



## Original Article

# Insights into Ergonomics Among Dental Professionals of a Dental Institute and Private Practitioners in Hubli–Dharwad Twin Cities, India



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## ABSTRACT

**Background:** To assess the knowledge, attitude, and practice of ergonomics among dental professionals of Hubli–Dharwad twin cities, India.

**Methods:** Investigator-developed, self-administered, closed-ended questionnaire assessing knowledge, attitude, and practices regarding ergonomics during dental practice was filled in by undergraduates, house surgeons, postgraduates, and faculty members of dental institutions and private practitioners from Hubli–Dharwad twin cities.

**Results:** Data were collected from a total of 250 participants, 50 belonging to each academic group. Overall mean knowledge, attitude, and practice scores were 52%, 75%, and 55%, respectively. Significant correlation was found for age with attitude ( $\chi^2 = 10.734$ ,  $p = 0.030$ ) and behavior ( $\chi^2 = 12.984$ ,  $p = 0.011$ ). Marital status was significantly associated with all the three domains; knowledge ( $\chi^2 = 29.369$ ,  $p = 0.000$ ), attitude ( $\chi^2 = 29.023$ ,  $p = 0.000$ ), and practices ( $\chi^2 = 13.648$ ,  $p = 0.009$ ).

**Conclusion:** Participants had considerable awareness and behavior toward ergonomics in dental practice. The high attitude score indicates stronger acceptance of ergonomics principles and guidelines during routine dental procedures. The current study highlights the situation of ergonomics in dental practice in the form of knowledge, attitude, and practices.

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## 1. Introduction

Ergonomics is the scientific study of people and their working conditions, especially done in order to improve effectiveness [1]. In Greek, “Ergo” means work, and “Nomos” means natural laws or systems. Ergonomics, therefore, is an applied science concerned with designing products and procedures for maximum efficiency and safety [2]. Dentistry is a profession that generally produces various musculoskeletal pains and soreness, which are slow to appear; consequently, the symptoms are usually ignored until they become chronic and permanent lesions become evident [3]. It is

very important to maintain an adequate work posture and that the instruments and furniture that the dentist is working with have adequate working characteristics [4].

Among the wide range of musculoskeletal disorders, back pain was the most common among dentists, followed by neck pain, high muscle tension on the trapezoids, tendinitis, carpal tunnel syndrome, nerve trapping, early arthrosis, myopia, and auditive alterations [5].

Pargali and Jowkar [6] in 2010 reported that 73% of dentists complained of back and neck pain. Even though the practice of four-handed dentistry and the use of ergonomically well-adjusted

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equipment are on the rise, literature reports have reported a rise in back, neck, shoulder, and arm pain, in almost 81% of dental professionals [6]. Work-related stress, tension, and awkward postural positions can add to back and neck problems for the dentist [7–11]. There is always a neutral zone of movement for every joint and muscle. Injury risks increase whenever work requires a person to perform tasks with body segments outside of his or her neutral range in a deviated posture [12].

In Indian scenario, abrupt mushrooming of dental institutions is occurring. The total number of dental institutions in India is currently 300. The number of students enrolling for a Bachelor of Dental Surgery (BDS) degree in various dental institutions across India is approximately 24,700 [13] and is on the rise.

According to the syllabus for BDS proposed by the Dental Council of India (DCI), undergraduates are exposed to clinical working conditions for the very first time during the 3<sup>rd</sup> year of courses, during which every student undergoes training in various subjects on a rotating basis for a fixed amount of time. This is the time during which ergonomics, as a part of the regular curriculum, should be taught to students, so that its importance in practice is emphasized and various guidelines followed. For this reason, undergraduates, i.e., both 3<sup>rd</sup>- and 4<sup>th</sup>-year BDS students, were included as study participants.

