The Ergonomic Intervention for Musculoskeletal Diseases and Pain among Oral Health Therapist

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ABSTRACT

Musculoskeletal diseases and pain (MSDs) is commonly occurred among oral health therapist due to improper working positions. This condition can lead to work-related accidents, lower job satisfaction, and increased healthcare costs. In order to address this issue, ergonomic interventions encompassing cognitive, physical, and organizational aspects have been recommended to prevent the occurrence of MSDs. This study aims to assess the effectiveness of ergonomic interventions, specifically using the "EI" model, in alleviating MSDs among oral health therapists. The quality assessment related to pain utilized a validated standardized instrument. A purposive sample of 64 oral health therapists, working as dental assistants in Semarang, Indonesia, participated in the study. Data were gathered through a structured questionnaire incorporating the Nordic Body Map to identify the presence of pain. Additionally, a physiotherapist conducted an objective examination, assessing pain levels using the Visual Analog Scale (VAS). The results of the pain complaints test, as indicated by the Nordic Body Map, revealed a significant p-value of < 0.001, with Δ mean = 2.19 for the intervention group and 0.91 for the control group. Similarly, the pain level test using the Visual Analog Scale demonstrated a p-value < 0.001, with Δ mean = 30.38 for the intervention group and 14.91 for the control group. This suggests that the ergonomic model "EI" was significantly effective in reducing complaints of MSDs among oral health therapists.
Keywords : Ergonomics; Musculoskeletal Diseases; Musculoskeletal Pain; Oral Health Therapist

Introduction

Based on Law of Republic of Indonesia [1], an Oral Health Therapist was one of recognized dental professionals in Indonesia who had authority to carry out oral health therapy work in accordance with his/her expertise, including filling teeth with minimal intervention, scaling, extraction of anterior teeth, topical application, dental assistant, dental hygienist and medical record. Oral Health Therapists had potential occupational risk for developing musculoskeletal diseases and pain (MSDs) including improper working position, repetitive motions, high number of patients, vibration and administrative job [2] that might cause tissue injury permanently, chronic pain and dysfunction [3,4].

Work-related MSDs were prevalent among those therapist, proper work required motion of arms, wrists and hands while adopting awkward static neck, and shoulder postures for quite long time [5]. World Health Organization (WHO) stated MSDs as disorders that happened in muscles, tendons, joints, intervertebral discs, peripheral nerves and vascular systems that could develop chronically over time[6]. Occupational diseases can be occurred while doing work activities [7], the MSDs was the most common disease reported (60.4%) [8]. Prevalence rates of MSDs among dental professionals ranged from 10.8% to 97.9%. There was a reported increased incidence of MSDs

among dental assistant in recent year [9]. Neck was the body region affected most often (58.5%) followed by lower back (56.4%), shoulder (43.1%) and upper back (41.1%) [2]. A study showed that all participants reported discomfort at least one of part body, most common pain for dental professional occurred in neck (70.4%) and shoulder (71.6%) [10].

Occupational diseases can occur while doing work activities. Of the many occupational diseases, musculoskeletal complaints are the most frequently reported complaints. According to WHO, the incidence of musculoskeletal disease is the most common disease and is estimated to reach 60.4% of all occupational diseases. This musculoskeletal diseases and pain often lead decreased job satisfaction, work-related accident and occupational disorders was most common reason for lost workdays and increased health care expenditures in developed and developing countries [11-13]. Ergonomic interventions in cognitive, physical and organizational domains have been recommended to prevent their occurrence[14]. Ergonomic interventions with workplace stretching-exercise for preventing musculoskeletal disorders in health worker [8-15]. A previous study [16] stated ergonomic model educated oral health therapist how to work with proper position and do stretching in work place. That model reduced potential risk of improper working procedure. This study aims to evaluate effectiveness of ergonomic interventions with model "EI" among oral health therapists to relieve MSDs.

Methods

Research design used Quasi-experimental pre-test and post-test with control group design (Non Equivalent Control Group). Population was 300 Oral Health Therapists, member of professional called PTGMI (Persatuan Terapis Gigi dan Mulut) in Semarang, Central Java. Indonesia. Recruitment respondents had been done through cooperation with PTGMI, this study used Slovin's formula, a purposive sample of 64 Oral Health Therapists who met the inclusion criteria was selected and those willing to participate signed an informed consent form. There was 2 (two) groups, treated group (32 people) and control group (32 people).

