

The background of the journal cover is a green, slightly blurred image of a calendar page. A white toothbrush is positioned diagonally across the center. Large black numbers '18' and '24' are visible on the calendar grid. Handwritten text in green ink, including 'Dentist appointment' and 'Sun. 11', is also present.

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# Journal of Dentistry and Oral Hygiene

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*Review*

## Posturedontics in dentistry: A review

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Dentistry is a profession that generally produces muscular pain and soreness, they are usually harmless and slow to appear; consequently, the symptoms are usually ignored until they become chronic and permanent lesions are present. When practicing, dentists sometimes are forced to adopt unhealthy postures which depend mainly on factors related to the working conditions. Also, they are exposed to biomechanical risk factors, which indicates that work forced postures, would imply more risk of soreness and presence of skeletal-muscle lesions. These problems could begin to appear at the beginning of the students learning period, by acquiring inadequate postures and working habits that will accompany them for the rest of their professional life, acquiring an unhealthy lifestyle in their work environment. This can ultimately lead to musculoskeletal disorder (MSD). To protect their own health, dentists should seek out and receive education about musculoskeletal health, and injury prevention during work, by relaxation techniques, breathing and stretching exercises, etc. Very little attention is given on impact of dental work on the development of nerve and muscle pathologies. Therefore, the aim of this review was to critically analyze the literature on the prevalence of musculoskeletal pain and possible aetiology of this problem in dental professionals, and the various postural strategies and stretching and strengthening techniques during breaks to ensure long term comfort, efficiency and ease in dental practice.

**Key words:** Dentistry, musculoskeletal disorders, posture, stress management, breathing exercise, meditation.

### INTRODUCTION

The term work-related musculoskeletal disorders (MSDs) refers to the disorders to which the work environment contributes significantly to musculoskeletal disorders that are made worse or longer lasting by work conditions or workplace risk factors. Some of the examples of such workplace risk factors include jobs requiring repetitive, forceful or prolonged exertions of the hands, frequent or heavy lifting, pushing or pulling, or carrying of heavy

objects and prolonged awkward postures. The level of risk depends on the intensity, frequency and duration of the exposure to these conditions. A WMSD can be defined as a condition wherein work-related tasks affect the nerves, tendons, muscles and supporting structures. Conditions can vary from mild recurrent symptoms to severe and incapacitating. Early symptoms of WMSDs include pain, swelling, tenderness, numbness, tingling

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sensation and loss of strength.

## STUDY REVIEW

Several studies have shown that back, neck and shoulder pain are a major problem among dentists. Some studies, which were conducted over a period of 1 to 5 years found that over half of the participating dentists experienced musculoskeletal pain: Shugars et al. (1984) reported 60%, Rundcrantz et al. (1990) cited 72%, Augustson and Morken (1996) reported 81%, Finsen et al. (1997) reported 65% and Chowanadisai et al. (2000) reported 78%. Sixty-two percent of dentists reported at least one musculoskeletal complaint (Rundcrantz et al., 1990). Prevalence of general musculoskeletal pain ranges between 64 and 93%. The highest frequency of lower back pain was experienced by the 30- to 40-year-old age group (Augustson and Morken, 1996). In dentistry, overstrained and awkward back postures are responsible for back pain, repetitiveness for neck and shoulder disorders and psychosocial stressors for back, neck and shoulder complaints. Slight hand neuropathy has also been reportedly to be caused by exposure to high frequency vibration tools. Dental operators often cannot avoid prolonged static postures. Even in optimal seated postures, more than one half of the body muscles are contracted statically, and there is little movement of the vertebral joints. This may result in damaging physiological changes that can lead to back, neck or shoulders pain or musculoskeletal disorders. Therefore, this article provides a brief review of literature on musculoskeletal disorders in clinical dentistry and various methods of prevention with a special emphasis on different techniques for the clinicians and dental operators with an aim that it should help the dental operators to prevent these injuries and to work effectively and efficiently.

## PREVALENCE OF MUSCULOSKELETAL DISORDERS IN DENTISTRY

There are many studies regarding musculoskeletal disorders experienced by persons working in the dental field that have used surveys to assess pain perception. Literature reviews across the world have shown a high prevalence of MSD among dentists (Lehto et al., 1991; Lindfors et al., 2006; Hayes et al., 2009; Morse et al., 2010). Dentists assume static postures at work which require more than 50% of the body's muscle to contract while resisting gravity (Valachi and Valachi, 2003). When the body is repeatedly subjected to such prolonged static postures (PSP), it results in pain, injury, or career ending MSD. MSD has an impact not only on the physical but also on the psychological and social aspects of the practitioners (Leggat et al., 2007; Alexopoulos et al.,

2004). Work-related MSD in severe cases results in frequent absences and finally to early retirement. Although they vary in scope and objective, a targeted look at the upper back, neck, shoulders and wrists is common in all of the studies.

## DIFFERENT MECHANISMS IN THE GENERATION OF PAINS AND SORENESS IN DENTISTS

Lake in 1995 implicates several mechanisms involved in the occurrence of pains and soreness in dentists:

- (1) Elevated work area with permanent static positions of more than 30°, which would produce a reduction of blood flow in the supra spine tendon and would also originate high muscle tension on the trapezoids (Valachi and Valachi, 2003).
- (2) Lack of support of the forearms during repetitive holding of instruments which would compromise different body segments such as spine, shoulder, and wrists (Alexopoulos et al., 2004). The precision required forces the dentist to maintain forced wrist postures which might produce tendinitis or carpal tunnel syndrome (Dong et al., 2007).
- (3) The handling of vibrating instruments is associated with specific lesions such as nerve trapping, early arthrosis and even, with Raynaud syndrome (Dong et al., 2007).
- (4) Forced cervical static postures. In order to obtain a good vision of the mouth, dentists frequently adopt cervical torsions and flexions which end up in pain (Bramson et al., 1998).
- (5) Poor posture when seating. The flexion of the lumbar spine, when seating forward, produces marked pressure increments between the interdiscal spaces (Michalak-Turcotte, 2000).
- (6) Lighting at the work place: the lack or excess of light can generate myopia and irreversible retinal lesions, among others (Unthank and True, 1999).
- (7) Temperature, ventilation and humidity at the work place: If the temperature is high and the air is saturated with humidity, there is exhaustion, increased body temperature and, respiratory and circulatory disorders (Bare and Dundes, 2004).
- (8) Noise at the work place: Intermittent and continuous noise produced by high and low speed instruments is, according to many professionals, the biggest responsible for auditive alterations as years go by (Hyson, 2002; Park, 1978).
- (9) Equipment: Present dental chairs allow adaptation of the patient's position in height, inclination of the torso, flexion or hyper extension of the head of the patient. On the other side, both the dentist's chair as well as the dental assistant's must permit height regulation; allow controlling the height of the back of the chair and even,

regulate the lumbar-dorsal support in an anterior-posterior position and, the padding must be thin and permanent (Finkbeiner, 2001; National Institute for Occupational Safety and Health (NIOSH), 1997).

## IMPACTS OF FAULTY POSTURES

All faulty postures will subsequently result in the following (Morse et al., 2010):

### Neck and shoulder disorders

- (1) Myofascial pain disorder,
- (2) Cervical spondylosis,
- (3) Thoracic outlet syndrome,
- (4) Rotator cuff tendinitis/tears.

### Back disorders

- (1) Herniated spinal disc,
- (2) Lower back pain,
- (3) Sciatica.

### Hand and wrist disorders

- (1) DeQuervains disease,
- (2) Trigger finger,
- (3) Carpel tunnel syndrome,
- (4) Guyons syndrome,
- (5) Cubital tunnel syndrome,
- (6) Hand-arm vibration syndrome,
- (7) Raynauds phenomenon.

There are other factors related with the appearance of pain and muscular lesions such as gender, being higher in female dentists, and age, although this is controversial. Ratzon et al. (2000) reported a high prevalence of non-specific lower back and cervical (55 and 38.3%, respectively) WMSDs amongst dentists, which were well correlated with the time spent sitting. Another study reported a 58% rate of upper segment (neck, shoulder, backbone and upper limb) musculoskeletal pain amongst dentists, with 26% of respondents reporting daily pain and 40% moderate/strong pain (Santos and Barreto, 2001). Moimaz et al. (2003) found that 50.5% of the female dentist respondents reported some problem related to professional performance, most commonly columnar pain. Because the development of WMSD symptoms affects productivity, adaptation strategies for occupationally dangerous tasks must be adopted (Michalak-Turcotte, 2000).

The Ergonomic Standard mandated by the

Occupational Safety and Health Administration (OSHA) recommended that the most efficient and effective way to remedy 'ergonomic hazards' causing musculoskeletal strain should be through engineering improvements in the workstation (Table 1).

