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Upper Extremity and Neck Disability In Dentist with Concurrent Changes In Pinch Strength: an Observational Study

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ABSTRACT

Dental practice is a high risk profession and face the risk of musculoskeletal disorders (MSDs) due to uncomfortable static posture during work, repetitive movements, long term static contractions and use of high vibration tools. The purpose of the study was to assess upper extremity and neck disability in dentist. And to study the relationship of upper extremity and neck disability with pinch strength. A total of 316 dentist were recruited from various clinics and dental colleges from Belagavi for the study on the basis of inclusion and exclusion criteria after signing the informed consent form. Disability was measured by Neck Pain Disability Index and Disability of Arm, Shoulder, Hand Questionnaire. Pinch Strength was measured by pinch gauge. There was increasing disability with increase in age and increase in work experience. Pinch strength was affected with increasing disability and because of repetitive work by hand and wrist. It can be concluded that awkward neck posture and repetitive work done by upper extremity exacerbates degenerative changes and increases risk of disability in dentist with increase in age and experience. In addition there is also a loss of pinch strength on the dominant side with increase in age and experience.

Keywords: Dentist, Pinch Strength, Neck Pain Disability, Disability of arm, shoulder and hand.

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INTRODUCTION

Dental practice is a high risk profession and every year a large number of dentist are at risk of job related musculoskeletal disorders.¹⁻³ The bureau of labor and statistics projects dental hygiene to be one of the 30 fastest growing occupation nationwide. The US department of labor defines work related musculoskeletal disorders (WMSDs) as injuries or disorder of the muscles, nerves, tendons, joints cartilage and spinal discs associated with exposure to risk factors in the work place.⁴

Musculoskeletal disorder is not a diagnosis; it is a group of disorders with similar characteristics some examples include tendonitis, peritendinitis, epicondylitis, trigger finger, carpal tunnel syndrome, cubital tunnel syndrome, thoracic outlet syndrome, vibration hand-arm syndrome. Different factors which are responsible for upper limb injuries and neck disabilities are heredity, uncomfortable static posture during work, lack of regular exercise, repetitive movements, and long term static contractions⁵ and use of high vibration tools⁶, psychological stress. It is already known that stress can increase muscle tension and cause pain, especially in trapezius muscle.^{8 13 14} The physiological effects of using static seated postures in dentistry for longer periods are predisposed to neck shoulder, elbow and wrist pain.

Dentists are prone to suffer from cumulative disorders due to constant exposure to occupational health hazards. While working, dentists usually assume uncomfortable static postures and maintain their head in a rotated position. With the neck flexed and shoulders/upper arm abducted, or sustain other awkward positions for a long period.^{7,8,10} Holding a static awkward posture for long periods can lead to chronic muscular fatigue, discomfort or pain.

If muscle is fatigued repeatedly without sufficient recovery being allowed for muscle, disorders are likely to occur. If there is occurrence of damage daily, long-lasting

Impairment can develop due to work activity, and the capacity of the muscle may be insufficient to repair the damage as fast as it occurs.¹¹

Dentist are required to maintain a high-level of precision during dental prophylaxis, especially manual scaling, involving high levels of force and precision in order to remove hard calculus from the relatively small area of the tooth's surface. They need repetitive forceful pinching or gripping, sustained non-neutral wrist positions, and use of vibrating tools. eg, periodontal scaling and root planning possess.¹⁵

The ability to grip and manipulate objects is essential in performing various activities of daily living. Assessment of hand strength has proved to be reliable and valid as an objective parameter to evaluate the functional integrity of the hand as part of the musculoskeletal

system¹². Hand function includes range of motion, sensations co-ordination, dexterity, fine motor skills as well as grip.

The proper technique for holding instrument is called a modified pen grasp; it is grasping the instrument between the thumb and radial aspects of the index and middle figures in a tripod fashion. Pinch grip which is used by the subordinate and dominant hands of the clinician, increases the risk of hand and wrist pain.¹⁶

Dental professionals are high risk population for work related musculoskeletal disorders because of their uncomfortable static posture during work and repetitive movements. Many studies on upper extremity pain, neck pain has been done.

