related stress is likely due to low levels at baseline among this sample.

#### **Impact: Behavioral stress symptom reduction**

PPSI behavioral stress symptoms include disordered eating, crying spells, angry outbursts, and social withdrawal. A significant decrease in behavioral stress symptom was revealed. As behavioral stress has a significant interpersonal component, the fact that each intervention group developed a unique and supportive community during yoga classes likely contributed to these positive findings. The yoga class structure provided space for students to connect in an environment not focused on academics, which in and of itself may have contributed to reduction in stress-related symptoms (though perceived stress levels did not change across the study period). The development of social relationships was frequently commented on by yoga

participants and appears likely to have assisted students in reducing behavioral stress symptoms. Across the 10 weeks, yoga participants become increasingly connected to one another, offering mutual support and advice to distressed peers. The yoga protocol was designed for working with participants in a group setting and highlights the importance of the growth and support that occurs while in community. The protocol includes philosophy about the eight limbs of yoga, which encourages positive interactions with others. For example, the second class theme is yoga's ethical principles, promoting right action towards others. Further, at the beginning of each class, participants were invited to find comradery by sharing experiences from their academic program and lives. Participants were also encouraged to practice yoga together before their clinic rotations.

#### **Impact: Emotional stress symptom reduction**

PPSI emotional stress symptoms include anxiety, depression, sadness, anger, and cognitive difficulties. Data revealing a reduction in emotional stress-related levels following yoga intervention suggest that yoga may be a valuable practice for students who find it difficult to balance emotional and academic pressures. Students' emotional health has been reported to be more of a limiting factor than physical health despite the fact that students report significant physical symptoms.<sup>[94]</sup> Emotional stress was addressed in this intervention through social connections (addressed above). It was also directly approached by the psychological components of the intervention. Significant class time was dedicated to recognizing internal states of wellbeing, identifying habitual thinking, and noticing emotional reactivity. Problem-solving about how to deal with such habits and reactions, transforming them into deliberate choices and responses instead, was integrated throughout the breathing, posture, and introspection practices (including guided meditations). For example, during Session Six, yogic theories of habits and obstacles were discussed and cued. For example, during breathing practices involving a slight retention of the breath at the top and bottom of each inhalation and exhalation, exploration of habitual responding and emotional reactivity was explored. During posture practice, participants were invited to notice habitual execution of the posture and then empowered to change something (e.g., switch sides in a different way in lunge posture). This encouraged participants to broaden awareness of intention and promoted generalizable mindfulness. Contexts for application of this increased emotional awareness and subsequent behavioral choice included work, academic, and relationship settings, among others.

#### **Impact: Physical stress symptom reduction**

PPSI physical stress symptoms include body pains, heart palpitations, high blood pressure, and gastric upset. The ameliorative effects of active yoga practice on physical stress symptoms demonstrated in this study are likely

not only to reduce physical health issues in the present, but also to prevent development of problems during later dental careers. Physical symptom amelioration is hypothesized to be mediated by the yoga protocol's heavy focus on interoception and proprioception, helping students become increasingly aware of internal body states. Once internal states were noted, yoga participants were encouraged to explore how bodily responses could change through modifications and perceptions. Also integrated into the protocol were deliberate posture (e.g., a 5-min set of forearm and wrist stretches), breathing (e.g., diaphragmatic), and mindfulness (e.g., awareness of proper alignment and proprioception) for use while engaging in dental work. Application of these practices during clinical practice was discussed and students were empowered to use internal cues to help them determine when and how to relieve physical stress during their workday.

### Limitations

This study utilized a quasi-experimental design in which participants self-selected into intervention versus control groups. Although this approach provided important feasibility data, it limited the generalizability of efficacy data in that preintervention levels of stress-related symptoms were confounded with yoga participation. Participants developed unique identifiers to link survey responses across time. These unique identifiers were not always kept consistent, resulting in lost data. Additionally, posttest measures (immediately upon protocol completion) were missed after the first intervention in Oregon, resulting in further lost data for baseline-posttest comparisons. More data points may have rendered additional comparisons significant.

### Future Directions and Conclusions

This study demonstrated the feasibility of implementing a yoga protocol into curricula for dental hygiene students. Generalizability is limited by self-selection and loss of some outcome data. Future researchers might explore whether random assignment to yoga conditions garners similar results. Studies focusing on recruiting male participants may reveal important gender differences in yoga impacts for this population. Longitudinal studies exploring effects of long-term yoga practice on development of symptoms later in dental careers might provide suggestions for dental hygienists regarding maintaining an active yoga practice throughout their careers.

