

# Effect of Pranayama Techniques with *Marmanasthanam Kriya* as Yogic Relaxation on Biopsychosocial Parameters Prior to Endodontic Therapy: A Cross Sectional Study Design

## Abstract

**Background:** The root canal treatment is one of the common dental or endodontic therapies associated with high levels of patient anxiety. Yoga therapy (YT) is reported in medical literature as an effective modality in bringing down anxiety in clinical scenarios; however, the reports of the same for dental settings are fewer. The current study aimed to evaluate the effect of YT on biopsychosocial parameters in patients undergoing root canal therapy. **Materials and Methods:** A cross sectional study was conducted on 50 participants who underwent dental root canal therapy. The sample was divided into two groups: Yoga group (Group A;  $n = 25$ ) who received YT and control group (Group B;  $n = 25$ ) who were subjected to self-relaxation during dental procedure. The state of anxiety was measured by a 5-point single-item Likert scale and the cardiovascular (CV) parameters (systolic blood pressure [SBP], diastolic blood pressure [DBP], heart rate [HR]) and CV indices (pulse pressure [PP], mean arterial pressure [MAP], rate-pressure product [RPP], and double product [DoP]) were derived and compared between both the groups. **Results:** The intergroup comparison showed statistically significant differences in anxiety score ( $P < 0.001$ ), SBP ( $P < 0.001$ ), MAP ( $P < 0.001$ ), RPP ( $P < 0.001$ ), DoP ( $P < 0.001$ ), HR ( $P < 0.029$ ), DBP ( $P < 0.003$ ), and PP ( $P < 0.116$ ). **Conclusion:** A significant reduction was recorded in terms of anxiety and primary and derived CV parameters in the yoga group. The YT can be adopted as an interventional tool for anxiety management in patients indicated for dental root canal therapy.

**Keywords:** Anxiety, dentistry, endodontic therapy, yoga therapy, yoga

## Introduction

Anxiety has been defined by the American Psychological Association as an emotion characterized by feelings of tension, worried thoughts associated with raised blood pressure (BP).<sup>[1]</sup> It is evident from the published literature that dental anxiety is a common problem affecting widespread societies and is the major cause for poor oral health-care attendance leading to poor oral health. Dental anxiety is one of the most common causes of anxiety referred to as patient-specific reaction toward stress associated with dental treatment, in which stimulus is unknown, vague, or not present.<sup>[2]</sup> Highly anxious patients are more prone to avoid dental treatments in initial stages of disease which might lead to complicated dental procedures. Around 2.5%–20% of the world population suffer from dental anxiety which persists as a widespread problem.

The prevalence of dental anxiety is as high as 32.2% in patients planned for endodontic treatment.<sup>[3]</sup> Anxious patients are more than twice likely to feel moderate-to-intense intraoperative pain during root canal treatment (RCT).<sup>[4]</sup> To provide good oral health in addition to creating a healthy patient–dentist relationship, it is vital to reduce dental anxiety in every patient as it is a psychological inhibitor.

Yoga, an ancient traditional science of India, is a noninvasive and time-tested method to reduce stress and anxiety.<sup>[5]</sup> Yoga helps establish “sukhasthanam,” a dynamic sense of physical, mental, and spiritual well-being and it has been observed that yogic intervention can reduce anxiety.<sup>[6,7]</sup> It is regarded as a holistic approach to health and is known to facilitate healing, promote a sense of calmness, and enhance

**Akshaya  
Thiruvalluvan,  
Vandana Sekizhar,  
Meena  
Ramanathan<sup>1</sup>,  
Ananda Balayogi  
Bhavanani<sup>1</sup>,  
Dhanavel  
Chakravathy<sup>2</sup>,  
Jagat R. C. Reddy**

Departments of Oral  
Medicine and Radiology and  
<sup>2</sup>Conservative Dentistry and  
Endodontics, Indira Gandhi  
Institute of Dental Sciences,  
Sri Balaji Vidyapeeth (Deemed  
to be University), <sup>1</sup>Centre  
for Yoga Therapy Education  
and Research of Sri Balaji  
Vidyapeeth (Deemed to be  
University), Puducherry, India