Inclusion criteria
1. As a dental assistant who works in hospital and private clinic.
2. Has pain complaints after working in hospital or private clinic.
3. Length of work > 2 years as a dental assistant.

Exclusion Criteria
1. On leave and sick
2. Pregnant.
3. Has history of systemic disease.

Steps of this study as follow
1. Orientation (to describe aim & research time) and building interaction (to establish good relationship with respondents).
2. Initial assessment of respondents' characteristics and pain assessment with NBM (Nordic Body Map).
3. Examination by a physiotherapist based on objective examination through pressure pain (palpation) and silent pain (movement against resistance and muscle activity) using VAS (Visual Analog Scale).
4. Training with Ergonomic model "EI" was conducted by a physiotherapist explaining proper work postures (sitting position; neck, arm and shoulder position; standing position) and how to do body stretch at work place (workplace stretching exercise). This training process was carried out through virtual meeting (zoom) then continued discussion for approximately 60 minutes (1 hour).
5. The work stretching exercise consisted of 12 steps (Picture 1) was carried out for 10-15 minutes as follows focused on neck, arm and shoulder; hold each movement 8 counts and repeated 4 times. Participants of treated group implemented this model independently every day for 14 days under supervision of researcher and physiotherapist.
6. Control group was given a poster without education and supervision of a physiotherapist.
7. Implementation, evaluation, and measurement level of pain complaints and scale after 14 days.

Picture 1. Work Place Stretching

Picture 1 showed that there were 12 steps of workplace stretching exercise as follows Step 1: Warming Up; Step 2: Twist the Torso; Step 3: Full Body Stretch; Step 4: Move Hand to Side; Step 5: Neck Stretch; Step 6: Elbow Stretch; Step 7: Arm Muscle Stretch; Step 8: Chin Lift; Step 9: Forearm Stretch Facing Up; Step 10: Forearm Stretch Facing Down; Step 11: Shrug; Step 12: Cooling Down.

In this study, research and development method carried out to create Ergonomic model "EI" including information collection, model design, expert validation (ergonomics expert, dentist and physiotherapist), feasibility model and model trial. MSDs (pain complains of muscle and spine) was measured by NBM with score 1=pain and score 0=no pain. While pain level was measured by assessment sheet of VAS (0=no pain, 1-3= mild, 4-6= moderate, 7-9= controlled severe pain, 10=unbearable pain).

Data were collected by means of a structured questionnaire with Nordic Body Map for presence of pain and affected zones. The quality assessment concerned to pain was conducted using reliable and validated standardized instrument. Characteristics of 64 oral health therapists in Semarang were evaluated by ANOVA test with CI (Confidence Interval) 95%. Variables were evaluated by statistical test including gender, smoking habit, Body Massa Index, sport exercise, workplace and working hours per day. Research data used an interval scale, statistical test used interclass correlation coefficient to determine feasibility of the Ergonomic model "EI". Previously, data normality test used the Shapiro Wilk. Data obtained was not normally distributed, then effectiveness test in the paired group used a dependent sample test (Wilcoxon) and for the unpaired group, an independent sample test was used Mann-Whitney test) with CI 95%.

Informed consent was obtained from participants by mail. This study was conducted after approval from the Ethics Committee of Islam Sultan Agung Semarang University (No.53/III/2021/ Komisi Bioetik).

Results and Discussion

Table 1.
Demographic Data

Characteristics	Intervention Group		Control		p value
	n	%	n	%	
Gender					
Male	2	6.30	2	6.30	0.399*
Female	30	93.80	30	93.80	
Sports					
≤3x/week	21	65.60	22	68.80	0.794*
>3x/week	11	34.40	10	31.30	
Smoking					
Yes	2	6.30	2	6.30	1.000*
No	30	93.80	30	93.80	
Body Massa Index					
Underweight (≤ 18,40)	2	6.30	6	18.80	
Normal (18,50-24,80)	23	71.90	23	71.90	0.060*
Overweight (≥24,90)	7	21.90	3	9.40	
Work Place					
Private Clinic	27	84.40	29	90.60	0.458*
Hospital	5	15.60	3	9.40	
Working Hours/day					
≤ 7 hours	15	46.90	19	54.90	0.324*
≥ 8 hours	17	53.10	13	40.60	
Length of Working					
≤ 5 years	19	59.40	25	87.10	0.109*
≥ 6 years	13	40.60	7	21.90	