## PREVENTION OF NECK, SHOULDER AND BACK PROBLEMS

- (1) Sitting and standing posture should alternate in between the work to reduce postural fatigue and maximize postural variety (OSHA, 2000; Ariens et al., 2001).
- (2) Always try to maintain erect posture with feet flat on the floor
- (3) Sitting posture should be straight or recline slightly in a chair with good back support, and use a good footrest if necessary (Murphy, 1998). Tilt the seat angle slightly forward 5 to 15° to increase the low back curve. This will place your hips slightly higher than your knees and increase the hip angle to greater than 90°, which may allow for closer positioning to the patient (Harrison et al., 1999; Chaffin et al., 1999).
- (4) When positioning patients, make sure your shoulders are relaxed and the forearms approximately parallel with the floor. Patients should be placed in a semi-supine position for mandibular procedures and a supine position for maxillary procedures.
- (5) Use light weighted equipment that is comfortable to use.
- (6) Adjust armrests to support elbows in the neutral shoulder position. Keep elbows and upper arms close to the body and do not raise and tense the shoulders while working. Also, ensure that hand postures are not deviated because this could lead to wrist problems (Milerad and Ekenvall, 1990).
- (7) Avoid long appointments as far as possible, so that you can change posture and relax the upper extremities.
- (8) Directional stretching involves a rotation, side bending or extension component that generally is in the opposite direction of that which the operator frequently works.
- (9) Aerobic exercise should be performed three to four times a week for at least 20 min. Aerobic exercise increases blood flow to all of the tissues in the body and improves their ability to use oxygen, improves cardiovascular and cardiorespiratory functions (Marshall et al., 1997).

### Neck, hand and finger stretching

Figure 1 shows the neck, hand and finger stretching pattern.



**Table 1.** Symptoms of different types of MSD.

<b>Type of musculoskeletal disorders</b>	<b>Symptoms</b>
<b>Neck and Shoulder disorders</b>	
Myofascial pain disorder	Pain and tenderness in the neck, shoulder and arm muscle. Painful trigger points upon touch.
Cervical spondylosis	Intermittent/chronic neck and shoulder pain or stiffness, headache, hand and arm pain, numbness, tingling and clumsiness.
Thoracic outlet syndrome	Pain in shoulder, arm or hand, numbness, tingling of fingers, muscle weakness/fatigue, cold arm or hand.
Rotatory cuff tendinitis/tears	Pain and stiffness in shoulders associated with backward and upward arm movements. Weakness of rotator cuff muscle.
<b>Hand and wrist disorders</b>	
DeQuervain's disease	Pain in thumb and wrist area when grasping, pinching, twisting.
Carpal tunnel syndrome	Hand or finger numbness, pain, tingling, burning, clumpiness. Eventual muscle weakness and atrophy. Symptoms often worse with increased activity.
Guyon's syndrome	Symptoms begin with feeling of pins and needles in ring and index fingers.
<b>Back disorders</b>	
Herniated spinal disk	Back and leg numbness, tingling pain, weakness. Worsens with coughing, sneezing, sitting, driving, bending forward.
Lower back pain	Pain, stiffness in lower spine and surrounding tissues.
Sciatica	Pain from lower back or hip radiating to the buttocks and legs. Leg weakness, numbness or tingling. Possible causes are prolapsed intervertebral disc pressuring the sciatic nerve, worsened with prolonged sitting or excessive bending/lifting.

## Stress management

Operators may use various stress-reduction techniques to decrease stress-related muscular tension. These include breathing techniques, progressive relaxation, visualization, massage, aerobic exercise, meditation or yoga (Hanten et al., 2000).

Find a quiet place, make sure you will not be disturbed for 5 or 10 min, and take these five steps:

- (1) Sit in a comfortable chair with your spine upright and with your palms on your abdomen.
- (2) Make your breath conscious. Breathe through your nose, with complete awareness of your inhalation and exhalation.
- (3) Make your breath complete, with the assistance of your abdominal muscles. Inhale completely and balloon your abdomen out, then exhale and squeeze your abdomen toward your spine. Repeat this cycle 10 times.

(4) Put your right hand on your heart and consciously feel your breath moving through your heart.

(5) Using the rhythm of your heartbeat or pulse, whichever is easier for you to find, inhale and exhale the same count in and out whether four, six, or eight beats. Repeat this practice 10 times.

## Breath meditation

### ***Focused breathing meditation***

The lack of sufficient oxygen can increase stress, making individuals feel anxious. Focused breathing focus their attention on the tip of the nostrils where air must enter and exit. They then feel the air as it moves into the body and out of the body, in a calm, relaxed manner. The increased oxygen helps to relax muscles and increases calming chemicals in the brain.



Figure 1. Neck, hand and finger stretching.

### ***Gentle breath meditation: Technique***

Sit in a chair with your back straight but supported and have your feet flat on the floor without crossing your legs. Rest your arms on top of your legs with your forearms facing up or slightly opened ensuring your arms are uncrossed. Let your hands find their own place. Do not worry too much about your posture just be in a position that is comfortable for you using this description as a guide. It is unnecessary to be sitting in any awkward cross-legged or lotus positions for your meditation to be effective. Once comfortable close your eyes with the intention of connecting to yourself (Most people close their eyes to shut out the world, distract or numb themselves, which is not the purpose of meditation) ([www.universalmedicine.com.au](http://www.universalmedicine.com.au)).

Mechanically and intentionally begin by breathing in gently, focusing only on the in-breath. Breathe in your normal rhythm, the breath does not need to be slow or long and definitely not soft but gentle. Focus the mind on the gentle in-breath at the tip of your nose. Make each

and every in-breath gentle.

After a few breaths, you should feel a cool breeze at the tip of your nose towards the upper part of the nostril (If your breath is entering around the entire circumference or rim of the nostril you are breathing a soft breath not a gentle one).

Bring your awareness to the coolness at the tip of the nose during the in-breath. Should the mind get busy or begin to wander, simply bring the attention back to tip of the nose.

If you find yourself nodding off then simply take a longer, deeper but gentle in-breath. Whilst developing the gentle in-breath do not worry about the out-breath just allow it to take its own course.

Do not try and control your breath, just observe it, your breath will develop its own natural rhythm.

Once the in-breath is cool at the tip of the nose, the mind is focused and a natural rhythm has developed, begin to bring your attention to the out-breath.

Keeping the awareness on the cool, gentle in-breath bring your attention to the out-breath. Begin to mechanically

and intentionally breathe out with the same gentleness as the in-breath. As the out-breath becomes gentle, become aware of the warmth at the tip of your nose this time at the lower part of your nostril. As you breathe out, focus your attention on the warmth at the tip of the nose.

Continue to breathe with your natural rhythm do not try to control your breath. Continue observing and focusing your attention on the cool in-breath as you breathe in and warm out-breath as you breathe out.

Once both the in-breath and the out-breath feel gentle and your awareness is at the tip of the nose begin to release your body and allow it to also become gentle. With the next out-breath, release your body by depressing the chest and shoulders mechanically but gently. Consciously release the out breath instead of the body simply deflating.

Allow tightness or hardness in your body to release on the out-breath and let your body become gentle. This allows the fire energy of the soul to diffuse into your body and facilitate healing.

Continue to be aware of the gentle quality of the in- and out-breaths, let the mechanical aspect go and your natural rhythm to take over. Bring your attention back to the coolness at the tip of the nose should your mind wander. After 5 to 10 min of this, you are ready to end the meditation. Open your eyes and gently go about your business.

### **Square breathing**

Imagine in your mind travelling round a square. Breathe in slowly over a count of 3, pause for a slow count of 3, breathe out slowly over a count of 3, pause for a count of 3, and repeat.

The aforementioned tip comes from Craigentiny's free Beat Your Dental Fear e-Course.

### **Belly breathing**

When we panic, we often experience shortness of breath. Our first instinct is to inhale, to get our breath back. But this does not work, because in order to take a deep breath in, you have to first exhale all the air in your lungs. Otherwise, all you get is just another laboured, shallow breath from the chest. Belly breathing helps you with getting good deep breaths, and helps to relax and calm yourself.

(1) Place one hand so it straddles your belt line and the other on your chest, right over the breastbone. You can use your hands as a simple biofeedback device. They will tell you what part of your body, and what muscles, you are using to breathe.

(2) Open your mouth and sigh as if someone had just told

you something really annoying. As you do, let your shoulders and the muscles of your upper body relax downward with the exhalation. The point of the sigh is not to completely empty your lungs – but to relax the muscles of your upper body.

(3) Pause for a few seconds.

(4) Close your mouth. Inhale slowly through your nose by pushing your stomach out. That is right, push your belly out, just like newborn infants do. This is not a beauty contest. When you have inhaled as much air as you comfortably can, just stop. You are finished with that inhale.