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### Conflicts of interest

There are no conflicts of interest.

## References

1. Rambabu T, Suneetha K. Prevalence of work related musculoskeletal disorders among physicians, surgeons and dentists: A comparative study. *Ann Med Health Sci Res* 2014;4:578-82.
2. Shams-Hosseini NS, Vahdati T, Mohammadzadeh Z, Yeganeh A, Davoodi S. Prevalence of musculoskeletal disorders among dentists in Iran: A systematic review. *Mater Sociomed* 2017;29:257-62.
3. Widanarko B, Legg S, Devereux J, Stevenson M. The combined effect of physical, psychosocial/organisational and/or environmental risk factors on the presence of work-related musculoskeletal symptoms and its consequences. *Appl Ergon* 2014;45:1610-21.
4. Ng A, Hayes MJ, Polster A. Musculoskeletal disorders and working posture among dental and oral health students. *Healthcare (Basel)* 2016;4:1-15.
5. Ayers KM, Thomson WM, Rich AM, Newton JT. Gender differences in dentists' working practices and job satisfaction. *J Dent* 2008;36:343-50.
6. Calvo JM, Kwatra J, Yansane A, Tokede O, Gorter RC, Kalendarian E. Burnout and work engagement among US dentists. *J Patient Saf* 2017:1-8.
7. Miron C, Colosi HA. Work stress, health behaviours and coping strategies of dentists from Cluj-Napoca, Romania. *Int Dent J* 2018;68:152-61.
8. Toon M, Collin V, Whitehead P, Reynolds L. An analysis of stress and burnout in UK general dental practitioners: Subdimensions and causes. *Br Dent J* 2019;226:125-30.
9. Uziel N, Meyerson J, Birenzweig Y, Eli I. Professional burnout and work stress among Israeli dental assistants. *Psychol Health Med* 2019;24:59-67.
10. Aulak DS, Quinn B, Wilson N. Student burnout. *Br Dent J* 2016;220:219-20.
11. Kawada T. Sleep, depression, and burnout in medical students: Risk assessment. *Acad Psychiatry* 2017;41:682-3.
12. Perez-Padron M, Bernabé E, Gomez-Santos G, Tsakos G, Lozano de Luaces V. Healthy mind and body in a healthy work environment. *Int Dent J* 2010;60:395-8.
13. Pau AK, Croucher R. Emotional intelligence and perceived stress in dental undergraduates. *J Dent Educ* 2003;67:1023-8.
14. Rada RE, Johnson-Leong C. Stress, burnout, anxiety and depression among dentists. *J Am Dent Assoc* 2004;135:788-94.
15. Sancho FM, Ruiz CN. Risk of suicide amongst dentists: Myth or reality? *Int Dent J* 2010;60:411-8.
16. Alghadir A, Zafar H, Iqbal ZA. Work-related musculoskeletal disorders among dental professionals in Saudi Arabia. *J Phys Ther Sci* 2015;27:1107-12.
17. Chismark A, Asher G, Stein M, Tavoc T, Curran A. Use of complementary and alternative medicine for work-related pain correlates with career satisfaction among dental hygienists. *J Dent Hyg* 2011;85:273-84.
18. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. *JAMA* 2007;298:1685-7.
19. Ylipää V, Szuster F, Spencer J, Preber H, Benko SS, Arnetz BB. Health, mental well-being, and musculoskeletal disorders: A comparison between Swedish and Australian dental hygienist. *J Dent Hyg* 2002;76:47-58.
20. Bretherton R, Chapman HR, Chipchase S. A study to explore specific stressors and coping strategies in primary dental care practice. *Br Dent J* 2016;220:471-8.
21. Anjum S, Monica M, Rao Y, Reddy P, Abbas I, Priya S.