There is a study that states during scaling, polishing and flossing the hand or wrist movements occurred more than 30 minutes while the task was performed. Hammer et al. suggested that highly repetitive work (repetition greater than 30 minutes) if done for long periods of time could lead to tendon disorders in hand.¹³

Study has been done which states that dentists have maximum pinch strength in all three positions, followed by Surgeons, Nurses and Physiotherapists.¹⁴ But there is paucity of evidences which defines the relation between upper extremity and neck disability on pinch strength with exposure to work in dentist. Therefore there is need to study the prevalence of upper extremity and neck disabilities with concurrent changes in pinch strength in dentist.

MATERIALS AND METHOD

The study with a cross-sectional study design. Was conducted on 316 subjects through non-probability sampling design for a period of 3 months. Males and females between 20 to 45 years of age, involved in dental profession for more than one year were included in the study. Subjects with congenital anomalies, Upper limb trauma/ injury in the past 6 months without recovery, Neurological condition were excluded from the study.

OUTCOME MEASURES:

Neck pain disability index (NPDI)

The Neck Pain Disability Index (NPDI) is a 10-item questionnaire that measures a patient's self-reported neck pain related disability. Each question is measured on a scale from 0 (no disability) to 5, and an overall score out of 100 is calculated by adding each item score together and multiplying it by two. A higher NDI score means the greater a patient's perceived disability due to neck pain.

Disability of Arm, Shoulder, Hand Questionnaire (DASH)

The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire is a self-administered region-specific outcome instrument developed as a measure of self-rated upper extremity

disability and symptoms. The DASH consists mainly of a 30 item disability/symptom scale, scored 0 (no disability) to 100

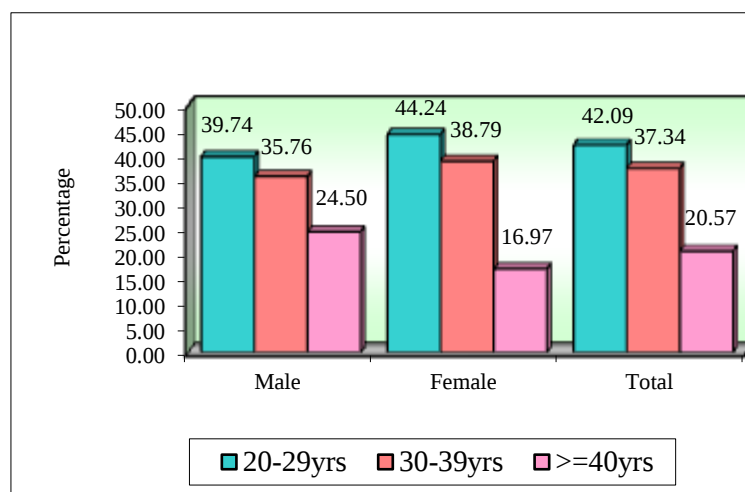
PROCEDURE:

Ethical clearance was obtained from the institutional ethical committee. The study protocol was explained to them in their vernacular language. After signing the informed consent, subjects were screened further based on the inclusion and exclusion criteria prior to their enrolment to the study Nordic pain questionnaire was administered for assessment of pain and discomfort. Demographic details of each subject will be taken, scales pertaining to neck disability and upper extremity disability were administered to the subjects. Pinch strength was measured with pinch gauge, with their shoulder adducted and neutrally rotated, elbow flexed at 90 degree, forearm in neutral position and wrist between 0-30 degree of dorsiflexion and between 0 and 15 degree of ulnar deviation.¹⁵