(5) Pause briefly. How long you decide. Everybody has different size lungs and counts at a different rate. Pause for whatever time feels comfortable, and be aware that when you breathe this way, you are taking larger breaths than you are used to. For this reason, you should breathe more slowly than you are used to. If you breathe at the same rate you use with small, shallow breaths, you will probably get a little light headedness from over breathing. It is not harmful. Light headedness and yawning are simply signals to slow down as follows:

(a) Open your mouth. Exhale through your mouth by pulling your stomach in.

(b) Pause

(c) Close your mouth and go back to the inhale.

(d) Continue for a few minutes until you feel satisfied.

Once you can belly breathe comfortably, you should practice this technique every hour on the hour for a minute or so (you do not need to interrupt what you are doing). And obviously, only during waking hours at 1, 2, 3 pm and so on. Over time (a week's practice or thereabouts), it will become much easier to switch to belly breathing when you feel panic coming on. The following technique comes from Dave Carbonell's excellent "Panic Attacks Workbook".

### **Progressive muscle relaxation**

This is another popular relaxation technique. It works by isolating one muscle group, making the muscles go tense for 8 to 10 s, and then letting the muscle relax and the tension go. This technique does not work so well in the dental context, because it takes quite a long time until you have gone through all the different muscle groups.

However, it really does help to relax your muscles. When we are anxious or when we anticipate pain, we tense our muscles (with many people literally "gripping the chair").

You may find out that making an active effort to relax your muscles can really help. Concentrate on finding areas of tension in your body and relaxing them, one after the other.

Common areas of tension include your hands (you may want to place them loosely on your belly, that way, you can check that you are breathing through your belly at the same time), the shoulders, the back, or indeed your whole body.

### Perform exercises during short breaks

(1) With the elbow at shoulder height and at 90° angle, gently pull the arm across the front of the body with opposite arm. Look over the shoulder being stretched and hold for two to four breathing cycles. Repeat with the other side.

(2) With the knee wider than the shoulder width, bend to the left side, resting full body weight through the left elbows on the left knee. Stretch the right arm overhead and look towards the ceiling. Hold for two or four breath cycles. Repeat on the other side.

(3) Upper trapezius stretch-anchor the right hand behind the seat of the operator chair, gently bring the left ear towards the left armpit. Hold for a two to four breathing cycles. Repeat on other side.

(4) Assume a neutral head posture (ears over the shoulders) do not let the head move forward throughout the exercise.

(5) Lift the chest upwards, position the arms at sides with fingers pointing upwards and palms facing forwards. Roll the shoulders back and down squeezing the shoulder blades downward and together. Hold for long breathing cycle. Repeat five times (Nagpal, 2012).

### CONCLUSION

This review clearly demonstrates that MSD represents a significant burden for the dental profession. Adopting adequate postures in clinical practice and having a favorable work environment could reduce the MSDs. Therefore, it is of vital importance to promote the occupational health and prevention programs regarding ergonomic postures which must be acquired by the dentists during their clinical practices.

Work related strain injuries are on the rise in dentistry. This problem can be managed by using a multi factorial approach that includes proper postural positioning, frequent breaks during work, stretching and breathing exercise, etc. The importance of following proper ergonomic principles should be realized so that these problems can be avoided by increasing awareness of the postures used during work and following healthy practices to reduce the stress of dental work on the practitioner's body.

### Conflict of interest

Author have none to declare.

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*Full Length Research Paper*

# Factors' affecting mother's brushing technique of less than five years age children in Pakistan

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Proper tooth brushing technique may help to protect the accumulation of plaque and reduce the prevalence of dental caries and gingivitis in children. The mothers play an important role in uptake of encouraging dental health practices. A cross sectional study was conducted among mothers in Karachi, Pakistan from October to December, 2014. A total of 281 mothers were selected by using consecutive sampling technique. Data were collected by using a semi structured pretested questionnaire. Socio-demographic and behavioral factors related to brushing technique were identified by applying logistic regression model. Majority of these mothers (82%) were having improper brushing technique. After adjusting socio-demographic variables, the odds of having improper brushing technique among illiterate mothers were five times (AOR = 5.34, CI = 2.03 to 14.4) more as compared to literate mothers. The other factors that showed significant association in multivariate analysis were mothers who had house hold income <10,000 Pakistan rupees and mothers who had negative attitude regarding dental caries and oral hygiene. This study concluded that majority of these mothers were not aware about the proper technique of brushing teeth and factors affecting brushing techniques were identified as socioeconomic status and low level of education found significantly associated with behavioral practices.

**Key words:** Brushing technique, mothers, less than 5 years children, Pakistan.

## INTRODUCTION

Proper tooth-brushing programs may help to improve certain oral diseases, such as chronic gingivitis and caries which are considered as major public health problems (Koerber et al., 2005). Mother's positive attitude helps in behavior modification and plays an essential role in encouraging the proper dental health practices. Studies suggest that an increase in severity of dental caries is because of the unawareness and ignorance of

mothers who did not instruct their children for healthy lifestyle from birth (Huebner and Riedy, 2010). Moreover, tooth brushing habits learnt in the early years of life are deeply ingrained in child's mind and leads to the implementation of good oral hygiene methods in later life (Khadri et al., 2010).

*Streptococcus mutants* and plaque levels were significantly lower among children who had initiated tooth

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brushing by age 12 months, and had mothers that brushed their own teeth regularly (Mohebbi et al., 2008; Habibian et al., 2002). Mothers should have focused on the significance of the removal of bio-film that covers the dental surface with the support of the proper tool for the oral health maintenance. It is accomplished by mechanical way, which includes fluoride containing toothpaste, dental flossing and tongue scraping. Other actions for maintaining proper oral hygiene, for example, Xylitol chewing gums, antibacterial agents, for instance chlorhexidine and iodine were also used for effective management of dental caries (Young et al., 2010).

Researchers found that more than 40% of mothers were not aware of the proper tooth brushing technique, such as brushing for 2 min, the need for a parental supporter for children up to the age of eight to ten years and using a pea-size amount of fluoride toothpaste. Besides that regularity of brushing teeth is also important at least twice a day or more, ideally after meals in the morning and before going to bed (Adams et al., 2009; Zero et al., 2012). Furthermore, co-operation of children during tooth brushing were found to be a major factor for how often children and parents brush their teeth (Suzuki, 1990; Tiberia et al., 2007). Studies showed that tooth brushing is one of the consistent element of obliging messages given to children, adolescents and adults in programs to promote oral health. The other factors like socioeconomic, demographic and behavioral were found related to the practice (Beikler and Flemmig, 2011; Villalobos-Rodelo et al., 2006) and tooth brushing fluctuations across these factors were identified.

Parents, especially mothers, were found prevailing figures in determining children's behavior who decide the type of toothbrush, the amount of toothpaste used and the pattern of brushing their children's teeth. Furthermore, the earlier the control, the more likely it will determine the attitude and behavior of their children, which may be hard to change afterwards in life.

Proper brushing technique among mothers is very important for the prevention of early childhood caries and gum diseases like gingivitis in children, but there is lack of research in this important aspect in Pakistan. This study is distinctive to determine the brushing technique among mothers and it is also helpful for the initiation of an oral health awareness program to improve the perception and behavior of good oral hygiene.

The objective of this study was to determine the factors affecting the brushing technique among mothers of less than 5 years age children in Karachi, Pakistan.

## METHODOLOGY

### Study area, design and period

A cross sectional study was conducted among mothers attending a tertiary care hospital in Karachi, Pakistan from October to December, 2014.

### Sample size and sampling technique

A sample size of 281 mothers was calculated by using the proportion of mother's knowledge regarding oral hygiene (24%) with 95% confidence interval and a 5% margin of error. The data was collected by using consecutive sampling technique.

### Instrument and data collection

Mothers above 18 years of age, having a child less than 5 years were included in the study and were interviewed using a semi structured pretested questionnaire. The questionnaire was based on socio-demographic characteristics of mothers, and behavior and perceptions regarding brushing technique. Data were collected after taking written consent from the mothers and they were informed about the purpose and benefits of the study.

### Scoring

A scale was used in measuring behavior and perceptions which was based on nine items containing statements about brushing technique. For each correct answer, a score of 1 point was given, while a score of 0 (zero) point was for incorrect answer. A cut off point for improper brushing technique was 1 to 4 score and a score of 5 points or more were given for proper brushing technique.

### Data management and analysis

Data was entered and analyzed using the software Statistical Package for Social Science (SPSS) version 16. Descriptive statistics were used to describe socio-demographic characteristics. For inferential statistics, scoring was performed for proper/improper brushing techniques. The association between the converted scores and other independent variables were determined through logistic regression analysis. Adjusted odds ratio and their 95% confidence intervals were calculated. The independent variables having p-value  $\leq 0.25$  were included in the multivariate analysis. The P-value of  $< 0.05$  has been considered significant.