Most of the graduates end up in private practice and few are involved in academia; the faculties of dental colleges are also engaged in private practice [14]. Hence, the dentists who are in private practice should place special emphasis on ergonomic habits to improve their longevity. The age of the dentist is closely related to how many years the dentist has been practicing. One study observed increasing years of practice to be related to an increased prevalence of musculoskeletal problems [15]. Female dentists outnumber males [16], and the literature suggests that they are more likely than men to experience musculoskeletal pain [17]. Therefore, education is needed regarding various musculoskeletal problems that occur because of unhealthy postural habits during delivery of oral health services, and preventive and corrective measures for healthy lifestyles during professional practice should be promoted. In the Indian set-up there is a severe dearth of literature evaluating knowledge, awareness, and practices among dental professionals regarding optimal postures at the time of rendering oral health services. Therefore, the current observational survey was conducted to evaluate the awareness, attitudes, and practice of ergonomics during routine dental procedures among undergraduates, house surgeons, postgraduates, faculty members of Sri Dharmasthala Manjunatheshwara (SDM) College of Dental Sciences and Hospital, Dharwad, Karnataka, India and private practitioners of Hubli–Dharwad twin cities, India.

## 2. Materials and methods

The study was conducted among undergraduates (3<sup>rd</sup>- and 4<sup>th</sup>-year BDS students), house surgeons, postgraduates, and faculty members and private practitioners of the aforementioned private dental college and cities. Ethical clearance was obtained from the Ethical Review Committee of the Institutional Review Board of SDM College of Dental Sciences and Hospital. The head of the institution and other faculty members were informed about the purpose of the study and their permissions obtained. The study population consisted of 50 each from a group of undergraduates, house surgeons, postgraduates, and staff attending the institution and private practitioners, practicing in Hubli–Dharwad twin cities, through a convenient sampling method.

The questionnaire was investigator developed, self-administered, and closed-ended. The undergraduates, house surgeons, postgraduates, and staff were gathered in a lecture hall and one of

the authors gave instructions regarding the purpose of the survey and completion of the survey questionnaire. Study participants were given a format consisting of informed consent, instructions, and the questionnaire. They were given 1 hour to complete the questionnaire.

Private practitioners were approached by the same author (S.K.) who gave the instructions to the rest of the study participants at their clinics. The purpose of the survey was explained and those who gave consent for participation in the study were included. The items for the questionnaire were generated from four sources: theory, research, observation, and expert opinion [18]. The questionnaire consisted of a total of 37 items with 21, eight, and eight items assessing knowledge, attitude, and behavior, respectively. Attitude was assessed on a five-point Likert scale: definitely yes, yes, neutral, no, and definitely no. The response options for behavior were also assessed on a five-point Likert scale as follows: < 1 month, 1–6 months, 6–12 months, > 1 year, and never (for the first 2 items) and always, very often, often, rarely, and never (for items 3–8). Knowledge was assessed by a total of 21 questions on ergonomics that focused on principles of ergonomics in routine dental procedures such as cavity preparation, extraction of teeth, and various complications. Questions related to attitude assessed whether ergonomics should be part of the dental curriculum, if dentists should follow the ergonomic principles in routine dental practice, whether the dental chair and instruments play any role in following ergonomic principles in routine dental practice, whether the dentist should alternate between sitting and standing between patient appointments, and whether various dental institutions should conduct continuing dental education. Questions pertinent to behavior assessed how frequently the respondents obtained information related to ergonomics in dentistry either from the Internet or scientific journals, used dental loupes for magnification purposes, made an effort to maintain neutral posture while working, attended any workshop/lecture on ergonomics in dental career, or performed stretching exercises in between patient appointments. The range of possible scores for knowledge, attitude, and behavior were 0–21, 8–40, and 8–40, respectively. Correct answers for knowledge questions were given a score of 1 and wrong answers were given a score of 0. Attitude scores ranged from 5 (definitely yes) to 1 (definitely no), and behavior scores ranged from 5 (< 1 month) to 1 (never). Prior to the start of the study, the questionnaire was pretested on 50 study participants. Cronbach  $\alpha$  values for knowledge, attitude, and behavior were 0.684, 0.784, and 0.810, respectively. The split-half reliability values for knowledge, attitude, and behavior were 0.791, 0.881, and 0.698, respectively.