**Address for correspondence:**  
Dr. Akshaya Thiruvalluvan,  
Department of Oral Medicine  
and Radiology, Indira Gandhi  
Institute of Dental Sciences,  
Sri Balaji Vidyapeeth (Deemed  
to be University),  
Puducherry - 607 402, India.  
E-mail: akshaya.thiruvalluvan@  
gmail.com

Access this article online

Website: [www.ijoy.org.in](http://www.ijoy.org.in)

DOI: 10.4103/ijoy.IJOY\_133\_20

Quick Response Code:



**How to cite this article:** Thiruvalluvan A, Sekizhar V, Ramanathan M, Bhavanani AB, Chakravathy D, Reddy JR. Effect of pranayama techniques with *Marmanasthanam Kriya* as yogic relaxation on biopsychosocial parameters prior to endodontic therapy: A cross sectional study design. *Int J Yoga* 2021;14:146-51.

Submitted: 03-Dec-2020

Revised: 05-Mar-2021

Accepted: 06-Apr-2021

Published: 10-May-2021

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: [WKHLRPMedknow\\_reprints@wolterskluwer.com](mailto:WKHLRPMedknow_reprints@wolterskluwer.com)

well-being and self-control.<sup>[8]</sup> Yoga produces a sense of mind–body balance in opposition to the stress response that is generally found to exist.<sup>[9]</sup> Alternative therapies such as the yoga therapy (YT) and music therapy are reported to reduce anxiety in clinical settings.<sup>[10-14]</sup>

The biopsychosocial model has emerged from the need of a better understanding of the human being as a holistic unit, integrating the biological, psychological, and sociological perspective as well. Yoga being a holistic science follows the same philosophy too.<sup>[12]</sup> All relevant determinants of health and disease support the incorporation of biological, psychological, and social factors in the assessment, prevention, and treatment of diseases. It contributes to a better understanding of the impact of psychosocial factors on health and stimulates the greater interest of medical theory and practice in offering a holistic approach to a patient.<sup>[13]</sup> Yogic intervention is proven to be extremely useful in reducing stress and anxiety in many clinical scenarios, but the literature on dental applications, more so in endodontic settings, is fewer. The current study aimed to evaluate the effect of yogic therapy (YT) on biopsychosocial parameters in patients undergoing RCT for the first time.

## Materials and Methods

### Trial design

This was a cross sectional study with an allocation ratio of 1:1.

### Participants

The inclusion criteria were those participants who were between 25 and 50 years of age, who were diagnosed for carious lesions of pulp (radiographically verified) or indication for an RCT as per the discretion of endodontists, those who underwent RCT for the first time, and willing to participate in this study. The participants who were unsuitable for endodontic therapy, those who had undergone RCT before, who had significant psychosis, practicing yoga before, pregnant/lactating mothers, unwilling, and uncooperative were excluded.

### Study settings

A prospective cross sectional study was conducted from July 2020 to September 2020 (period of 03 months) at the Department of Oral Medicine and Radiology and Department of Conservative Dentistry and Endodontics, Indira Gandhi Institute of Dental Sciences, Sri Balaji Vidyapeeth Deemed University, Pondicherry, in collaboration with Center for Yoga Therapy, Education and Research (CYTER) Sri Balaji Vidyapeeth Deemed University, Pondicherry. The ethical clearance was obtained before the commencement of the study from the Institutional Ethical committee, Indira Gandhi Institute of Dental Sciences, Sri Balaji Vidyapeeth, Pondicherry (Reference number: IGIDSIEC2020NRP16PGAKOMR). The trial was

registered with Clinical Trial Registry of India (Reference number: CTRI/2020/06/026104).

### Interventions

The participants were sorted into Group A (YT) and Group B (controls).