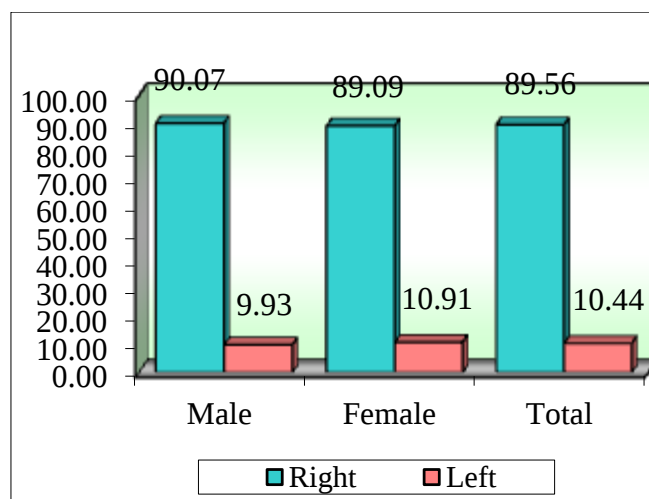
RESULTS AND DISCUSSION

Table1: Distribution of male and female dentist's by age groups

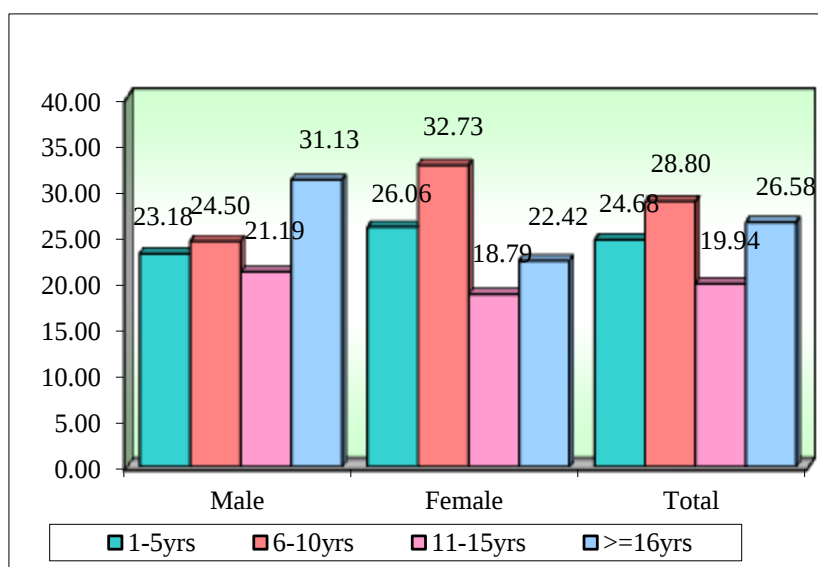
Age groups	Male	%	Female	%	Total	%
20-29yrs	60	39.74	73	44.24	133	42.09
30-39yrs	54	35.76	64	38.79	118	37.34
>=40yrs	37	24.50	28	16.97	65	20.57
Total	151	100.00	165	100.00	316	100.00
Chi-square=						
Mean age	32.52		31.30		31.88	
SD age	6.94		6.80		6.88	



Graph 1: Male and Female dentist's by age groups



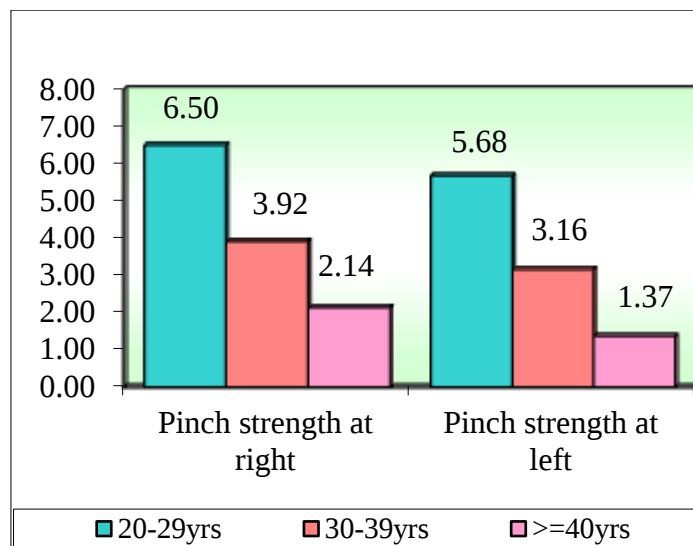
Graph 2: Distribution of male and female dentist's by dominance



Graph 3: Distribution of Male and Female Dentist's By Experiences

Table 2: Comparison of age groups with respect to pinch strength at right and left sides by one way ANOVA