- Emotional intelligence: The less explored influential factor on the academic performance of a dental student. *Int Dent J Student Res* 2017;5:42-5.
22. Heo N, Lee Y. Study about the relation between clinical practice stress, satisfaction and self-concept of dental hygiene department student. *J Korean Soc Dent Hyg* 2018;18:399-410.
  23. Kodumuri P, Thomas C, Singh AP, Rathod S. Evaluation of perceived stress levels and its source among dental students: A cross-sectional study. *J Evol Med Dent Sci* 2016;5:3425-8.
  24. Mascarenhas F, Townsend J, Caballero P, Yu Q, Fidel PL Jr. Student and faculty perspectives of a faculty-student mentoring programme in a dental school. *Eur J Dent Educ* 2019;23:184-9.
  25. Park S, Jang G, Seo E. Self-efficacy, self-image, and image as a dental hygienist of the dental hygiene student. *J Korean Soc Dent Hyg* 2015;15:1043-51.
  26. Deeb GR, Braun S, Carrico C, Kinser P, Laskin D, Golob Deeb J. Burnout, depression and suicidal ideation in dental and dental hygiene students. *Eur J Dent Educ* 2018;22:e70-e74.
  27. Farrelly C, Sun J, Mack F. Impact of stress on depression and anxiety in dental students and professionals. *Int Public Health J* 2013;5:485-98.
  28. Schmitter M, Liedl M, Beck J, Rammelsberg P. Chronic stress in medical and dental education. *Med Teach* 2008;30:97-9.
  29. Frese C, Wolff D, Saure D, Staehle HJ, Schulte A. Psychosocial impact, perceived stress and learning effect in undergraduate dental students during transition from pre-clinical to clinical education. *Eur J Dent Educ* 2018;22:555-63.
  30. Divaris K, Mafla AC, Villa-Torres L, Sánchez-Molina M, Gallego-Gómez CL, Vélez-Jaramillo LF, *et al.* Psychological distress and its correlates among dental students: A survey of 17 Colombian dental schools. *BMC Med Educ* 2013;13:91.
  31. Harris M, Wilson JC, Holmes S, Radford DR. Perceived stress and well-being among dental hygiene and dental therapy students. *Br Dent J* 2017;222:101-6.
  32. Martín-Asuero A, García-Banda G. The Mindfulness-based Stress Reduction program (MBSR) reduces stress-related psychological distress in healthcare professionals. *Span J Psychol* 2010;13:897-905.
  33. Banth S, Ardebil MD. Effectiveness of mindfulness meditation on pain and quality of life of patients with chronic low back pain. *Int J Yoga* 2015;8:128-33.
  34. Epel E, Daubenmier J, Moskowitz JT, Folkman S, Blackburn E. Can meditation slow rate of cellular aging? Cognitive stress, mindfulness, and telomeres. *Ann N Y Acad Sci* 2009;1172:34-53.
  35. Manocha R, Black D, Sarris J, Stough C. A randomized, controlled trial of meditation for work stress, anxiety and depressed mood in full-time workers. *Evid Based Complement Alternat Med* 2011;2011:960583.
  36. Nagendra RP, Maruthai N, Kutty BM. Meditation and its regulatory role on sleep. *Front Neurol* 2012;3:54.
  37. Seshachalam PA. Healthy way to handle work place stress through yoga, meditation and soothing humor. *IOSR J Bus Manage* 2016;18:18-25.
  38. Smith SA. Mindfulness-based stress reduction: An intervention to enhance the effectiveness of nurses coping with work-related stress. *Int J Nurs Knowl* 2014;25:119-30.
  39. Wachholtz AB, Malone CD, Pargament KI. Effect of different meditation types on migraine headache medication use. *Behav Med* 2017;43:1-8.
  40. Gopal A, Mondal S, Gandhi A, Arora S, Bhattacharjee J. Effect of integrated yoga practices on immune responses in examination stress – A preliminary study. *Int J Yoga* 2011;4:26-32.