The questions underwent subsequent revisions prior to the main study. The revisions were related to the clarity of 10 questions of knowledge, and five and three questions each from attitude and behavior. The results of the pilot study were not included in the main study; only the reliability and validity was assessed. The pilot study participants did not take part in the main study.

The data were entered into the MS Excel (MS Office version 2007, Microsoft, Redmond, WA, USA) and Intercooled STATA version 9.2 (Stata Corp., College Station, TX, USA) was used to perform statistical analysis. One-way analysis of variance was used to assess the differences in knowledge, attitude, and behavior among academic positions. Scheffe's test was used to assess pairwise differences in the knowledge of study participants with respect to academic positions. Pearson's correlation analysis was used to assess associations between knowledge, attitude, and behavior of study participants. Chi-square test was used to assess associations of age, sex, religion, and marital status with knowledge, attitude, and behavior of study participants.

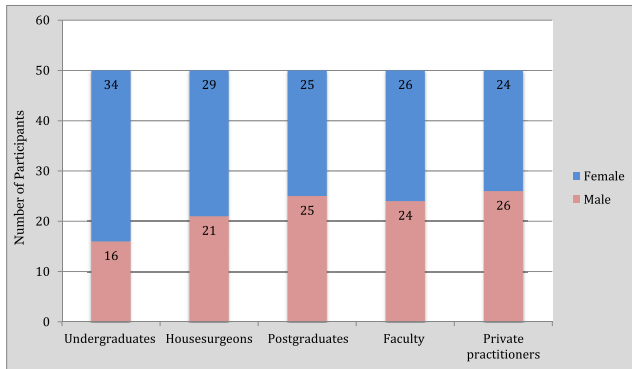


Fig. 1. Sex wise distribution of study participants.

### 3. Results

The questionnaires were completed by a total of 112 male (44.8%) and 138 female (55.2%) dental professionals belonging to various academic positions (Fig. 1).

For ease of understanding, responses given by participants were divided into three categories: good, fair, and poor. The mean  $\pm$  standard deviation (SD) for knowledge was  $10.99 \pm 3.98$ ; for attitude was  $30.25 \pm 5.21$ ; and for practices was  $22.04 \pm 6.09$ . The most respondents were categorized as fair for all three variables (Table 1).

Participants' responses are categorized as good, fair, and poor based on mean  $\pm$  SD.

The highest scores for knowledge were found in private practitioners ( $12.40 \pm 2.94$ ), for attitude were found in postgraduates ( $31.58 \pm 5.62$ ), and for practices were found in house surgeons ( $26.86 \pm 4.48$ ; Table 2). A statistically significant difference for knowledge, attitude, and practices was observed between the academic positions. Pair-wise comparison using Scheffe *post hoc* test revealed that the difference between undergraduate–house surgeon, house surgeon–postgraduate, and house surgeon–private practitioner was significant for knowledge and practices. Between the house surgeons and the postgraduates, a significant difference was observed for all three variables of the study (Table 2).

Pearson's correlation analysis was conducted (Table 3), and showed a positive significant correlation of knowledge with attitude ( $r = 0.399$ ,  $p = 0.000$ ) and a negative significant correlation with practices ( $r = -0.363$ ,  $p = 0.000$ ). Correlation of attitude with practices was not statistically significant ( $r = -0.035$ ,  $p = 0.582$ ).