### Ethical consideration

The ethical approval was obtained from the Institutional Review Board, Dow University of Health Sciences, Karachi. A written consent was obtained from the study participants.

## RESULTS

### Descriptive statistics

The mean age of mothers was  $29 \pm 4.1$  years. Majority (90%) of the participants were married. About 51% mothers had more than two children. Regarding educational status, 57% of mothers were illiterate. About 20% women were working on daily wages, while 68.7% were earning less than 10,000 Pakistani rupees. Majority (86.3%) of mothers were Muslims by religion.

Mean score of behavior regarding brushing technique among mothers were 1.18 (SD  $\pm$  0.38). Majority of the mothers had improper brushing technique (82%) towards the maintenance of oral hygiene.

For, mother's assessment regarding brushing technique, only 6.8% mothers knew about the time spend on brushing and half of the mothers (59.4) responded that brushing is necessary after breakfast and before going to sleep. Only 22.1% mothers were aware about the correct methods of brushing and 14.2% had reported that replacement of the toothbrush is essential after 3 months. Unfortunately only few mothers (5.3%) knew about the need for parental assistance for children during tooth brushing at the age of 10 years. Regarding use of fluoridated toothpaste, 37.7% mothers affirmed that they were using it and only 13.9% were aware about that fluoride helps to strengthen the teeth. For mother's perception regarding the frequency of brushing, only 18.5% were aware that two times a day brushing is necessary while 69.8% were using tooth brush with paste (Table 1).

The univariate analysis showed that odds of having improper brushing technique among illiterate mothers were five times (OR=5.36, CI=2.67-8.11, p value<0.001) more as compared to literate mothers. The odds of having improper brushing technique among mothers who had household income <10,000 Pakistani rupees were 4 times (OR=4.52, CI=1.82-11.1, p value 0.001) more as compared to mothers having household income >10,000 Pakistani rupees. The odds of having improper brushing technique among mothers who were divorced were 2 times (OR=2.43, CI= 1.67-3.56, p value 0.02) more as compared to married women. The odds of having improper brushing technique among mothers who had negative attitude regarding dental caries and oral hygiene related statements were 2 times (OR=2.12, CI=0.89-4.62, p value <0.001) more as compared to mothers who had positive attitudes.

### Multivariate analysis

After adjusting socio-demographic variables, the odds of having improper brushing technique among illiterate mothers were five times (AOR=5.34, CI=2.03-14.4) more as compared to literate mothers. The odds of having improper brushing technique among mothers who had house hold income <10,000 Pakistan rupees were four times (AOR=4.62, CI=1.87-11.1). The odds of having improper brushing technique among mothers who had negative attitude regarding dental caries and oral hygiene related statements were 2 times (AOR=2.14, CI=0.93-4.70) more as compared to mothers who had positive attitudes (Table 2).

### DISCUSSION

In this study, only 18.1% of Pakistani mothers were practicing correct brushing technique. Factors affecting the brushing technique among mothers less than 5 years

of age children were socioeconomic status, low level of education and behavioral practices.

In this study, only 18.1% mothers responded that brushing is necessary twice a day, in contrast to study conducted at Manchester (UK) reporting that 71% mothers brushing their children's teeth twice a day and only 40% mothers were found brushing their children's teeth inadequately (Blinkhorn et al., 2001).

Another study conducted at Michigan reported that frequency of tooth brushing was a significant predictor in promoting good oral health of children by mothers (Akpabio et al., 2008). It is dreadfully essential to teach a child proper health habits as early as possible, whereas in our study, majority of the mothers (65.5%), responded that they taught regularly their children, but unfortunately their knowledge regarding oral health was not adequate to practice correct brushing technique.

A study conducted at Bialystok, Poland showed that children usually spend time on brushing too diminutive and focused mostly on the front teeth (Joanna and Ewa, 2012). In this study, unfortunately majority of mothers were not aware about spending time on brushing.

In this study, majority of the mothers did not know about the brushing method. A similar study conducted at lasi, Romania showed that 50% of mothers were lacking in skills of cleaning children's teeth (Marinela et al., 2008). It is very important that mothers should have adequate information and motivation to maintain good oral health for preventing dental caries and other gum diseases of their children.

Study conducted at Thailand showed that brushing technique should be brushing frequency of teeth at least twice a day or more, ideally after meals in the morning and before going to bed. When the first teeth erupt, there should be supervised brushing from adults up to the age of eight years (Zero et al., 2012). In the present study, 59.4% mothers agreed that brushing is necessary after breakfast and before going to sleep and only few mothers (5.3%) responded that child's tooth brushing should be under the supervision of mothers/care givers at the age of eight to ten years.

In the present study, only 15.3% mothers were aware about the dental floss. A study conducted at Norway showed that mothers who flossed regularly were more likely to have children who regularly flossed their teeth (Rossow, 1992). Flossing is very important for removing inter-proximal debris; one study found that only 13% of 622 adult flossed daily and 52% admitted that they never floss (Segelnick, 2004).

In our study, 37.1% mothers responded that they use toothpaste containing fluoride. Similar study conducted at Bangalore, India reported that parents did not know whether the tooth paste contain fluoride or not and what should be the appropriate concentration of fluoride necessary for pre-school children (Vinay et al., 2011). Another study showed that mother's knowledge about fluoride was not enough (Suresh et al., 2010). In this



**Table 1.** Assessment regarding brushing technique among mothers (n=281).

Variable	Mother's response (%)
Frequency of brushing (Correct response)	18.5
Time spend on brushing (Correct response)	6.8
Brushing after breakfast and before sleep (Correct response)	59.4
Brushing method (Correct response)	22.1
Replacement of toothbrush (Correct response)	14.2
Supervise Child's tooth brushing (age) (Correct response)	5.3
Mothers taught regarding tooth brushing (Correct response)	65.5
Use of fluoridated tooth paste (Correct response)	37.1
Use of dental floss (Correct response)	15.3
Tool for brushing (Correct response)	69.8
Fluoride function (Correct response)	13.9

**Table 2.** Association of behavior level regarding tooth brushing technique and the independent variable included in the study (Adjusted).

Variable	Improper brushing technique	AOR* (95% CI)	p-value
<b>Mother's age (Years)</b>			
18-29	123	0.64 (0.27-1.54)	0.36
30-39	107	1	
<b>Marital status</b>			
Married	204	1.39 (0.28-1.38)	0.10
Divorced	26	1	
<b>No of children</b>			
≥2	117	0.49 (0.21-1.18)	0.14
≤2	113	1	
<b>Education</b>			
Illiterate**	159	5.34(2.03-14.4)	<0.001
Literate	71	1	
<b>Occupation</b>			
Working mothers	37	0.90 (0.36-2.24)	0.84
Non working mothers	193	1	
<b>House hold income</b>			
≤10000PKR*	183	4.62 (1.87-11.1)	0.001
≥10000PKR	47	1	
<b>Religion</b>			
Muslim	202	0.86 (0.12-1.54)	0.90
Non Muslim•	28	1	
<b>Attitude</b>			
Negative attitude	6	2.14 (0.93-4.70)	<0.001
Positive attitude	51	1	

\*PKR: Pakistani rupee; \*\*Illiterate (cannot read and write) •Non muslim (Christians and Hindus). P value was calculated by logistic regression and significant at the ≤0.05 level. AOR\*: Adjusted odd ratio.

study only few 13.9% mothers were aware about the function of fluoride and considered it preventive for dental caries.

In this study, mothers' negative attitude regarding dental caries and its prevention were found strongly associated with improper brushing technique (p value <0.001). A survey conducted in London reported that poor attitude of parents towards oral health of infants and young children were found to be associated with increased caries prevalence (Hinds and Gregory, 1995).

A study conducted at Mexico showed that people of lower socioeconomic status have fewer resources to meet oral health challenges: less free time, less money to buy toothpaste and toothbrushes (Vallejos-Sánchez et al., 2006). In our study, mothers who had income less than 10,000 Pakistani rupees were found to be associated with improper brushing technique.

In the present study, mother's low level of education was found to be associated with the improper brushing technique. The study conducted at England, reported that parents coming from the deprived areas and with lower educational levels have a low level of oral health knowledge. Mothers with higher education have a better knowledge regarding the oral hygiene practices and the importance of deciduous teeth. It has been suggested that the parents in general, improved level of education is considered to be an appropriate source of information and getting aware about oral health (William et al., 2002).

## Conclusion

This study concluded that majority of the mothers were not aware about the proper brushing technique. The factors identified were socioeconomic status and low level of education found significantly associated with behavioral practices.

## RECOMMENDATION

Mothers played an imperative role in children's healthy habits from birth to. This study suggested to design oral health awareness programs for mothers so that suitable, appropriate and feasible model for health promotion of dental health. The most important recommendation is uplifting of socioeconomic status of mothers. In future, analytical and community based studies are recommended.

