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POWER WEB, RESISTIVE HAND EXERCISER AND HAND PUTTY EXERCISES FOR PINCH STRENGTH IN DENTAL PROFESSIONALS

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ABSTRACT

Hand and wrist pain are more prevalent among dental professionals than the general public, due to the sustained grips and prolonged awkward postures throughout the day. Up to 40% of dentists and nearly 75% of dental hygienists experience frequent hand pain and wrist pain. An important risk factor for these disorders is forceful pinching. Hence the objective of this study is to identify and prevent the occurrence of wrist and hand related musculoskeletal problem in budding dental professionals by providing early intervention by assessing the pinch strength and to rule out the improvement of pinch strength after the exercise program. The subjects in Group A underwent exercises involving Power web and Resistive hand exerciser while Group B underwent exercises with Hand Putty . The duration of intervention was for 30 minutes for 3 weeks. The outcome measure was palmar pinch strength, which was evaluated by Pinchometer. The results showed a significant improvement in palmar pinch strength in both the groups. (mean difference for Group A, mean difference for group B). Also, the difference between the two groups was significant at the level of <0.05 (p= 0.047). On the basis of mean difference obtained for both the groups the study concluded that even though there was improvement in pinch strength for both the groups, palmar pinch strength of participants in Group A (Power web and Resistive Hand Exerciser Exercises) is more as compared to group B. The results of the study indicate that participants who underwent power web and Resistive Hand Exerciser had performed better than the participants who underwent Hand Putty exercises in Palmar Pinch strength as measured by Pinchometer

KEYWORDS: Power Web, Resistive Hand Exercise, Hand Putty Exercise, Palmar Pinch Strength

INTRODUCTION

Pinch strength is the Quantification of ability to exert pressure with the Palm and Digits . An individual forcefully exerts a two or three jaw chuck grip or squeeze or pinches a dynamometer, which can be measured in SI or metric unit of pressure.[12]

Grip and pinch strength is The measurable ability to exert pressure with the hand, fingers, or both. It is measured by having a patient forcefully squeeze, grip, or pinchdynamometers; results are expressed in either pounds or kilograms of pressure.[9]

Pinch strength is one of the important characteristics of a normal hand. Grasping or pinching light objects becomes a problem when any item is held for long period of time. The pressure in holding the items can reduce blood flow and strain tendons, leading to hand symptoms. Repetitive motion, such as prolonged grasping, can lead to tendonitis.

Hand and wrist pain are more prevalent among dental professionals than the general public, due to the sustained grips and prolonged awkward postures throughout the day. Up to 40% of dentists and nearly 75% of dental hygienists experience frequent hand pain and wrist pain. On an average, 2 out of 3 dental professionals experience pain because of these occupational hazards. The overall prevalence of musculoskeletal disorders in dental professionals varies from 63 to 93 per cent worldwide [1]. It is postulated that upper limb muscles and skeleton are more implicated during dental operation rather than other parts of the body[3- 8]. Musculoskeletal disorders account for the most common reason (29.3%) for early retirement age in dental professional worldwide[2]. The prevalence of upper-extremity musculoskeletal disorders, such as tendinitis, is elevated among dental practitioners. An important risk factor for these disorders is forceful pinching; however, the pinch forces and instrument forces during scaling are unknown.

Dentists are among the group who have increasingly been referred for physical therapy and seeking ergonomic advice in the recent years. There is a scope for further decreasing the occurrence and severity of these disorders by performing regular specific exercises.[3],[4] In most of the studies the dentists are reported to be relatively inactive and very few took some form of physical exercise and acknowledge the benefits of the same.[5] Musculoskeletal complaints had a significant negative impact on dentists' self-reported general health.[6] The best ergonomic working principles should be taught to the students, dental schools should provide a comfortable working environment, those practicing general dentistry.[7] Hence the objective of this study is to identify and prevent or reduce the occurrence of wrist and hand related musculoskeletal problem in budding dental professionals by providing early intervention by assessing the pinch strength and to rule out the improvement of pinch strength after the exercise program.