The participants allotted to the Yoga group received guided Yogic relaxation for 15 min before the dental root canal therapy and those to control group were advised self-relaxation for the same period. Patients were made to take up a relaxed sitting posture in a straight-backed comfortable chair following which the guided Yogic relaxation was given by a qualified yoga therapist [Table 1]. Control group participants were made to sit and relax themselves in a quiet manner.<sup>[14]</sup>

Intervention techniques and yoga procedure in the order given are as follows:

- i. Sukha pranayama: This involved pleasant breathing through both nostrils (inhalation to a count of 6 and exhalation to the count of 6 each round, and a total of 6 rounds of this pranayama was done for 2 min with frequency of 3 breaths/min)
- ii. Chandra pranayama: This involved exclusive left nostril breathing (Nasarga Mudra); closing of the right nostril with the right thumb, inhaled to a count of 6 and exhaled to the count of 6 exclusively through the left nostril for a total of 9 rounds; performed for duration of 3 min
- iii. Pranava pranayama: This was performed using Chin Mudra with index finger and thumb of both hands touching each other with other three fingers opened out and held together, placing the hands with the mudra on the thighs, palms facing downward. The deep breaths were taken (in sound of exhalation.) The next three rounds (Madhyam Pranayama) involved the index finger and thumb touching each other, curling your other three right fingers inward to form the Chinmaya Mudra, placing the hands with the mudra on the thighs, and palms facing downward. The deep breaths were gain taken with sound of “ooooo” Further three rounds called Adhyam pranayama were done with Adhi Mudra where you clench your fists with your thumb in the center. The Mudra was kept on thighs, breathing deeply into the upper chest and clavicular regions for a count of 6 and exhaling with the sound “mmm.....” To perform the last component of Pranava Pranayama, keeping your hands in Adhi Mudra, place knuckles of your right and left hands touching in front of the navel region (Brahma Mudra). The participants were asked to take a deep breath in and out with the sounds of aaa...ooo...mmm.... for three rounds
- iv. Marmanasthanam kriya: The participant is guided to concentrate upon parts of the body in a particular order from the toes of the feet slowly up till the head and this is performed in the sequence with entire focus on the

**Table 1: Yogic techniques included in guided Yogic relaxation (with duration)<sup>[14]</sup>**

Techniques (with mudra adopted in brackets)	Count of each breath (inhalation/exhalation)	Number of rounds	Duration (min)
<i>Sukha Pranayama</i> : Pleasant breathing through both nostrils	6/6	6	2
<i>Chandra Pranayama</i> : Exclusive left nostril breathing (Nasarga Mudra)	6/6	9	3
<i>Pranava Pranayama</i> comprising of the Akara Nada (Chin), Ukara nada (Chinmaya), Makara nada (Adi), and Omkara (Brahma)	6/10 (both nostrils)	Three rounds of each of the components	5
<i>Marmanasthanam Kriya</i>	Part-by-part complete relaxation	Not applicable	5
Total			15

part mentioned and command these areas to relax while concentrating, gives a very satisfactory, deep relaxation. Then, slowly reverse the order starting with the head and working your way down to the toes. This was done for 5 min.<sup>[14]</sup>

The interventions were given by two therapists (therapist 1: associate professor/deputy director of yoga therapy at deemed university, South India, with MSc, PhD and an experience: 10+ years. and therapist 2: director/professor of yoga therapy at deemed university, South India, with MBBS, MD (AM), DSc (Yoga) and experience: 20+ years relevant clinical experience).

### Outcomes

BP (both systolic BP [SBP] and diastolic BP [DBP]), heart rate (HR), and anxiety scale assessment were done for both the groups before and after the RCT procedure. From BP and HR, other cardiovascular (CV) indices such as pulse pressure (PP), mean arterial pressure (MAP), rate-pressure product (RPP), and double product (DoP) were derived using appropriate formulae. The noninvasive BP apparatus was used to record HR, SBP, and DBP readings before and after the study period (15 min). To ensure objectivity, all recordings were performed using an automatic BP monitor (Omron HEM 7203, Kyoto, Japan) that uses an oscillometric method with an instrumental accuracy of  $\pm 5\%$  for HR and  $\pm 3$  mmHg for BP. The pre-session recordings were taken after 5 min of quiet comfortable sitting, while post-session recordings were taken at the end of the session. These secondary parameters were derived using formulae:  $PP = SBP - DBP$ ;  $MAP = DPB + 1/3 PP$ ;  $RPP = HR \times SBP/100$ ;  $DoP = MAP \times HR$ . The state of anxiety was measured by a single-item 5-point Likert scale having the options from “no anxiety, mild anxiety, moderate anxiety, severe anxiety, and extremely high anxiety.” The Likert scale was used as it is useful to record the anxiety levels easily and quickly and also when the researchers have a very short time or psychometric tool space and need to reduce the burden on the patients waiting for an invasive interventional procedure evoking high levels of anxiety.<sup>[14,15]</sup>