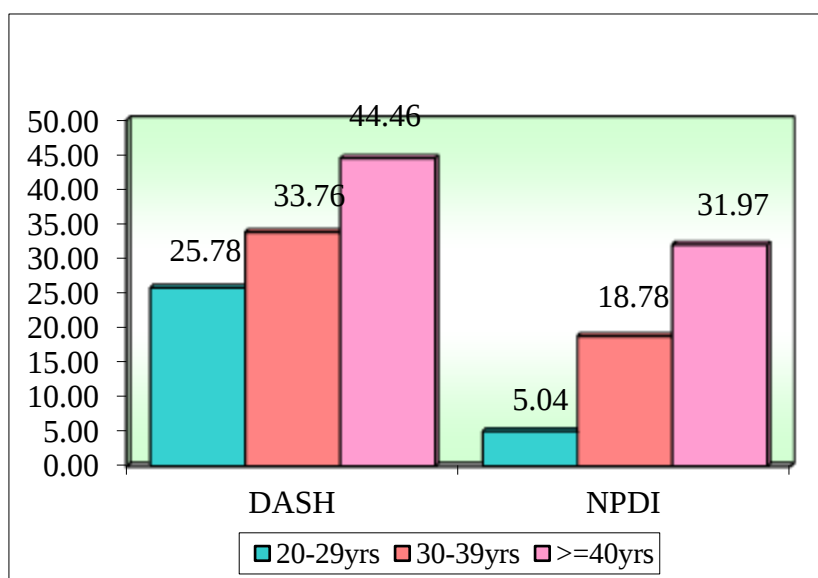
Age groups	Pinch strength at right		Pinch strength at left	
	Mean	SD	Mean	SD
20-29yrs	6.50	2.06	5.68	2.10
30-39yrs	3.92	1.54	3.16	1.59
>=40yrs	2.14	0.86	1.37	0.63
Total	4.64	2.40	3.85	2.39
F-value	164.3703		156.4401	
P-value	0.0001*		0.0001*	



Graph 4: Comparison of age groups with respect to pinch strength at right and left sides

Table 3: Comparison of age groups of dentists with respect to DASH and NPDI scores by one way ANOVA

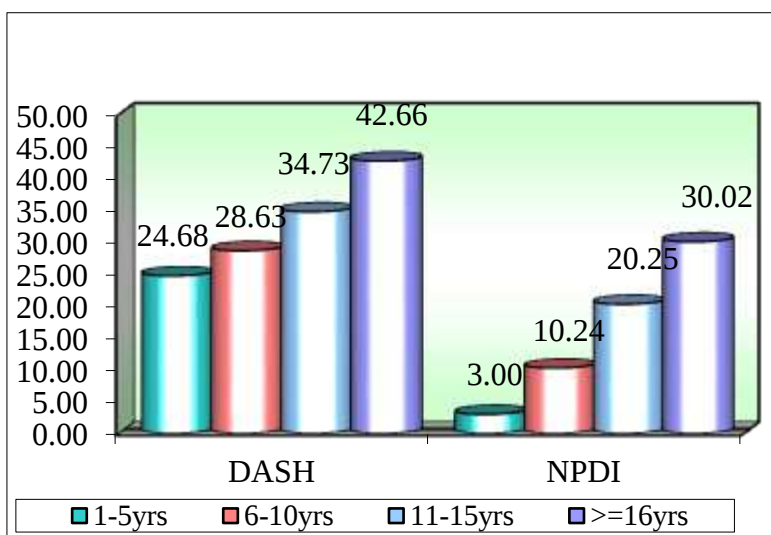
Age groups	DASH		NPDI	
	Mean	SD	Mean	SD
20-29yrs	25.78	2.00	5.04	4.41
30-39yrs	33.76	4.45	18.78	7.27
>=40yrs	44.46	3.12	31.97	4.72
Total	32.60	7.76	15.71	11.77
F-value	697.9313		514.7020	
P-value	0.0001*		0.0001*	