OBJECTIVE OF THE STUDY

- To find out the effect of Power web, Resistive Hand Exerciser which is Ergonomically shaped and made to fit the contours of the hand, latex-free and Hand Putty exercises in improving pinch strength in dental professional
- To compare the effectiveness of Power web ,Resistive Hand Exerciser and Hand Putty exercises

METHODOLOGY

The subjects were randomly selected from a Dental College, Bangalore. They were informed about the study and its advantages. Ethical clearance was obtained from the Ethical Review Board. The participants who were willing to participate in the study were asked to sign an Informed consent form. They were then screened for inclusion and exclusion criteria and were divided into two groups. Group A underwent exercises involving Power web and Resistive hand exerciser while Group B underwent exercises with Hand Putty . The duration of intervention was for 30 minutes for 3 weeks. The outcome measure was palmar pinch strength, which was evaluated by Pinchometer.

Inclusion Criteria

- Dental Professionals (P G Students)
- **Age Group:** 25 – 35 Years
- Subjects willing to participate in the study

Exclusion Criteria

- Subjects with Musculoskeletal problem of upper extremity
- Subjects with any kind of wrist or hand injuries in the past 1 year

- Subjects with any systemic or neurological problems
- Ambidextrous individuals.
- Subjects not willing to participate in study

MATERIALS

- Pincho meter (Base line – Mechanical – orthopaedic & sports medicine)
- Grip & Pinch Strength: Normative Data (V. Mathiowetz, et al)
- Power web – Medium 7 inches (Green)
- Resistive Hand Exerciser - Medium (Blue)
- Hand Putty – Medium(Green)

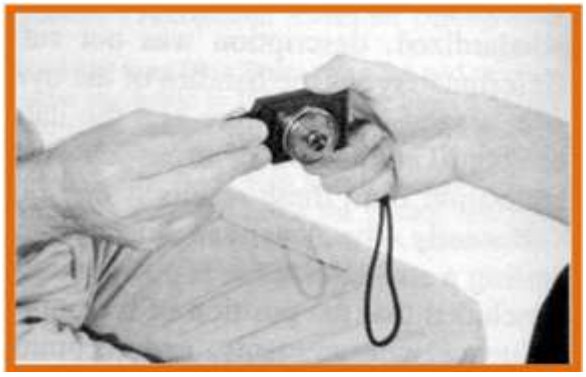
PROCEDURE

Group A and Group B participants were explained about the procedure. A brief interview of age & dominance of each participant before preceding for each test, was conducted. Each Participant was first seated on the chair with straight back, without arm, feet resting flat on the floor, shoulder adducted & neutrally rotated, elbow flexed to 90°, forearm in neutral position & wrist between 0° and 30° extension, 0° and 15° ulnar deviation (as per ASHT)[8-10]. Procedure was demonstrate to the participant. Pinches were assessed first on dominant hand & then on non-dominant. The pinchometer, was held by the examiner at the distal end to prevent dropping. The calibration of instrument was tested periodically during the study.

Instruction: Instruction to subjects was given in the same tone and volume in order to discourage the over-bearence of instruction on the brain.

Number of Trials & Rest Period: Each participant was instructed to provide three firm controlled pinches. Between each reading, 60 seconds of inter-trail rest was provided to avoid fatigues 12. Three consecutive maximum scores were recorded in each trail & then mean of palmar pinch was calculated.

Length of Contraction Time: Three attempts for each subject were conducted alternating right and left hands with one minute rest between attempts to overcome fatigue. Same researcher read the pinch gauge dial to record various attempt to avoid human error. The gauge was reset to zero prior to each recording of pinch strength. Subjects were asked to give maximum effort.



Figure

Intervention

Group A: Exercises with Power web were given for 15 min and Resistive Hand Exerciser exercises were given for 15 min.

Power Web Exercises: Finger Flexion, abduction & adduction,

Resistive Hand Exerciser Exercises: Finger press, roof top exercise, Finger squeeze and palmar pinch.

Group B: Hand Putty exercises are given for 30 min which include- finger Flexion, abduction & adduction, finger press, roof top exercise, Finger squeeze and palmar pinch.