## Competing interests

The authors declare that they have no competing interest.

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*Full Length Research Paper*

## Comparative analysis of variation in morphology of rugae pattern amongst sibling pairs

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Palatal rugae are epithelial ridges on anterior part of palatal mucosa on each side of mid palatine raphe behind incisive papilla. The aim of this study was to compare the uniqueness of rugae pattern amongst sibling pairs, determine the predominant rugae pattern and to assess the gender difference in rugae forms in 5 to 15 years old children and its utility in sex determination. Casts of 50 sibling pairs aged 5 to 15 years were obtained and the rugae pattern was analyzed using Santos's classification. The association of gender with the number of rugae pattern was tested using Chi-square test and unpaired t-test. A significant level of 5% was considered as critical value. All analysis was done using the Statistical Package of Social Sciences 17.0 software (SPSS Inc., Chicago, IL). Rugae were almost uniformly distributed among males and females. The rugae patterns were uniquely structured and there was no evidence of similarity amongst siblings. The most observed form of rugae was curve (30.89%) followed by line (21.07%) and sinous (19.62). Palatal rugae serve as a reference landmark in various dental treatment modalities and can be a valuable tool for personal identification. Rugae pattern may be an additional method of differentiation between the Indian male and female children.

**Key words:** Palatal rugae, palatoscopy, identification tool, forensic odontology.

### INTRODUCTION

Palatal rugae are epithelial ridges on anterior part of palatal mucosa on each side of mid palatine raphe behind incisive papilla (Bajracharya et al., 2013). Anatomically, the rugae consist of oblique ridges that radiate out tangentially from the incisive papillae.

Histologically, the rugae are stratified squamous; mainly para keratinized epithelium on a connective tissue base, similar to the adjacent tissue of the palate (Gray, 2008). Embryologically, differences in the rugae cores from human embryo of over 20 weeks are observed (Datta,

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2007). Owing to their anatomical position in oral cavity, these asymmetric ridges provide excellent post mortem details in human identification as they remain well protected from trauma and incineration (Bajracharya et al., 2013).

The study of palatal rugae is called as Rugoscopy/Palatoscopy which was first proposed in 1932, by Spanish investigator Troban Hermas (Rajan et al., 2013). Presently, rugoscopy also encompasses various fields of dentistry including forensic odontology, prosthodontics and orthodontics. Palatal rugae are highly individualistic and distinctive and act as an adjunct to other methods of identification which mainly include dental record, finger prints and DNA comparisons (Shetty and Premalatha, 2011). Amongst these palatoscopy is a lesser known and unusual technique but is preferred sometime because of its low utilization cost, simplicity and reliability in forensic sciences (Rajan et al., 2013; Shetty and Premalatha, 2011).

This study was attempted with the following aims and objectives: to compare the uniqueness of rugae pattern amongst sibling pairs; to determine the predominant rugae pattern in 5 to 15 years Indian children; and to assess the gender difference of rugae forms in 5 to 15 years old children and its utility in sex determination.

## MATERIALS AND METHODS

Fifty sibling pairs aged 5 to 15 years were randomly selected from outpatient Department of Paedodontics and Preventive Dentistry and designated as samples. The sample comprised of 50 males and 50 females. Only subjects who were healthy, free of congenital abnormalities, inflammation, trauma or orthodontic treatment were considered. Subsequent to the informed consent from subject's parents/guardian, maxillary arch impressions were made using addition silicone as impression material owing to its high tear strength and accuracy. The casts were then made by pouring type 3 dental stone in the impressions. Casts selected for the study were obtained from chosen subjects and were free of any air bubbles or voids, especially in the anterior one-third of the palate.

Rugae patterns on the cast were delineated using black graphite pencil under adequate light and were subsequently analyzed using Santos's classification (Caldas et al., 2007) which is a practical classification based on the rugae location. This classification indicates and characterizes the following: one initial rugae, the most anterior one on the right side is represented by a capital letter; several complementary rugae, the other right rugae are represented by numbers; one sub-initial rugae, the most anterior one on the left side is represented by a capital letter; several sub-complimentary rugae, the other left rugae are represented by numbers.

Rugae patterns (Figure 1) were recorded as per the classification and results were tabulated. The numbers and letters given to each rugae based on its form is as shown in Table 1 (Caldas et al., 2007).

### Statistical analysis

The association of gender with the number of rugae and pattern was tested using Chi-square test. Association between rugae forms

and gender were tested using unpaired t-test. A significance level of 5% was considered as critical value. All analyses were done using the Statistical Package of Social Sciences 17.0 software (SPSS Inc., Chicago, IL).

## RESULTS

Total rugae recorded in 100 samples were 1447 which were almost uniformly distributed among males (727) and females (720) (Figure 2). The rugae patterns were uniquely structured and patterned in all the individuals and there was no evidence of similarity amongst siblings. Variable rugae patterns were observed in each working cast depicting that every individual has a different set of rugae pattern. However, the most observed form of rugae was curve (30.89%) followed by line (21.07%) and sinuous (19.62). Point (0%) amongst all other rugae form was the most infrequently observed (Figure3).

Contrast in rugae pattern was noticed on comparing both sexes. Curve (29.57%) and sinuous (20.35%) forms were frequently seen in males, while in females curve (32.22%) and line (22.5%) forms were more common (Figure 4).

An uneven distribution was recorded on both sides. Wherein, the number of rugae observed on right side (761) was more than on left side (686). However, curve was the most repeated pattern seen on both the sides (Figure 5).

## DISCUSSION

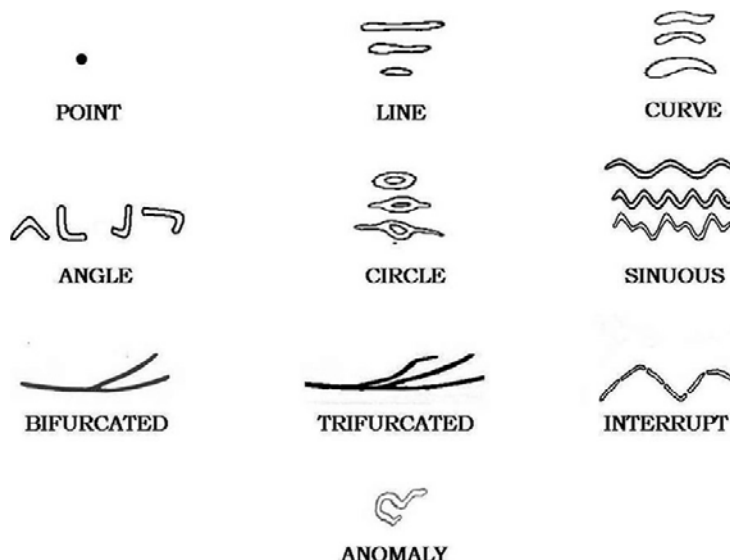
Rugae as defined by Glossary of Prosthodontic Terms-8 are anatomical folds or wrinkles (usually used in the plural sense); the irregular fibrous connective tissue located on the anterior third of the palate (The Academy of Prosthodontics, 2005). Palatal rugae also known as plicae palatinae transversae or rugae palatina as these are transversely running crests in mammals, which are exclusively formed by the mucosa of the hard palate except where an ossified base can be distinguished (Rajan et al., 2013; Saraf et al., 2011).

Every individual presents with unique and relatively permanent palatine rugae patterns as observed in this study. They remain reasonably stable during the patient's growth; thus, they may serve as suitable reference points from which the clinician can derive the reference planes necessary for longitudinal cast analysis (Rajan et al., 2013). Also, their fingerprint like uniqueness help to establish identity of an individual through discrimination (via casts, tracings or digitized rugae patterns) thus are considered as an alternative source of information in forensic (English et al., 1988; Saraf et al., 2011).

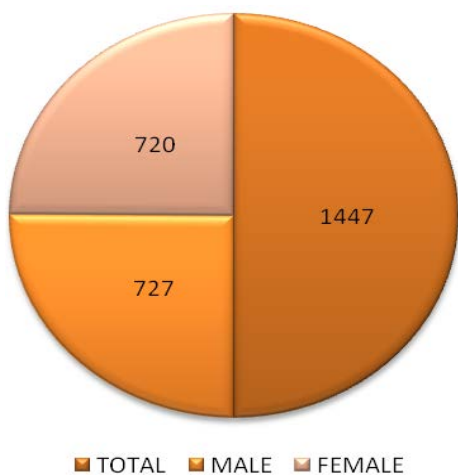
The inimitable property of palatal rugae to retain their shape throughout the life is derived from their structural element containing glycosaminoglycans which by its

**Table 1.** Matins dos santos' palatal rugae classification.

Rugae type	Anterior position	Other position
Point	P	0
Line	L	1
Curve	C	2
Angle	A	3
Circle	O	4
Sinuuous	S	5
Bifurcated	B	6
Trifurcated	T	7
Interrupt	I	8
Anomaly	An	9



**Figure 1.** Different forms of palatal rugae.



**Figure 2.** Distribution of rugae pattern amongst male and female.

hydrophilic nature causes the tissues to swell and contributes to the maintenance of the shape of rugae throughout life. Fibroblasts and collagen fibers beneath the thickened epithelium contribute to the stability of palatal rugae (Shetty and Premalatha, 2011).