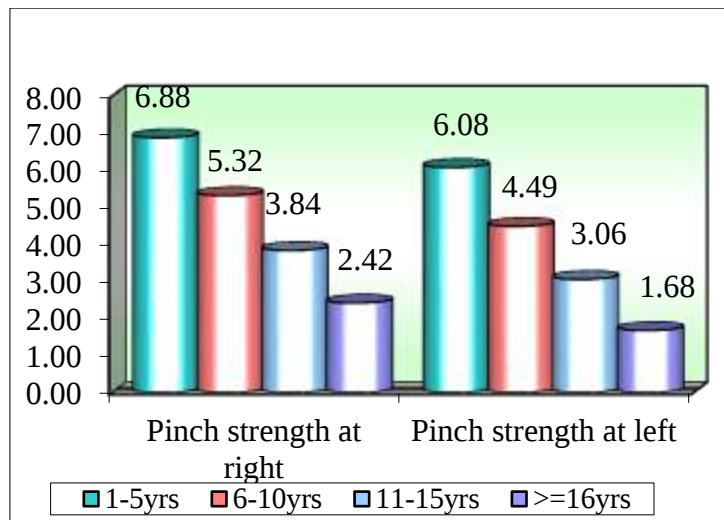
Graph 5: Comparison of age groups of dentists with respect to DASH and NPDI

Table 4: Comparison experiences of dentists with respect to DASH and NPDI scores by one way ANOVA

Experience	DASH		NPDI	
	Mean	SD	Mean	SD
1-5yrs	24.68	1.31	3.00	2.03
6-10yrs	28.63	2.54	10.24	6.00
11-15yrs	34.73	4.40	20.25	6.91
>=16yrs	42.66	4.80	30.02	6.27
F-value	697.9313		514.7020	
P-value	0.0001*		0.0001*	

**Graph 6: Comparison of experience of dentists with respect to DASH and NPDI****Table 5: Comparison of experiences with respect to pinch strength at right and left sides by one way ANOVA**

Experience	Pinch strength at right		Pinch strength at left	
	Mean	SD	Mean	SD
1-5yrs	6.88	2.16	6.08	2.04
6-10yrs	5.32	1.87	4.49	2.06
11-15yrs	3.84	1.58	3.06	1.60
>=16yrs	2.42	1.10	1.68	0.97
Total	4.64	2.40	3.85	2.39
F-value	164.3703		156.4401	
P-value	0.0001*		0.0001*	



Graph 7: Comparison of experiences with respect to pinch strength at right and left sides

Table 6: Correlation between age in yrs. with pinch strength at right and left sides, DASH and NPDI scores at Karl Pearson's correlation coefficient method

Variables	Correlation between age in yrs with		
	r-value	t-value	p-value
Pinch strength at right	-0.7216	-18.4673	0.0001*
Pinch strength at left	-0.7099	-17.8591	0.0001*
DASH	0.9138	39.8566	0.0001*
NPDI	0.8974	36.0378	0.0001*

*p<0.05

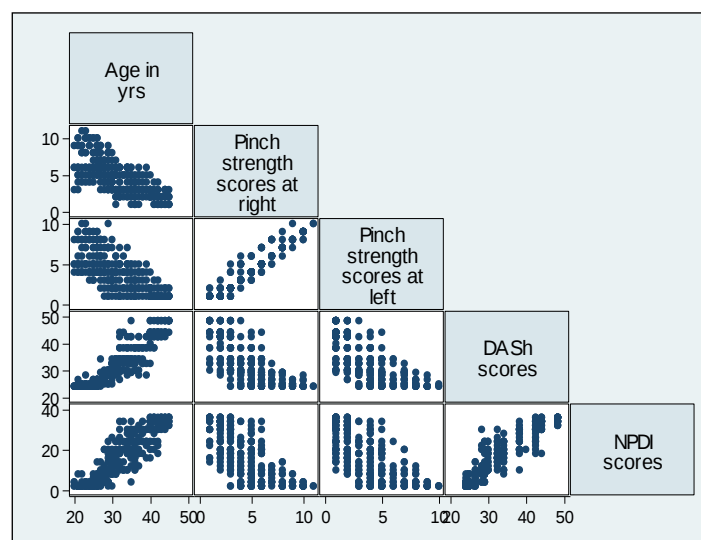


Table 7: Correlation between experience in yrs. with pinch strength at right and left sides, DASH and NPDI scores at Karl Pearson's correlation coefficient method