### Sample size

All the participants had given written informed consent in both English and local languages (Tamil). A sample size

of 50 was (minimum sample size required for each group is = 25) was computed with reference to the previous study<sup>[14]</sup> and using the standard formula and  $n = n_0 / (1 - d)$  where  $n$  = required sample size,  $n_0$  = calculated sample size,  $d$  = dropout rate, and  $\alpha = 0.05$ . The estimated standard deviation ( $\sigma$ ) was 10.1, estimation error ( $d$ ) = 0.8, and ratio (Group 2/ Group 1) = 1.

### Blinding

The participants were blinded from the group being assigned.

Statistical methods: The obtained data were subjected to statistical analysis. Data were assessed for normality using Kolmogorov–Smirnov test. The parametric statistical methods were applied for intra- and intergroup comparisons using Student’s paired and unpaired *t*-test, respectively, using GraphPad InStat version 3.06 for Windows 95, (GraphPad Software, San Diego California USA) software.  $P < 0.05$  was accepted for significant differences.

### Results

The CV parameters obtained were comparable at baseline. Anxiety scores show statistically significant differences at the baseline due to convenient sampling. Hence to nullify such initial differences, delta % has been calculated [Table 2]. The intragroup comparisons of pre–post data of anxiety and primary and derived CV indices showed significant reduction ( $P < 0.001$ ) in Group A. The actual  $P$  values have been given for unpaired *t*-test and the intergroup comparison showed statistically significant differences ( $P < 0.001$ ) in anxiety score, SBP, MAP, RPP, and DoP and a difference of  $P < 0.029$  for HR,  $P < 0.003$  for DBP, and  $P < 0.116$  for PP was found between the groups. Group B (control group) also showed a reduction in scores, but statistically significant differences in mean scores were evident in Group A [Table 2].

**Table 2: Comparison of state of anxiety and primary and derived cardiac parameters among groups**

	Group A (n=25)			Group B (n=25)			P		
	Before	After	Delta (%)	Before	After	Delta (%)	Before	After	Delta (%)
Anxiety score	4.83±0.81	1.92±0.86***	-55.33±20.20	3.68±0.74	3.64±0.70	-0.80±4.00	0.003	<0.001	<0.001
HR (bpm)	77.84±8.94	73.6±8.50***	-5.35±4.19	77.12±6.91	78.56±6.95	2.04±5.81	0.752	0.029	<0.001
SBP (mmHg)	132.84±11.60	118.76±10.63***	-10.47±4.89	129.68±11.86	131.48±14.00	1.48±6.96	0.346	<0.001	<0.001
DBP (mmHg)	79.4±9.75	71.92±8.21***	-9.18±5.89	79.52±8.25	80.00±10.00	0.66±7.69	0.963	0.003	<0.001
PP (mmHg)	53.44±11.88	46.84±9.41***	-11.02±13.97	50.16±9.33	51.48±11.02	3.48±18.05	0.283	0.116	<0.01
MAP (mmHg)	97.21±8.76	87.53±7.93***	-9.86±4.35	96.24±8.54	97.16±10.24	0.99±6.17	0.693	<0.001	<0.001
RPP (units)	103.31±14.37	87.19±11.08***	-15.31±5.26	100.01±12.69	103.30±14.58	3.62±10.13	0.394	<0.001	<0.001
DoP (units)	7568.34±1142.82	6431.69±881.82***	-14.72±5.21	7421.41±914.50	7632.26±1062.84	3.14±9.64	0.618	<0.001	<0.001

\*\*\*DBP=Diastolic blood pressure, DoP=Double product, HR=Heart rate, MAP=Mean arterial pressure, PP=Pulse pressure, RPP=Rate-pressure product, SBP=Systolic blood pressure. P<0.05 was considered for significance.