This study was to determine the uniqueness of rugae pattern amongst sibling pairs, establish the predominant rugae pattern in 5 to 15 years Indian children and to assess the gender difference of rugae forms in 5 to 15 years old children and its utility in sex determination.

In the present study, the rugae patterns were uniquely structured and patterned in all the individuals and there was no evidence of similarity amongst siblings. Similar observations were recorded by Ibeachu et al. (2014) who compared rugae patterns amongst different ethnic groups of Nigeria. Comparable results were obtained by Virdi et al. (2009). Indira et al. (2011) also concluded that rugae pattern is unique for each individual suggesting heredity

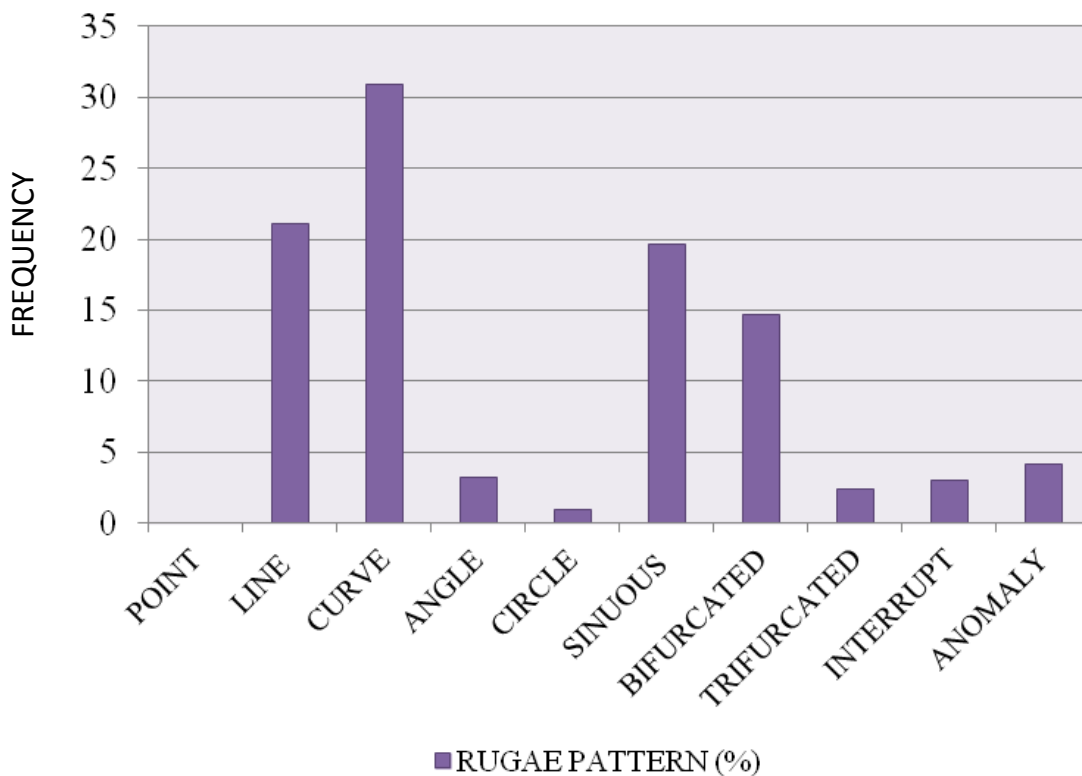


Figure 3. Representation of variation in the forms of palatal rugae pattern.

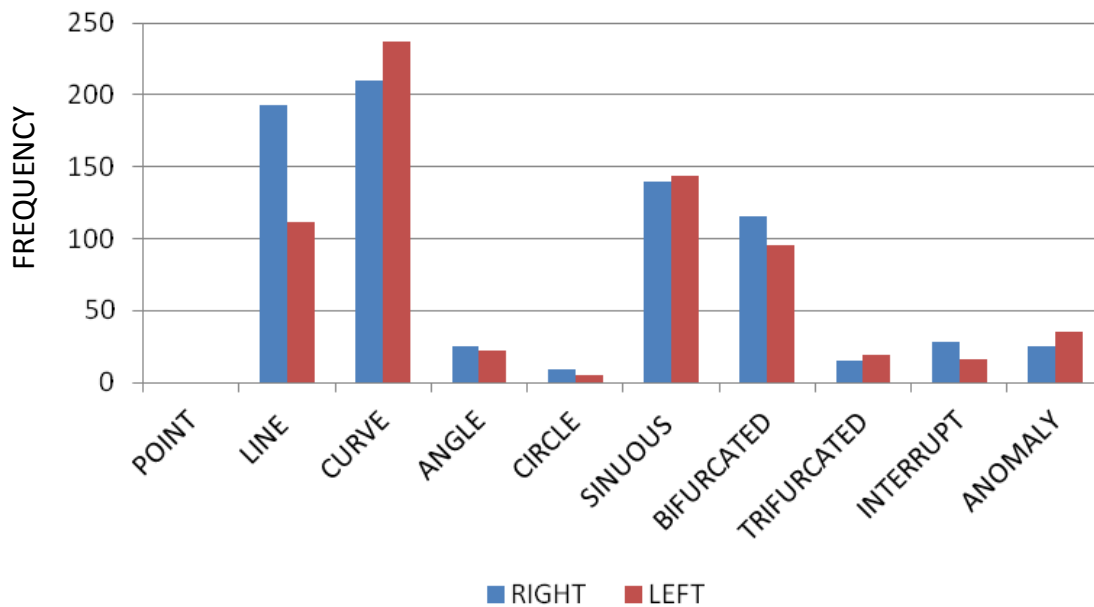
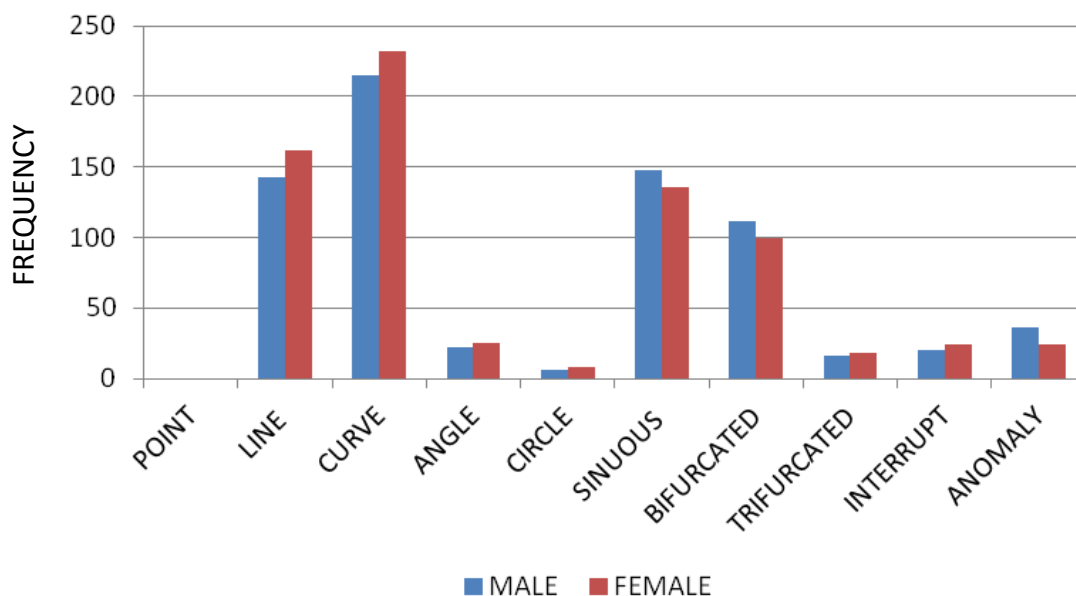


Figure 4. Variation in the distribution of different forms of rugae pattern on right and left side.

does not play an important role in determining the orientation of rugae pattern. This finding is in congruity

with results obtained in the similar studies conducted earlier (English et al., 1988; Shetty et al., 2005).