To assess correlation between various sociodemographic variables with knowledge, attitude, and practices, the Chi-square test was used (Table 4). A significant correlation of age with attitude ( $\chi^2 = 10.734$ ,  $p = 0.030$ ) and practices ( $\chi^2 = 12.984$ ,  $p = 0.011$ ) was observed. Marital status was significantly correlated with

Table 1  
Knowledge, attitude, and behavior of respondents

Variables	N	%
Knowledge	$\leq 7$ (poor)	20
	8–14 (fair)	57.2
	$\geq 15$ (good)	22.8
Attitude	$\leq 25$ (poor)	18.4
	26–35 (fair)	64.4
	$\geq 36$ (good)	17.2
Behavior	$\leq 15$ (poor)	18
	16–28 (fair)	63.6
	$\geq 29$ (good)	18.4

Table 2  
Knowledge, attitude, and behavior among different academic positions

	Academic position knowledge					
	Knowledge		Attitude		Behavior	
	Mean	SD	Mean	SD	Mean	SD
Undergraduate	11.58	3.42	30.25	5.21	22.04	6.09
House surgeon	7.82	2.81	28.36	3.15	26.86	4.48
Postgraduate	11.84	4.43	31.58	5.62	20.28	5.58
Faculty	11.30	4.37	29.72	5.26	22.30	4.57
Private practitioner	12.40	2.94	31.30	6.50	21.52	6.24
F value	12.318		3.207		14.010	
p	0.000		0.014		0.000	
	Pair-wise comparison using Scheffe test					
	Knowledge		Attitude		Behavior	
Undergraduate–house surgeon	0.000*		0.477		0.000*	
Undergraduate–postgraduate	0.998		0.806		0.932	
Undergraduate–faculty	0.997		0.990		0.114	
Undergraduate–private practitioner	0.869		0.911		0.387	
House surgeon–postgraduate	0.000*		0.045*		0.000*	

SD, standard deviation.

\* The mean difference is statistically significant at 0.05 level by using analysis of variance test.

knowledge ( $\chi^2 = 29.369$ ,  $p = 0.000$ ), attitude ( $\chi^2 = 29.023$ ,  $p = 0.000$ ), and practices ( $\chi^2 = 13.648$ ,  $p = 0.009$ ).

### 4. Discussion

Musculoskeletal pain is a major problem among dental personnel that affects efficiency and job satisfaction; the prime reason for this may be attributed to inappropriate workplace ergonomics. In the Indian context where numbers of practicing dentists are steadily increasing, there is a continued increase in prevalence of musculoskeletal problems. The ergonomically incorrect and correct positions to work are illustrated in Figs. 2 and 3, respectively. Ergonomics has been always neglected, from both a

Table 3  
Pearson correlation analysis of knowledge, attitude, and behavior among respondents

	Knowledge		Attitude		Behavior	
	r value	p	r value	p	r value	p
Knowledge						
Attitude	0.399	0.000*				
Behavior	−0.363	0.000*	−0.035	0.582		

\* Correlation is significant at 0.01 levels.

Table 4  
Correlation analysis of demographic variables with knowledge, attitude, and behavior concerning ergonomics among study participants by using the Chi-square test

Demographic variables	Knowledge		Attitude		Behavior	
	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p
Age	3.807	0.433	10.734	0.030*	12.984	0.011*
Sex	0.648	0.723	1.131	0.568	2.060	0.357
Religion	7.022	0.319	6.853	0.335	10.046	0.123
Marital status	29.369	0.000*	29.023	0.000*	13.648	0.009*

\* Significance level at  $p \leq 0.05$ , Chi-square test.



**Fig. 2.** Ergonomically incorrect position to work, leading to excessive bending of the dentist's neck.

knowledge and practice point of view during clinical work. In addition, ergonomics is not part of the syllabus proposed by the DCI for both undergraduates and postgraduates [13]; as a result, the knowledge of ergonomics is disseminated using informal means only. This necessitates assessment of awareness, attitude, and practices toward ergonomic principles during routine dental procedures among dental professionals at different academic positions; i.e., undergraduates, house surgeons, postgraduates, and faculty members.