## Discussion

Yoga is an ancient traditional practice that has its roots in India. Therapeutic yoga has been known to reduce or alleviate structural, physiological, and emotional pain. The practice of yoga is being established over the years. It is known to maintain harmony and balance between the mind and body.<sup>[16,17]</sup> Despite the technological advances in dentistry, anxiety about dental treatment and the fear of pain associated with these treatments remain globally widespread. The anxiety and fear are considered to be major barriers to dental treatment.<sup>[18]</sup> Literature clearly supports the fact that Yoga is the best suitable lifestyle that can play a significant role in addressing and alleviating psychosomatic problems, modulate autonomic functions, relieve stress, bring down anxiety, and improve psychophysiological functions including cardiorespiratory fitness and quality of life.<sup>[19-21]</sup>

Yogic techniques are easy to follow and practice, improve quality of life, and promote overall health by empowering human beings and also provide them an opportunity for self-improvement.<sup>[22]</sup> Yoga therapy promoted a significant reduction of HR as reported by Ankad *et al.* who inferred that the reduction was due to autonomic modulation mediated through modification of breathing patterns that were followed in yogic techniques, which may trigger various central and autonomic mechanisms as well as mechanical and hemodynamic adjustments in CV functioning.<sup>[23]</sup> Vinay *et al.* observed similar results by the impact of yoga on HR variability (HRV). They concluded that yoga practice reduces sympathetic activity to a great extent as well as elevates mood and relieves stress by increasing serotonin levels. It has also been stated that yoga increases blood flow and levels of oxygen saturation and improves oxygenation of the tissues.<sup>[24]</sup> Another study by Kuppusamy suggested that a reduction in HR could indicate the greater parasympathetic nervous system activity which will reduce the risk of CV morbidity.<sup>[25]</sup>

In our study, a significant reduction was found in BP among the Yoga group participants after guided yoga therapy.<sup>[26]</sup> Similar results have been reported in earlier studies too.<sup>[27-29]</sup> A study by Cohen and Cramer had concluded that yoga is useful as an adjunctive treatment along with drug therapy in patients with mild and moderate hypertension.<sup>[27-29]</sup>

The yogic intervention is found to be effective in reducing and normalizing BP and suggested that a decrease in the BP may be due to influence on vasomotor center which leads to a desirable reduction in sympathetic tone and peripheral resistance resulting from yoga therapy.<sup>[27,28]</sup> A systematic review and meta-analysis showed a consistent reduction in SBP, DBP, and HR after yoga which was in accordance with this present study too.<sup>[29]</sup> Gururaja *et al.* reported a reduction in both state anxiety and trait anxiety reaffirming the efficacy of yoga in decreasing stress levels and improving mental and emotional health status.<sup>[30]</sup> Yoga



was quoted for applications in the management of dental patients for stress related (oral lichen planus, burning mouth syndrome, and aphthous ulcers) along with added anti-inflammatory and antianxiety effects.<sup>[31]</sup> The YT had been cited for applications in reduction of anxiety in dental students<sup>[32]</sup> and in those suffering with chronic periodontitis.<sup>[33]</sup>

Considering endodontic therapy (RCT or surgery), a study measured HR, SBP, and DBP in those undergoing endodontic surgery and controls. The intergroup differences increased during local anesthesia, rotary instrumentation, root filling, and peri-radicular curettage. The stress experienced during the care procedure was correlated to the level of anticipated anxiety. Thus, this signifies that endodontic procedures (inclusive of RCT) are stressful and cause anxiety measured by HR, SPB, and DPB.<sup>[34]</sup> These parameters, i.e., HR, SPB, and DBP, are correlated to stress (during RCT as in the current study or stress in general) and reduction may be achieved in these parameters and stress via yogic relaxation therapy.

The other parameters which showed statistically significant differences were MAP, RPP, DoP, and PP which were unique to the current study where YT was evaluated in patients undergoing root canal therapy. The effects of yogic breath regulation on modulation of autonomic functions have assessed by the measures of SBP and DBP, HR, HRV, respiratory rate, galvanic skin resistance, and pulse rate. The benefits of yoga therapy and relative changes in these parameters are discussed extensively but no under dental settings when RCT was performed.<sup>[35]</sup>

The limitation of our study only addressed the immediate effect of a single session and it is a representative of a small sample of patients only. The second limitation of the study is that the measurement of anxiety was done using a 5-point Likert scale and not a standardized scale. Therefore, further studies on the effects of long-term training, in a larger scale of population and outcomes measured using a standardized scale, may deepen our understanding of the intrinsic mechanisms by which such positive changes are occurring. Future directions include randomized control trails employing YT in dental-related anxiety on a large sample.