  41. Groessl EJ, Chopra D, Mills PJ. An overview of yoga research for health and well-being. *J Yoga Phys Ther* 2015;5:1-4.
  42. Ramos-Jiménez A, Hernandez RP, Wall-Medrano A. Hatha yoga program determinants on cardiovascular health in adult and physically active women. *J Yoga Phys Ther* 2011;1:1-5.
  43. Shetty A. Yoga as physical therapy intervention and future direction for yoga research. *J Yoga Phys Ther* 2016;6:e122.
  44. Singh UP. Psychophysiological effects of yoga for adults with occupational stress. In: Telles S, Singh N, editors. *Research-Based Perspectives on the Psychophysiology of Yoga Advances in Medical Diagnosis, Treatment, and Care*. Hershey, PA: IGI Global; 2018. p. 359-82.
  45. Wang I. Effects of yoga postures, yoga breathing, and yoga relaxation program on physical symptoms of stress, fatigue, stress response and self-esteem for irregular women workers. *Korean J Health Psychol* 2010;15:67-90.
  46. Khalsa SB, Cohen L, McCall T, Telles S. *The Principles and Practice of Yoga in Healthcare*. Edinburgh: Handspring; 2016.
  47. Fishman L, Saltonstall E. Yoga in pain management. In: Audette JF, Bailey A, editors. *Integrative Pain Medicine*. New York: Springer; 2008. p. 259-84.
  48. do Rosário JL, Orcesi LS, Kobayashi FN, Aun AN, Diolindo Assumpção IT, Blasioli GJ, *et al.* The immediate effects of modified Yoga positions on musculoskeletal pain relief. *J Bodyw Mov Ther* 2013;17:469-74.
  49. Ward L, Stebbings S, Sherman KJ, Cherkin D, Baxter GD. Establishing key components of yoga interventions for musculoskeletal conditions: A Delphi survey. *BMC Complement Altern Med* 2014;14:196.
  50. Tilbrook HE, Cox H, Hewitt CE, Kang'ombe AR, Chuang LH, Jayakody S, *et al.* Yoga for chronic low back pain: A randomized trial. *Ann Intern Med* 2011;155:569-78.
  51. Williams K, Abildso C, Steinberg L, Doyle E, Epstein B, Smith D, *et al.* Evaluation of the effectiveness and efficacy of Iyengar yoga therapy on chronic low back pain. *Spine (Phila Pa 1976)* 2009;34:2066-76.
  52. McCaffrey R, Park J. The benefits of yoga for musculoskeletal disorders: A systematic review of the literature. *J Yoga Phys Ther* 2012;2:1-11.
  53. Polsgrove MJ, Eggleston BM, Lockyer RJ. Impact of 10-weeks of yoga practice on flexibility and balance of college athletes. *Int J Yoga* 2016;9:27-34.
  54. Crowe BM, Van Puymbroeck M, Schmid AA. Yoga as coping: A conceptual framework for meaningful participation in yoga. *Int J Yoga Therap* 2016;26:123-9.
  55. Sung PS. New perspective: Outcome measurement indices for yoga therapy. *J Yoga Phys Ther* 2014;4:157.
  56. Koneru S, Tanikonda R. Role of yoga and physical activity in work-related musculoskeletal disorders among dentists. *J Int Soc Prev Community Dent* 2015;5:199-204.
  57. Hotkar J. Significance of Sahaja Yoga meditation in reducing academic stress. *Yoga Mimamsa* 2017;49:17-9.
  58. Javnbakht M, Hejazi Kenari R, Ghasemi M. Effects of yoga on depression and anxiety of women. *Complement Ther Clin Pract* 2009;15:102-4.
  59. Khemka SS, Ramarao NH, Hankey A. Effect of integral yoga on psychological and health variables and their correlations. *Int J Yoga* 2011;4:93-9.
  60. Li D, Tsui MC. Evidence-based clinical application of yoga for stress management. *J Yoga Phys Ther* 2016;6:1.
  61. Singh AP. Yoga for mental health: Opportunities and challenges. *MOJ Yoga Phys Ther* 2017;2:1-6.
  62. Brems C. Yoga as a mind-body practice. In: Uribari JE,