Results showed that knowledge scores were 52%, which are similar to results found in a study conducted by Garbin et al [19], in which the knowledge of ergonomics was satisfactory among 55.1% of dental students; Bârlean et al [20] observed respondents' self-perceived knowledge about correct working posture to be 52.6%. Whereas in the Indian context, the study conducted by Madaan and Chaudhari [21] regarding overall awareness of ergonomics in dentistry among 3<sup>rd</sup>- and 4<sup>th</sup>-year students and house surgeons, showed much lower scores (19%) compared to the current study. The level of attitude found in the current study is 75%, which is a good reflection of acceptability and willingness to adopt the ergonomic principles in routine dental practice by the study participants.

Compared to attitude scores, the practice scores in the current study were low, i.e., 55%, but are slightly higher than the 38.6%



**Fig. 3.** Ergonomically correct position to work, resulting in less strain of the dentist's neck muscles.

found in the study conducted by Mailoa and Rovani [22]. The slightly higher scores of practices for ergonomics than knowledge during routine dental practice is probably because of informal training and years of clinical experience leading to self-acquired optimal neutral posture.

Among the five different academic positions, the overall mean knowledge was highest among private practitioners (Table 3), which can be explained based on the study results of Leggat and Smith [23] and Akesson et al [24]; that years of clinical experience and the various musculoskeletal disorders necessitates them to revise and update their knowledge regarding ergonomics related to clinical dentistry. The probable reason for the high positive attitude toward ergonomics among postgraduates compared to other academic positions could be because of the likelihood of being affected by various musculoskeletal disorders during undergraduate clinical working periods. Such high positive attitude not only shows room for infusion of awareness but also willingness to put this awareness into practice (Table 3). Among all academic groups, house surgeons showed highest scores of practices, which could be because of the strict supervision of faculty where enough emphasis is placed on ensuring that house surgeons follow ergonomic principles and guidelines during clinical procedures.

The correlation analysis revealed significant positive association between knowledge and attitude ( $r = 0.399$ ; Table 4). However, there was a significant negative correlation between knowledge and practices ( $r = -0.363$ ). This signifies that despite the presence of awareness and positive attitude toward ergonomics during dental procedures, there is a lack of practice of the same. Furthermore, knowledge, attitude, and practice might not share a linear relationship and additional qualitative studies involving in-depth interviews are warranted to explore the relationships among these variables for ergonomics.

Apart from the knowledge, attitude, and practices, the questionnaire form also comprised certain questions pertaining to participants' sociodemographic information such as age, sex, religion, and marital status. There was a significant correlation of age with attitude and practices ( $p = 0.030$  and  $p = 0.011$ , respectively). Ratzon et al [25] explained that, with increasing age, dental professionals experience more pain and suffering from various musculoskeletal disorders, leading to subsequent adoption of new ergonomics practices. A study conducted by Kanteshwari et al [26] showed no correlation between age and musculoskeletal problems.

Marital status was found to be significantly correlated with all three domains. According to Wyke and Ford [27], the less negative behavior of health and a sense of responsibility for family among married people might have accounted for these positive correlations.

In the Indian scenario, according to the syllabus proposed by DCI, ergonomics is not an inherent aspect of each and every disciplinary syllabi of dentistry to be followed in a respective manner at both the under- and postgraduate level [28]. Many textbooks and academic materials comprise various aspects of ergonomics to be used during routine dental procedures, but the lack of significant emphasis on these ergonomic principles can be one of the reasons for the low levels of awareness and practices found in the current study.

Research conducted to date regarding ergonomics in clinical dentistry in India has listed some of the important and most prevalent musculoskeletal disorders, such as low back pain, neck pain, pain in the wrist and hand joints or shoulder, etc., affecting full- or part-time dental practitioners. Neck pain, wrist pain, and back pain are the most common complaints. These musculoskeletal disorders affect as many as one-third of dental practitioners, and Muralidharan et al [29] reported that such musculoskeletal



disorders absorb approximately 40% of all costs related to treatment of work-related injuries.