## Conclusion

A statistically significant reduction for the parameters corresponding to anxiety, primary CV parameters, and derived CV indices ( $P < 0.001$ ) was noted in the yoga group as compared to controls. The YT can be adopted as an interventional tool for anxiety management in patients indicated for endodontic therapy.

## Acknowledgments

The authors thank the management and authorities of Sri Balaji Vidyapeeth. We sincerely thank Dr. Vijayaraja. S,

Senior Lecturer, Department of Conservative Dentistry and Endodontics; Dr Bakkiyalakshmi. A, Dr Harshavardhan JM, Dr Manoj KT, and Dr Ajithkumar S, Postgraduates, Department Conservative Dentistry and Endodontics; and Dr. G. Ezhumalai, Senior Statistician and Research consultant, Sri Balaji Vidyapeeth, for their wholehearted support for this study.

We also take this opportunity to convey our deepest sense of thanks and gratitude to Mrs. Latha Shanmugam and Mrs. Sarulatha G, yoga instructors of CYTER who efficiently conducted the guided yogic relaxation sessions.

## Ethical clearance

The ethical clearance was obtained form the Institutional Ethical committee (IEC), Indira Gandhi Institute of Dental Sciences, Sri Balaji Vidyapeeth (Deemed to be Univeristy), Pondicherry (Reference number: IGIDSIEC2020NRP16PGAKOMR) on (16.12.2019).

## Financial support and sponsorship

The authors have declared it to be self-funded.

## Conflicts of interest

There are no conflicts of interest.

## References

1. Locke AB, Kirst N, Shultz CG. Diagnosis and management of generalized anxiety disorder and panic disorder in adults. *Am Fam Physician* 2015;91:617-24.
2. Humphris GM, Dyer TA, Robinson PG. The modified dental anxiety scale: UK general public population norms in 2008 with further psychometrics and effects of age. *BMC Oral Health* 2009;9:20.
3. Wali A, Siddiqui TM, Gul A, Khan A. Analysis of level of anxiety and fear before and after endodontic treatment. *J Dent Oral Health* 2016;2:1-4.
4. Murillo Benítez M, Martín González J, Jiménez Sánchez MC, Cabanillas Balsera D, Velasco Ortega E, Segura Egea JJ. Association between dental anxiety and intraoperative pain during root canal treatment: a cross-sectional study. *Int Endod J* 2020;53:447-54.
5. Woodyard C. Exploring the therapeutics effects of yoga and its ability to increase the quality of life. *Int J Yoga* 2011;4:49-54.
6. Bhavanani AB. Diverse dimensions of Yoga. *Yoga Mimamsa* 2014;46:3-8.
7. Ramanathan M, Bhavanani AB, Trakroo M. Effect of a 12-week yoga therapy program on mental health status in elderly women inmates of a hospice. *Int J Yoga* 2017;10:24-8.
8. Nishat R, Bhuyan L, Nezam S, Singh S, Jaiswal MM, Singh R. The precedence and viability of yoga in the lives of D3-dental students, dental practitioners, and dental patients. *J Family Med Prim Care* 2019;8:3808-13.
9. Arora S, Bhattacharjee J. Modulation of immune responses in stress by Yoga. *Int J Yoga* 2008;1:45-55.
10. Daokar S, Pophli S, Pawar K, Wahane K, Tambake R, Late L. Effect of audio and audiovisual aids on anxiety level of patients during first appointment of root canal treatment: An *in vivo* study. *Int J Sci Stud* 2018;6:121-6.
11. Lai HL, Good M. An overview of music therapy. *J Nurs*