- Vassalotti J, editors. *Nutrition, Fitness and Mindfulness: An Evidenced-Based Guide for Clinicians*. New York: Springer; in press.
63. Dwivedi U, Kumari S, Nagendra H. Yoga and its impact on counterproductive work behavior. *Med J DY Patil Univ* 2016;9:55-60.
  64. Hartfiel N, Havenhand J, Khalsa SB, Clarke G, Krayner A. The effectiveness of yoga for the improvement of well-being and resilience to stress in the workplace. *Scand J Work Environ Health* 2011;37:70-6.
  65. Wolever RQ, Bobinet KJ, McCabe K, Mackenzie ER, Fekete E, Kusnick CA, *et al.* Effective and viable mind-body stress reduction in the workplace: A randomized controlled trial. *J Occup Health Psychol* 2012;17:246-58.
  66. Melville GW, Chang D, Colagiuri B, Marshall PW, Cheema BS. Fifteen minutes of chair-based yoga postures or guided meditation performed in the office can elicit a relaxation response. *Evid Based Complement Alternat Med* 2012;2012:501986.
  67. Vijender K, Saurabh B, Raju S. Yoga in dental practice; a new perspective. *Int J Curr Adv Res* 2016;5:734-5.
  68. Davis DD, Bjornberg NH. Flourishing in the workplace through meditation and mindfulness. *Ind Organ Psychol* 2015;8:667-74.
  69. Dane E, Brummel B. Examining workplace mindfulness and its relations to job performance and turnover intention. *Hum Relat* 2014;67:105-28.
  70. Brems C, Colgan D, Freeman H, Freitas J, Justice L, Shean M, *et al.* Elements of yogic practice: Perceptions of students in healthcare programs. *Int J Yoga* 2016;9:121-9.
  71. Park CL, Riley KE, Braun TD, Jung JY, Suh HG, Pescatello LS, Antoni MH. Yoga and cognitive-behavioral interventions to reduce stress in incoming college students: A pilot study. *J Appl Biobehav Res* 2017;22:e12068.
  72. Anderzén-Carlsson A, Persson Lundholm U, Köhn M, Westerdahl E. Medical yoga: Another way of being in the world—a phenomenological study from the perspective of persons suffering from stress-related symptoms. *Int J Qual Stud Health Well Being* 2014;9:23033.
  73. Brems C. A yoga stress reduction intervention for university faculty, staff, and graduate students. *Int J Yoga Therap* 2015;25:61-77.
  74. Rising DW, Bennett BC, Hursh K, Plesh O. Reports of body pain in a dental student population. *J Am Dent Assoc* 2005;136:81-6.
  75. Sauer-Zavala SE, Walsh EC, Eisenlohr-Moul TA, Lykins EL. Comparing mindfulness-based intervention strategies: Differential effects of sitting meditation, body scan, and mindful yoga. *Mindfulness* 2012;4:383-8.
  76. Saoji A, Mohanty S, Vinchurkar SA. Effect of a single session of a yogic meditation technique on cognitive performance in medical students: A randomized crossover trial. *J Relig Health* 2017;56:141-8.
  77. Brems C, Justice L, Sulenes K, Girasa L, Ray J, Davis M, *et al.* Improving access to yoga: Barriers to and motivators for practice among health professions students. *Adv Mind Body Med* 2015;29:6-13.
  78. Justice L, Brems C, Jacova C. Exploring strategies to enhance self-efficacy about starting a yoga practice. *Ann Yoga Phys Ther* 2016;1:1-7.
  79. Polychronopoulou A, Divaris K. Perceived sources of stress among Greek dental students. *J Dent Educ* 2005;69:687-92.
  80. Omigbodun OO, Odukogbe AT, Omigbodun AO, Yusuf OB, Bella TT, Olayemi O. Stressors and psychological symptoms in students of medicine and allied health professions in Nigeria. *Soc Psychiatry Psychiatr Epidemiol* 2006;41:415-21.
  81. Davis EL, Tedesco LA, Meier ST. Dental student stress, burnout, and memory. *J Dent Educ* 1989;53:193-5.
  82. Pöhlmann K, Jonas I, Ruf S, Harzer W. Stress, burnout and health in the clinical period of dental education. *Eur J Dent Educ* 2005;9:78-84.
  83. Acharya S. Factors affecting stress among Indian dental students. *J Dent Educ* 2003;67:1140-8.
  84. Alzahem AM, van der Molen HT, Alaujan AH, Schmidt HG, Zamakhshary MH. Stress amongst dental students: A systematic review. *Eur J Dent Educ* 2011;15:8-18.
  85. Rioux JG. Yoga therapy research: A whole-systems perspective on comparative effectiveness and patient-centered outcomes. *Int J Yoga Therap* 2015;25:9-19.
  86. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24:385-96.
  87. Cohen S, Williamson GM. Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, editors. *The Social Psychology of Health: Claremont Symposium on Applied Social Psychology*. Newbury Park, CA: Sage; 1988. p. 31-67.
  88. Cohen S, Janicik-Deverts D. Who's stressed? Distributions of psychological stress in the United States in probability samples from 1983, 2006, and 2009. *J Appl Soc Psychol* 2012;42:1320-34.
  89. Al-Samadani KH, Al-Dharrab A. The perception of stress among clinical dental students. *World J Dent* 2013;4:24-8.
  90. Middleton KR, Haaz Moonaz S, Hasni SA, Magaña López M, Tataw-Ayuketah G, Farmer N, *et al.* Yoga for systemic lupus erythematosus (SLE): Clinician experiences and qualitative perspectives from students and yoga instructors living with SLE. *Complement Ther Med* 2018;41:111-7.
  91. Muzik M, Hamilton SE, Lisa Rosenblum K, Waxler E, Hadi Z. Mindfulness yoga during pregnancy for psychiatrically at-risk women: Preliminary results from a pilot feasibility study. *Complement Ther Clin Pract* 2012;18:235-40.
  92. Sanders AE, Lushington K. Effect of perceived stress on student performance in dental school. *J Dent Educ* 2002;66:75-81.
  93. Freeman H, Vladagina N, Razmjou E, Brems C. Yoga in print media: Missing the heart of the practice. *Int J Yoga* 2017;10:160-6.
  94. Stewart-Brown S, Evans J, Patterson J, Petersen S, Doll H, Balding J, *et al.* The health of students in institutes of higher education: An important and neglected public health problem? *J Public Health Med* 2000;22:492-9.