Emerging trends related to these musculoskeletal disorders calls for a need to concentrate more on ergonomic awareness and practices in clinical dentistry. Also, specific stretching exercises for dentists, including those specifically designed for the trunk, shoulder girdle, hands, and neck, should be encouraged. Selection of the dental professional's stool, patient chair, hand instruments, etc., should be considered from an ergonomics point of view. Policy makers such as DCI and syllabus regulatory bodies of health universities should devise ways to include ergonomics as part of a syllabus, both theoretically and practically.

The inclusion of only one dental institute and dental professionals of only one selected twin city might limit the generalizability of the study results. The possibility of answering affirmatively or acquiescence bias, deviation or faking bad bias, and social desirability or faking good bias, should be considered. Likert scales might be subjected to the halo effect, positive skew, and end-aversion bias. Because the current study was questionnaire based, the representing ability of assessment of awareness, attitudes, and practices of ergonomics in routine dental procedures may not be an accurate reflection of the current situation.

In conclusion, the current study provides an insight into ergonomics for dental professionals during routine dental procedures. There is a requirement for the inclusion of ergonomics in the dental curriculum, and also stressing theoretical knowledge and practical implication during various dental procedures.

Every dental graduate should receive sufficient knowledge and training regarding ergonomics to be used during routine dental procedures, for which DCI can add the topic of ergonomics under the group of *Must Know*; the faculty should guide the students on ergonomic principles and ensure implementation during the clinical hours. Recognition of these musculoskeletal diseases at early stages and prompt treatment will help in reversing the disease process and preventing various disabilities.

## Conflicts of interest

All authors declare no conflicts of interest.