**Figure 5.** Variation in the distribution of different forms of rugae pattern among males and females.

The most observed form of rugae was curve (30.89%) followed by line (21.07%) and sinuous (19.62). Point (0%) amongst all other rugae forms was most infrequently observed. Contrast in rugae pattern was noticed on comparing both sexes. Curve (29.57%) and sinuous (20.35%) forms were frequently seen in males, while in females curve (32.22%) and line (22.5%) forms were more common.

Saraf et al. (2011) reported that wavy and curved pattern of rugae were found to be statistically different in the sexes, but were more common in both males and females. A significant gender difference was noticed in the circular type which was higher in males. Shubha et al. (2013) concluded that north Indian males have more number of rugae than their counterparts. Moreover, the percentage of curve rugae was more in north Indian.

Shetty et al. (2005) reported more number of curve form in Mysorean population and wavy form in Tibetan population. However, wavy form of rugae was predominant according to Rajan et al. (2013).

An uneven distribution was recorded on both sides. Wherein, the number of rugae observed on right side (761) was more than on left side (686). However, curve was the most repeated pattern seen on both sides. The results of this study were in accordance with Indira et al. (2011) who reported more rugae on the right side than on left and suggested intraoral environment as contributing factor.

On the contrary, Shetty and Premalatha (2011) found no significant differences in the total number of rugae on the right and left side of palate among both genders seen.

## Conclusion

Palatal rugae serve as a reference landmark in various dental treatment modalities and can be a valuable tool for personal identification. This study found out that palatal rugae are sufficient characteristic to indicate identity through discrimination. In view of the aforementioned findings, palatal rugae can be used as a personal print. The present study concludes that the rugae pattern may be an additional method of differentiation between the Indian male and female children.

## Conflict of interest

Authors have none to declare.

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*Full Length Research Paper*

## Utilization of electronic scientific information resources among undergraduate dental students in Kingdom of Saudi Arabia

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**This study aimed to evaluate undergraduate dental students' utilization of electronic scientific information resources and to identify the specific trends found among students at different years of study. A cross-sectional web survey of all undergraduate dental students in Riyadh Colleges of Dentistry and Pharmacy was conducted. Descriptive analysis was undertaken and differences between groups were examined using Chi-square test. A response rate of 40.5% (n = 740) was achieved. 44% of the respondents used Medline for study purpose and 47.8% for research. 56.1% used full-text journal articles online for both study and research purpose. Only 25.9% searched Medline at least 1 to 7 times/month for study purpose and 22.2% for research. 42% used full-text journal articles at least 1 to 7 times/month for both study and research purpose. Clinical students were more likely to use full-text journal articles for study and research and female students were more likely to use Medline for research (p < 0.05). A majority of the respondents were non-users of Medline. The use of Medline and full-text journal articles increased moderately toward the end of the study. Training dental students in effective information searching and including the use of full-text articles in the dental curriculum will increase the use of electronic scientific resources.**

**Key words:** Medline, full-text articles, dental, students, electronic resources.

### INTRODUCTION

Information nowadays is widely available through the internet and an efficient internet user would be able to reflect and conceptualize this information. Electronic scientific information resources have great significance in the progression of teaching and learning. E-learning resources and tools like database software and database websites such as Medline are key items in dentistry (Mattheos et al., 2008). Students can find the information available in the internet overwhelming; hence skills are

essential for identifying and verifying the quality of information. In addition, training is needed to learn how to proficiently use the web-based search tools and standardized filtering techniques in order to find high-quality information resources. A recent study among research scholars and postgraduate students reported that the majority used electronic scientific resources for research and study purpose (Sonkar et al., 2014). Few studies have been published on dental students'

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**Table 1.** Demographic characteristics of respondents

Variable		%	N
Age (years)	18-22	66.8	500
	23-27	29.9	216
	28 and above	3.2	24
Gender	Male	42.0	314
	Female	56.4	422
Year of study	Year 1	14.7	110
	Year 2	23.0	172
	Year 3	18.5	138
	Year 4	17.1	128
	Year 5	12.0	90
	Year 6	11.2	84

utilization of electronic scientific information resources. One such study in India reported that the majority used internet and electronic resources for finding health/dental sciences information and felt that they cannot be replaced by physical resources (Manhas, 2008). Indian and Jordanian dental students of clinical years used internet and Medline for their studies more than pre-clinical year students (Kumar et al., 2009; Rajab and Baqain, 2005). Another study amongst Iranian dental students reported that the majority knew how to use PubMed database to find their preferred references but only a few were able to use Medline (Hamissi et al., 2013). Only one-tenth of Finnish dental students were regular users of full-text articles. However, the use of full-text articles and Medline increased toward the end of the study (Romanov and Aarnio, 2006). This study was conducted among dental students of Riyadh Colleges of Dentistry and Pharmacy (RCsDP) in Kingdom of Saudi Arabia. The college offers a six-year dental curriculum made up of two phases: a three-year preclinical phase and a three-year clinical phase. The final year ends with a written scientific essay based on research that the students have conducted. As part of the curriculum, during the first year, dental students participate in a course in introduction to computer, which presents principles of searching scientific literature to obtain information from the Internet for study and research. With the implementation of complete computer based information system and the Saudi Digital Library (SDL) in RCsDP, this study aims to examine the utilization of electronic scientific resources among the undergraduate dental students and to identify the specific trends found among students at different years of study.

## METHODOLOGY

A cross-sectional population survey of all undergraduate dental students enrolled at Riyadh Colleges of Dentistry and Pharmacy

was conducted in 2014. This study involved an electronic questionnaire survey of 1825 dental students at RCsDP. The questionnaire consisting of 17 items was piloted on a representative sample of students who were not part of study population. During the pilot study, the face validity of each item of the questionnaire was examined and the collected data were used to assess the internal reliability of the questionnaire. Questions from the validated questionnaire were taken with slight modifications. The final questionnaire (17 items) had sections examining the use of scientific information resources in electronic form, the frequency of using different electronic scientific resources, the use of additional computing applications of information seeking/processing, and demographics. Among the choices on the questionnaire were:

- (1) Medline database separately for study and research
- (2) Electronic full-text articles
- (3) Electronic textbooks
- (4) Medical/dental information from the World Wide Web (WWW).

Closed questions which are very specific and offer the participants a fixed range of answers were utilized. The use of electronic scientific information was self-assessed with 0 (for 'no'), 1 (for 'yes') and the frequency of use on a four-point scale ranging from 1 (for "not at all") to 4 (for "at least once weekly"). Demographic details included age, gender, and year of study. The student data were collected using the electronic questionnaire. By means of e-mail lists, the survey was addressed to all dental students during the three-week survey period. Two reminder messages were used to promote response. A completed questionnaire indicated the consent to participate in the study. Anonymity and confidentiality was assured. There was no personal identifier on the questionnaire and no records were kept of students participating in the study. The quantitative data was entered onto computer for analysis using Statistical Package for Social Science (SPSS) version 18 for Windows. Descriptive analysis was undertaken to present an overview of the findings from this population. Differences between groups were examined using Chi-square test for linear trends across the rated questions, and cross tabulations to compare responses from different groups. The level of significance was set at  $p \leq 0.05$ .

## RESULTS

### Demographics

Among 740 respondents (response rate = 40.5%), the majority ranged from an age group of 18 to 22 years and were females (56.4%,  $n = 422$ ). 56.2% ( $n = 420$ ) of the respondents were pre-clinical students (year 1 to year 3) and 40.3% ( $n = 302$ ) were clinical students (year 4 to year 6) (Table 1).

### Use of internet and electronic resources

The majority accessed internet and electronic resources from home (91.4%,  $n = 684$ ), only 5.6% ( $n = 42$ ) accessed from college. WWW (46%,  $n = 344$ ) was the most preferred internet service and e-books (76.7%,  $n = 568$ ) was the most preferred electronic resource. The most common features of computer used by the respondents for studies was internet (42.8%,  $n = 320$ ).

**Table 2.** Use of Medline and full-text articles by year of study.

Year of study	Year 1 [n (%)]	Year 2 [n (%)]	Year 3 [n (%)]	Year 4 [n (%)]	Year 5 [n (%)]	Year 6 [n (%)]	All [n (%)]	p-value
Use of Medline in study	33 (29.8)	79 (46.2)	55 (40.0)	54 (42.1)	50 (55.8)	47 (56.1)	318 (44.0)	0.096
Use of Medline in research	48 (43.5)	79 (46.2)	63 (45.3)	67 (52.6)	48 (53.5)	49 (58.5)	354 (47.8)	0.665
Use of full-text journal articles in study and research	53 (47.9)	84 (48.8)	69 (50.0)	81 (63.2)	61 (67.4)	57 (68.3)	405 (56.1)	0.078

**Table 3.** Use of Medline and full-text journal articles by gender and course of study.

Variable	Gender		p-value	Course of study		p-value
	Male [n (%)]	Female [n (%)]		Pre-clinical [n (%)]	Clinical [n (%)]	
Use of Medline in study	118 (37.6)	184 (43.6)	0.505	167 (39.8)	151 (50.0)	0.073
Use of Medline in research	118 (37.6)	218 (51.7)	0.027	190 (45.2)	164 (54.3)	0.096
Use of full-text articles in study and research	148 (47.1)	236 (55.9)	0.183	206 (49.0)	199 (65.9)	0.003

Over half (54%, n = 404) the respondents utilized the computer and one-third (32.9%, n = 246) used internet every day for academic activities in dentistry. Just over half the respondents (52.4%, n = 392) felt that internet and electronic resources can replace physical (print) resources. The majority of the respondents graded their search skills (73%, n = 546) as intermediate and were confident with regard to the accuracy (91.8%, n = 686) and relevance (90.1%, n = 674) of information on the internet.