- 2002;49:80-4.
12. Molina JA. Understanding the biopsychosocial model. *Int J Psychiatry Med* 1983;13:29-36.
  13. Havelka M, Lucanin JD, Lucanin D. Biopsychosocial model – The integrated approach to health and disease. *Coll Antropol* 2009;33:303-10.
  14. Ajmera S, Amirtha Ganesh B, Bhavanani A, Dayanidy G, Ezhumalai G. A comparative study on the effect of music therapy alone and a combination of music and yoga therapies on the psychophysiological parameters of cardiac patients posted for angiography. *SBV J Basic Clin Appl Health Sci* 2018;1:13-8.
  15. Davey HM, Barratt AL, Butow PN, Deeks JJ. A one-item question with a Likert or Visual Analog Scale adequately measured current anxiety. *J Clin Epidemiol* 2007;60:356-60.
  16. Bhavanani AB. *Yoga Chikitsa: The Application of Yoga as a Therapy*. Pondicherry, India: Dhivyananda Creations; 2013.
  17. Bhavanani AB. Role of yoga in health and disease. *J Symptoms Signs* 2014;3:399-406.
  18. Marya CM, Grover S, Jnaneshwar A, Pruthi N. Dental anxiety among patients visiting a dental institute in Faridabad, India. *West Indian Med J* 2012;61:187-90.
  19. Bhavanani AB, Ramanathan M, Trakroo M. Immediate cardiovascular effects of a single yoga session in different conditions. *Altern Integr Med*. 2013;2:144.
  20. Vijayalakshmi P, Surendiran A. Effect of slow and fast pranayams on reaction time and cardiorespiratory variables. *Indian J Physiol Pharmacol* 2005;49:313-8.
  21. Innes KE, Bourguignon C, Taylor AG. Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: A systematic review. *J Am Board Fam Pract* 2005;18:491-519.
  22. Auriane PE, Ramanathan M, Bhavanani AB. Introducing pranayama to children with special needs. *Advis Panel* 2019:105-08.
  23. Ankad RB, Herur A, Patil S, Shashikala GV, Chinagudi S. Effect of short-term pranayama and meditation on cardiovascular functions in healthy individuals. *Heart Views* 2011;12:58-62.
  24. Vinay AV, Venkatesh D, Ambarish V. Impact of short-term practice of yoga on heart rate variability. *Int J Yoga* 2016;9:62-6.
  25. Kuppasamy M, Kamaldeen D, Pitani R, Amaldas J, Ramasamy P, Shanmugam P, *et al.* Effects of yoga breathing practice on heart rate variability in healthy adolescents: A randomized controlled trial. *Integr Med Res* 2020;9:28-32.
  26. Bhavanani B, Ramanathan M. Immediate cardiovascular effects of a single yoga session in different conditions. *Altern Integr Med* 2013;2:1-5.
  27. Cohen DL, Bloedon LT, Rothman RL, Farrar JT, Galantino ML, Volger S, *et al.* Iyengar yoga versus enhanced usual care on blood pressure in patients with prehypertension to stage I hypertension: A randomized controlled trial. *Evid Based Complement Alternat Med* 2011;2011:546428.
  28. Cramer H, Sellin C, Schumann D, Dobos G. Yoga in arterial hypertension: A three-armed, randomized controlled trial. *Deutsch Ärztebl Int* 2018;115:833.
  29. Cramer H, Lauche R, Haller H, Steckhan N, Michalsen A, Dobos G. Effects of yoga on cardiovascular disease risk factors: A systematic review and meta-analysis. *Int J Cardiol* 2014;173:170-83.
  30. Gururaja D, Harano K, Toyotake I, Kobayashi H. Effect of yoga on mental health: Comparative study between young and senior subjects in Japan. *Int J Yoga* 2011;4:7-12.
  31. Shohani M, Badfar G, Nasirkandy MP, Kaikhavani S, Rahmati S, Modmeli Y, *et al.* The effect of yoga on stress, anxiety, and depression in women. *Int J Prev Med* 2018;9:21.
  32. Shankarapillai R, Nair MA, George R. The effect of yoga in stress reduction for dental students performing their first periodontal surgery: A randomized controlled study. *Int J Yoga* 2012;5:48-51.
  33. Katuri KK, Dasari AB, Kurapati S, Vinnakota NR, Bollepalli AC, Dhulipalla R. Association of yoga practice and serum cortisol levels in chronic periodontitis patients with stress-related anxiety and depression. *J Int Soc Prev Community Dent* 2016;6:7-14.
  34. Georgelin-Gurgel M, Diemer F, Nicolas E, Hennequin M. Surgical and nonsurgical endodontic treatment-induced stress. *J Endod* 2009;35:19-22.
  35. Saoji AA, Raghavendra BR, Manjunath NK. Effects of yogic breath regulation: A narrative review of scientific evidence. *J Ayurveda Integr Med* 2019;10:50-8.