RESULTS

The data was analysed by using the statistical software SPSS 16 (Inc., Chicago, Ill) for windows. The descriptive statistics was calculated for the age and gender (Refer Graph 1). The homogeneity of subjects in terms of age and professional qualification between the groups was evaluated by using independent t test, whereas the gender distribution between the groups was compared by using chi-square test (Refer Table 1).

The overall differences between the two different time periods (Baseline and 3rd week) within the each treatment group (Power Web + Resistive Hand Exerciser & Hand Putty) for the outcome measure (Palmar Pinch Strength) were tested by using one-way repeated measures ANOVA and were found statistically significant at 0.05 level.

Mean difference between two time periods (baseline and 3rd week) for group 1 for dominant hand was 15.2633 (S.D.=2.28) and for non dominant hand was 8.6 (S.D.= 2.36).

Mean difference between two time periods (baseline and 3rd week) for group 2 for dominant hand was 1.2(S.D.= 1.1) and for non dominant hand was 1.1 (S.D.= 1.05).

Comparison of means by independent t test revealed that there was a significant difference between two groups at the level of p=0.05. (p=0.047).

By comparing the mean difference for two groups at two different time periods we concluded that strength improvement was more in group 1 as compared to group 2.

Table 1

Group Statistics					
	Intervention	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
dominant side 0 week	pw and RHE	15	25.0667	2.28244	.58932
	Hand Putty	15	21.6667	1.11270	.28730
dominant side 3 week	pw and RHE	15	40.3333	1.58865	.41019
	Hand Putty	15	22.8667	1.12546	.29059

Table 2

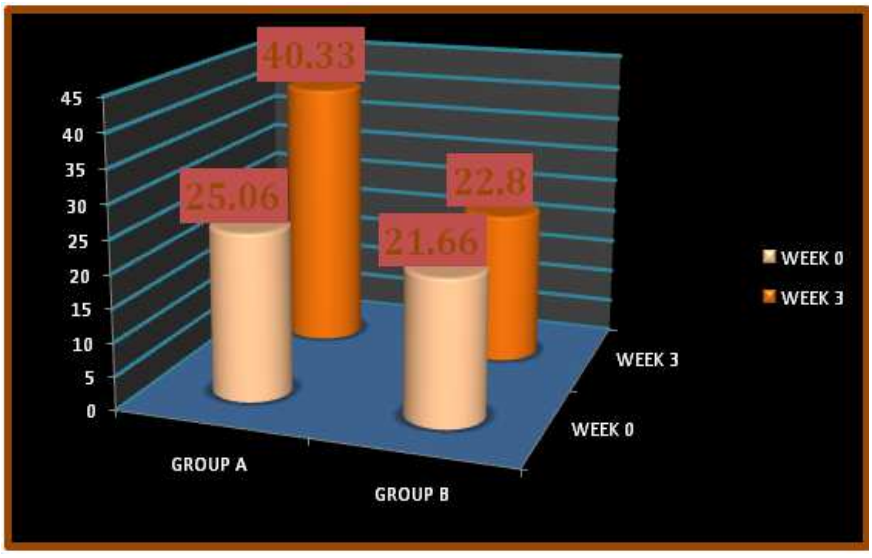
Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
age	30	25.00	32.00	27.6333	1.69143
gender	30	1.00	2.00	1.5000	.50855
Valid N (listwise)	30				

Table 3

Independent Samples Test for Dominant Hand							
		Levene's Test for Equality of Variances		T-Test for Equality of Means			
		F	Sig.	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
dominant side 0 week	Equal variances assumed	10.799	.003	3.40000	.65562	2.05702	4.74298
	Equal variances not assumed			3.40000	.65562	2.03368	4.76632
dominant side 3 week	Equal variances assumed	4.299	.047	17.46667	.50269	16.43695	18.49638
	Equal variances not assumed			17.46667	.50269	16.43182	18.50151

Table 4

Independent Samples Test for Non Dominant Hand							
		Levene's Test for Equality of Variances		T-Test for Equality of Means			
		F	Sig.	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
non dominant side 0 week	Equal variances assumed	.629	.434	.53333	.79801	-1.10132	2.16799
	Equal variances not assumed			.53333	.79801	-1.10337	2.17003
non dominant side 3 week	Equal variances assumed	4.132	.052	2.00000	.56569	.84125	3.15875
	Equal variances not assumed			2.00000	.56569	.83211	3.16789