Variables	Correlation between experience in yrs with		
	r-value	t-value	p-value
Pinch strength at right	-0.7173	-18.2429	0.0001*
Pinch strength at left	-0.7064	-17.6863	0.0001*
DASH	0.9134	39.7622	0.0001*
NPDI	0.8971	35.9715	0.0001*

*p<0.05

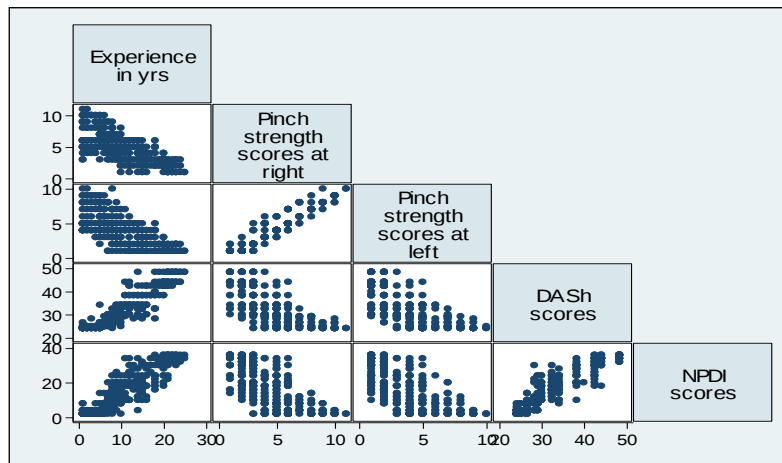


Table 8: Correlation between pinch strength at right side with DASH and NPDI scores at Karl Pearson's correlation coefficient method

Variables	Correlation between pinch strength at right side with		
	r-value	t-value	p-value
DASH	-0.7073	-17.7300	0.0001*
NPDI	-0.7005	-17.3911	0.0001*

*p<0.05

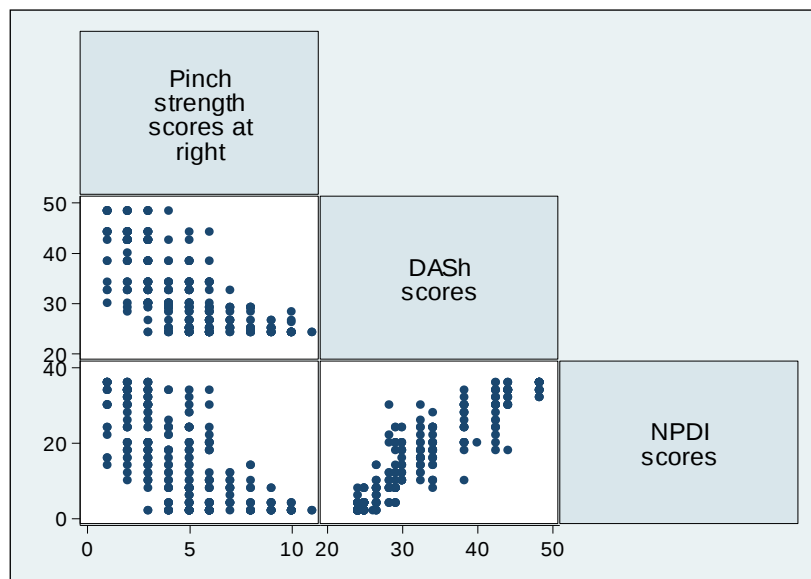
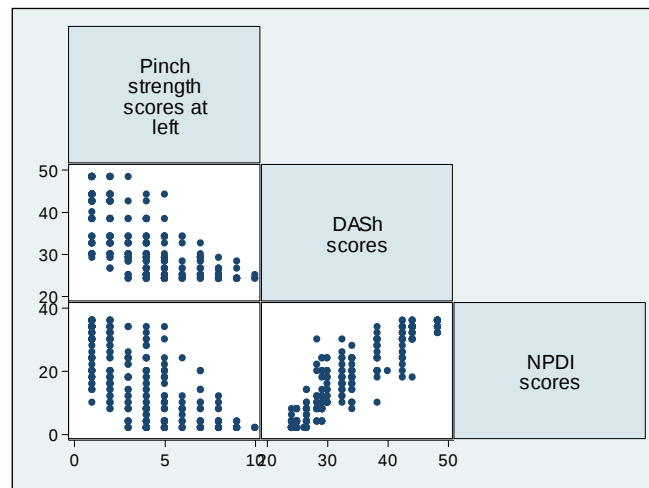