## References

- [1] Cambridge Advanced Learner's Dictionary & Thesaurus. Cambridge University Press.
- [2] Ergonomics for Dental Students [Internet]. American Dental Association; 2011 [cited 2103 Dec 22]. Available from: <http://www.richmondinstitute.com/wp-content/uploads/2012/03/Ergonomics-for-Dental-Students-2011.pdf>.
- [3] Diaz-Caballero AJ, Gómez-Palencia IP, Díaz-Cárdenas S. Ergonomic factors that cause the presence of pain muscle in students of dentistry. *Med Oral Patol Oral Cir Bucal* 2010;15:906–11.
- [4] Bramson JB, Smith S, Romagnoli G. Evaluating dental office ergonomic risk factors and hazards. *J Am Dent Assoc* 1998;129:174–83.
- [5] Yousef MK, Al-Zain AO. Posture evaluation of dental students. *JKAU Med Sci* 2009;16:51–68.
- [6] Pargali N, Jowkar N. Prevalence of musculoskeletal pain among dentists in Shiraz, Southern Iran. *Int J Occup Environ Med* 2010;1:69–74.
- [7] Chowanadisai S, Kukiattrakoon B, Yapong B, Kedjarune U, Leggat PA. Occupational health problems of dentists in Southern Thailand. *Int Dent J* 2000;50:36–40.
- [8] Szymanska J. Disorders of the musculo-skeletal system among dentists from the aspect of ergonomics and prophylaxis. *Ann Agric Environ Med* 2002;9:169–73.
- [9] Akesson I, Lundborg G, Horstmann V, Skerfving S. Neuropathy in female dental personnel exposed to high frequency vibrations. *Occup Environ Med* 1995;52:116–23.
- [10] Marshall ED, Duncombe LM, Robinson RQ, Kilbreath SL. Musculoskeletal symptoms in New South Wales dentists. *Aust Dent J* 1997;42:240–6.
- [11] Milerad E, Ekenvall L. Symptoms of the neck and upper extremities in dentists. *Scand J Work Environ Health* 1990;16:129–34.
- [12] An introduction to ergonomics. Risk factors, MSDs, approaches and interventions. A report of the Ergonomics and Disability Support Advisory Committee (EDSAC) to Council on Dental Practice (CDP). American Dental Association; 2004.
- [13] Dental Council of India. New Delhi, India: Government of India. [cited 2013 Mar 10]. Available from: <http://www.dciindia.org/search.aspx>.
- [14] Jain H, Agarwal A. Current scenario and crisis facing dental college graduates in India. *J Clin Diagn Res* 2012;6:1–4.
- [15] Cagnie B, Danneels L, Van Tiggelen D, De Loose V, Cambier D. Individual and work related risk factors for neck pain among office workers: a cross sectional study. *Eur Spine J* 2007;16:679–86.
- [16] Tendon S. Challenges to the oral health workforce in India. *J Dent Educ* 2004;68:28–33.
- [17] Unruh AM. Gender variations in clinical pain experience. *Pain* 1996;65:123–67.
- [18] Streiner DL, Norman GR. Devising the items. In: Steiner DL, Norman GR, editors. *Health measurement scales: a practical guide to their development and use*. PDQ Statistics. Oxford (UK): Oxford University Press; 1995. p. 15–26.
- [19] Garbin AJ, Garbin CA, Diniz DG, Yarid SD. Dental students' knowledge of ergonomic postural requirements and their application during clinical care. *Eur J Dent Educ* 2011;15:31–5.
- [20] Bărlean L, Dănilă I, Săveanu I. Dentists ergonomic knowledge and attitudes in north-east region, Romania. *Romanian J Oral Rehabilitation* 2012;4:40–3.
- [21] Madaan V, Chaudhari A. Prevalence and risk factor associated with musculoskeletal pain among students of MGM Dental College: a cross-sectional survey. *J Contemp Dent Pract* 2012;2:22–7.
- [22] Mailoa P, Rovani P. Study of ergonomic aspect in daily practice dentistry of some private dental clinic in Makassar [Internet]. Makassar (Indonesia): Hasanuddin University. 2011 [cited 2011 Nov 16]. Available from: <http://repository.unhas.ac.id/handle/123456789/689>.
- [23] Leggat PA, Smith DR. Musculoskeletal disorders self-reported by dentists in Queensland, Australia. *Aust Dent J* 2006;51:324–7.
- [24] Akesson I, Johnsson B, Rylander L, Moritz U, Skerfving S. Musculoskeletal disorders among female dental personnel – clinical examination and a 5-year follow-up study of symptoms. *Int Arch Occup Environ Health* 1999;72:395–403.
- [25] Ratzon NZ, Yaros T, Mizlik A, Kanner T. Musculoskeletal symptoms among dentists in relation to work posture. *Work* 2000;15:153–8.
- [26] Kanteshwari K, Sridhar R, Mishra AK, Shirahatti R, Maru R, Bhusari P. Correlation of awareness and practice of working postures with prevalence of musculoskeletal disorders among dental professionals. *Gen Dent* 2011;59:476–83.
- [27] Wyke S, Ford G. Competing explanations for associations between marital status and health. *Soc Sci Med* 1992;34:523–32.
- [28] Dental Council of India. Syllabus for undergraduate BDS [Internet]. Dental Council of India, Ministry of Health & Family Welfare, Government of India; 2006 [cited 2013 Jan 9]. Available from: [http://www.dciindia.org/BULLETIN\\_ST/pdf\\_files/BDS%20SYLLABUS.pdf](http://www.dciindia.org/BULLETIN_ST/pdf_files/BDS%20SYLLABUS.pdf).
- [29] Muralidharan D, Fareed N, Shanthi M. Musculoskeletal disorders among dental practitioners: does it affect practice?. *Epidemiology Research International* [Internet]. 2013 [cited 2013 Jan 23]. Available from: <http://dx.doi.org/10.1155/2013/716897>.