Graph 1: Comparison of Pre and Post Intervention Scores for Both the Groups for Dominant Hand

DISCUSSIONS

Pinch force refers to the amount of physical effort required to accomplish a task or motion. Performing forceful exertions may place excessive mechanical loads on the tissues (muscles, tendons, and other tissues) that are used to exert or transfer force from the skeletal system to the work. Dental hygienists are required to maintain a high level of precision during dental prophylaxis, especially manual scaling involves high levels of force and precision in order to remove hard calculus from the relatively small area of the tooth's surface.

In the Dentists repetitive forceful pinching or gripping is a risk factor for the development of CTS and other hand related problems. Roquelaure and colleagues 23 demonstrated an increased risk of developing CTS (odds ratio = 9.0, CI = 2.4 to 33.4) due to repetitive tasks (cycle time less than 10 seconds) involving a pinch force more than 10 N.

When we assessed the palmar pinch strength among the dental professionals we observed that the pinch strength was in lower limit of the normative data.

A Randomized controlled trial was carried out to assess the effect of Power web, Resistive Hand Exerciser and Hand Putty exercises for improving Pinch strength among Dental Professionals (PG Students) in Dental College in which out of 60 eligible PG Dental students 43 agreed to participate in the study.

After the intervention our results showed a significant improvement in palmar pinch strength in both the groups. (mean difference for Group A, mean difference for group B). Also, the difference between the two groups was significant at the level of < 0.05 ($p= 0.047$). On the basis of mean difference obtained for both the groups by independent t test we concluded that even though there was improvement in pinch strength for both the groups, palmar pinch strength of participants in Group A (Power web and Resistive Hand Exerciser Exercises) was improved more as compared to group B.

Some of the possible reasons we observed in Group A was, the compatibility of the equipment was good and the participants were able to follow and perform the exercises without difficulty because there was no change in the shape of the power web or Resistive hand exerciser, Whereas exercises with Hand Putty were little difficult to use given the pliability of the putty.

Also, Resistive Hand Exerciser are ergonomically shaped and made to fit the contours of the hand, latex-free. Resistive Hand Exerciser has the shape that feels great in the hand. It's designed to provide effective resistive therapy in a wide variety of exercises for the fingers, hand, wrist, and forearm. With regular use, there is improvement in grip strength, increase dexterity and mobility.

Power web allows the duplication of virtually all finger joint actions including flexion, extension, opposition, abduction and adduction. It provides resistance of each web and can be modified to meet specific needs by adjusting hand position and/or depth of finger insertion. It accommodates all hand sizes and strength levels.

Hand Putty can be formed into the various illustrated shapes, providing a balanced exercise program. Strengthening opposing muscles maintains a delicate muscular balance which improves one's dexterity and coordination.

Even though there is evidence, which shows the effects of Hand Putty on strength building, there are more studies over its play on increasing the dexterity of hand than strength.

Prescription of exercises with power web and Resistive Hand Exerciser is easier as it will target a given set of activities because of its fixed shape but in case of Hand Putty the shape and texture of the material call for repeated instruction to the participants.

Limitations of the Study

- We have used a sample size in our study. Hence the conclusion cannot be generalized.
- The sample size of the study was 30
- The duration of the study was 3 weeks

- Absence of control group.
- The study was conducted in asymptomatic subjects so the improvement can also be attributed to other confounding factors.

Recommendation for Future Research

- The intervention can be given for a longer duration for more accurate results.
- Sample size should be higher for generalization.
- Study can be performed in symptomatic subjects
- Efficacy of these interventions can also be studied in different populations dealing with activities related to dexterity, endurance and grip strength.

CONCLUSIONS

The results of our study indicate that participants in both Power web + Resistive Hand Exerciser and Hand Putty group improved in Palmar Pinch Strength. But, more importantly we found that the participants who underwent power web and Resistive Hand Exerciser had performed better than the participants who underwent Hand Putty exercises in Palmar Pinch strength as measured by Pinchometer

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