Table 9: Correlation between pinch strength at left side with DASH and NPDI scores at Karl Pearson's correlation coefficient method

Variables	Correlation between pinch strength at left side with		
	r-value	t-value	p-value
DASH	-0.6981	-17.2770	0.0001*
NPDI	-0.7006	-17.3994	0.0001*

*p<0.05



DISCUSSION:

The present study was done to assess the level of disability in dentist. Out of 316 dentist 42% had mild disability, 55% had moderate disability and only 3% had severe disability of shoulder, arm and hand. While in case of NPDI, 15% had minimal disability, 32% had mild disability, 31% had moderate disability and 21% had severe disability. We also found positive correlation between work experience and level of disability.

This is in agreement with available literature²⁴ that dentist are at high risk of musculoskeletal disorders due to static posture for prolonged period of time, repetitive work tasks, use of high vibratory tools. Repetitive motion disorders is actually a muscular condition. This muscular condition is caused when motions are repeated over and over again in every day work or every day activities. Repetitive motion disorder is actually umbrella term for a no of specific disorders like CTS, tendinitis, ganglion cyst, bursitis, tenosynovitis, tennis elbow. What actually causes repetitive motion disorder is too many repetition of a motion without interruption or unnatural motions, overexertion, muscle fatigue, or incorrect posture. The places in the body where we most often see repetitive motion disorder occurring are the shoulder, elbow hand and the wrists. Symptoms of these disorders are intense pain swelling. Numbness; loss of strength, less flexibility, which if untreated can cause permanent damage to muscle, tendons, nerves and ligaments²⁹

A study by Petra Lindfors et al (2006) on musculoskeletal disorders in the upper extremities and occupational position were related to work characteristics and general health problems in female dentist showed that female dentist are at high risk of developing upper extremity disorder.²⁵

Dentist reported significantly higher level of musculoskeletal pain 50.9%, 43.6% and 37.3% in the neck, wrist and back regions respectively.²⁰ working with upper arm elevated is considered as a risk factor for neck/shoulder disorders. Studies¹⁷ have shown high risk of

developing carpal tunnel syndrome (3.7 times) and (2.5 times) more likely to have hand/wrist problems.

Previous studies have already established the various risk for cumulative trauma disorder. High repetitive work may be regarded as causative factor for the occurrence of cumulative trauma disorders.²⁸

A study by Klein and Fernandez had shown that EMG activity in finger flexors increased with the magnitude of pinch force. Research has shown that the hand is four times stronger in a power grip position than in a pinch grip position commonly used by dentist.¹⁸

Dentist required high level of precision during dental prophylaxis, especially manual scaling, high level of force to remove hard calculus. They need repetitive forceful pinching and use of vibrating tools which results in altered pinch strength and can lead to obvious injuries.

In present study a positive correlation was found between neck pain disability and age and work experience that is with increasing age and experience disability increases. Also there was positive correlation between

Work experience and age with disability of shoulder, arm and hand. We found negative correlation between pinch strength on dominant hand and work experience that is with increase in the work experience pinch strength decreases.

We also found correlation between pinch strength and DASH and NPDI scores that is pinch strength reduces as the disability of neck and shoulder arm and hand increases, this may be explained by cumulative trauma suffered by subjects over the years resulting in increased pain and disability.

CONCLUSION

It can be concluded that awkward neck postures and repetitive work done by upper extremity exacerbates risk of disability in dentist with increase in age and experience. In addition there is also a loss of pinch strength on the dominant side with increase in age and experience.

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