### Information searching skills

13.9% (n = 104) reported average skills in searching Medline, 11.5% (n = 86) in SDL, 21.9% (n = 164) in other medical database, 17.4% (n = 130) in full-text articles, 27% (n = 202) in electronic textbooks, 35% (n = 262) in advanced search engines, and 24.1% (n = 180) in professional medical information.

### Use of Medline and full-text articles

Only 25.9% (n = 194) searched Medline at least 1 to 7 times/month for study purpose and 22.2% (n = 166) searched Medline at least 1 to 7 times/month for research. 42% (n = 314) used full-text journal articles online at least 1 to 7 times/month for both study and research purpose (Figure 1). 44% (n = 318) of the respondents used Medline for study purpose and 47.8% (n = 354) for research. Just over half the respondents (56.1%, n = 405) used full-text journal articles online for both study and research purpose (Table 2).

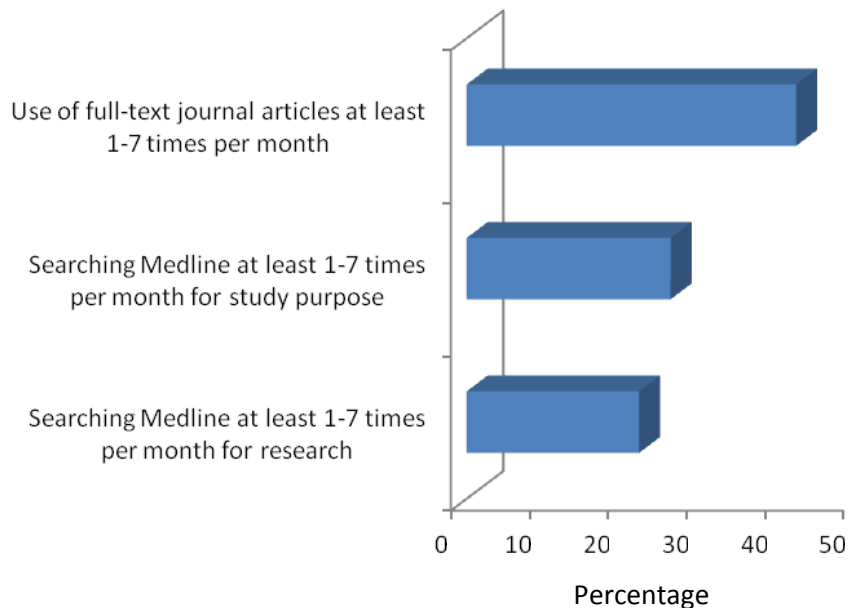
### Non-users of electronic information resources

The majority of the respondents were non-users of Medline for study (56%, n = 404) and research purpose (52.2%, n = 368). 43.9% (n = 317) were non-users of full-text journal articles online. 43.3% (n = 324) were non-users of SDL, 23.3% (n = 174) electronic dental/medical handbooks, and 19.3%

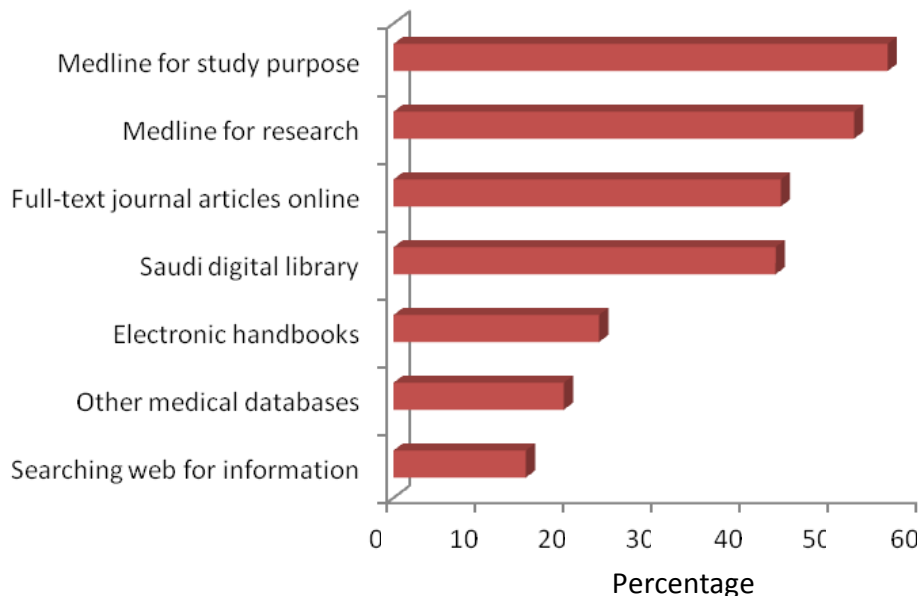
(n = 144) other medical databases. 15% (n = 112) never searched the web for professional dental/medical information (Figure 2). Chi-square test showed a statistical significant relation between age and search skills, use of full-text journal articles for study and research purpose (p < 0.05). There was a statistically significant relation between gender and use of internet services, electronic resources, and search skills (p < 0.05). Males were more likely to use WWW, e-books, and have higher search skills than females. Clinical students were more likely to use full-text journal articles for study and research than pre-clinical students and females are more likely to use Medline for research than males and was statistically significant (p < 0.05) (Table 3).

### DISCUSSION

The purpose of this study was to examine the use of electronic scientific resources among the undergraduate dental students in RCSDP using a



**Figure 1.** Searching Medline and use of full-text articles among dental students.



**Figure 2.** Non-users of electronic information resources.

web survey. WWW and e-books were the most preferred internet service and electronic resource among the students. The majority of the students reported below average skills in searching Medline. Fewer than half the respondents used Medline for study and research purpose and just over a half used full-text journal articles online for both study and research purpose. Only about a quarter of the students searched Medline at least 1 to 7 times/month for study and research purpose. Just under

half the respondents used full-text journal articles online at least 1 to 7 times/month for both study and research purpose. However, the use of Medline and full-text journal articles online increased moderately toward the end of the course for study and research purpose. In the present study, the majority of the dental students had an average level of internet and computer knowledge comparable to the findings in the previous studies (Ghasempour and Jarideh, 2014; Smith et al., 2009).

Over half the dental students in our study reported that internet and electronic resources can replace print resources in contrast with the Indian dental students (Manhas, 2008) where the majority felt that the Internet and electronic resource could only supplement the print resources. The majority of the students in the current study were confident in the accuracy and the relevance of information from the internet and was similar to the findings of Nigerian dental students (Butali et al., 2011). The dental students in this study graded their basic PC skills higher than their search skills corresponding with the findings of dental students in Finland (Romanov and Aarnio, 2006).

The findings on the frequency of the use of Medline for study and research purpose in our study were consistent with the past studies (Ayatollahi et al., 2010; Romanov and Aarnio, 2006). However, the frequency of use of full-text articles for study and research purpose was higher than the Finnish study (Romanov and Aarnio, 2006). Students of clinical years used internet and Medline for their studies more than pre-clinical students which were similar to the previous studies (Kumar et al., 2009; Rajab and Baqain, 2005). The use of full-text journal articles and Medline increased moderately toward the end of the course which was comparable to the studies in Turkey and Finland (Komerik, 2005; Romanov and Aarnio, 2006). This could be due to students' involvement in research activities, more intensive clinical practice, and getting familiar with the use of information resources at the end of their study years. RCSDP is the first private school which offers both undergraduate and postgraduate programs in dentistry and has the highest number of student intake in Kingdom of Saudi Arabia. However, the views of these dental students may not be representative of the national picture. Moreover, data collection by means of an electronic survey may have overestimated the use of electronic scientific resources and a modest response rate may have biased our results. Approximately half the respondents were non-users of full-text journal articles online and Medline for study and research purpose which should be taken into account for developing curriculum. To encourage students to access and utilize the electronic scientific information resources, the dental curriculum should include the use of full-text article and train students in effective searching references from databases.

### Conflicts of interest

The authors declare that they have no conflicts of interest.

### ACKNOWLEDGEMENT

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