*ANOVA Test

Table 2.
Mean Difference of Pain Complaints

Group	n	Mean±SD Pre Test	Mean±SD Post Test	Δ Mean	p value
Treated Group	32	7.97±3.26	5.78±3.43	2.19	0.000*
Control	32	9.50±3.06	8.59±3.11	0.91	0.001*

Wilcoxon Test

Table 3.
Mean Difference of Pain Complaints between Treated and Control Group

Group	n	Mean	SD	p value
Treated Group	32	5.78	3.55	0.000*
Control	32	8.59		

Mann Whitney Test

Table 4.
Mean Difference of Level Pain

Group	n	Mean±SD Pre Test	Mean±SD Post Test	Δ Mean	p value
Treated Group	32	55.19± 27.01	24.81± 17.58	30.38	0.000*
Control	32	60.44± 25.34	45.53± 24.41	14.91	0.000*

Wilcoxon Test

Table 5.
Mean Difference of Level Pain between Treated and Control Group

Group	n	Mean	SD	p value
Treated Group	32	24.81	23.54	0.000*
Control	32	45.53		

Mann Whitney Test

The major findings of this study included characteristics of participants, measurement present and level of pain among Oral Health Therapist in Semarang.

Table 1 showed that Oral health therapists treated, 6.3% (2 persons) were male and 93.80% (30 persons) were female; 65.6% (21 persons) had sport exercised ≤ 3x/week and 34.4% (11 persons) for >3x/week; 6.3% (2 persons) were smoker and 93.80% (30 persons) were no smoker; those dental assistant had Body Massa Index underweight (n=2; 6.3%), normal (n=23; 71.9%) and overweight (n=7; 21.9%). They worked at private clinic (n=27; 84.4%) and hospital (n=5; 15.6%) for ≤ 7 hours/day (n=15; 46.90%) and ≥ 8 hours/day (n=17; 53.10%). Their length of working were ≤ 5 years (n=19; 59.40%) and ≥ 6 years (n=13; 40.60%).

While Oral health therapist untreated (control), 6.3% (2 persons) were male and 93.80% (30 persons) were female; 68.80% (22 persons) had sport exercised ≤ 3x/week and 31.30% (10 persons) for >3x/week; 6.3% (2 persons) were smoker and 93.80% (30 persons) were no smoker; those dental assistant had Body Massa Index underweight (n=6; 18.80%), normal (n=23; 71.9%) and overweight (n=3; 9.40%). They worked at private clinic (n=29; 90.6%) and hospital (n=3; 9.40%) for ≤ 7 hours/day (n=19; 54.90%) and ≥ 8 hours/day (n=13; 40.60%). Their length of working were ≤ 5 years (n=25; 87.10%) and ≥ 6 years (n=7; 21.90%). This table indicated that there was no significant difference between two groups in the demographic data (p value = > 0.05).

Table 2. described that based on Wilcoxon test (paired test) of NBM assessment two groups (treated and control groups), for both groups there are significant effect in reducing pain complaints among oral health therapists (p value<0.05) however Δ mean between group was quite significant (Treated group=2.19 and Control=0.91).

Table 3. Results from Mann-Whitney (unpaired test) of NBM assessment showed that the p-value between treated and control groups was 0.000 (p < 0.05) meaning that the ergonomic

model "EI" was more effective in reducing pain complaints among oral health therapists compared to control.

Table 4. showed that results of paired test for the Visual Analog Scale (VAS) assessment had p-value treated group of 0.000 ($p < 0.05$), meaning that the ergonomic model "EI" was effective in reducing level of pain, as well as p-value control group was 0.001 ($p < 0.05$), meaning that there was also a reduction in level of pain among oral health therapist. Although Δ mean between group was quite significant (Treated group=30.38 and Control=14.91).

Table 5. showed that p-value between treated and control groups was 0.000 ($p < 0.05$) meaning that ergonomic model "EI" was more effective in reducing level of pain among oral health therapists compared to control.

In this study, there was no significant difference between two groups (treated and control groups) in the demographic data (p value> 0.05) which variable including gender, sports, body mass index, smoking, work place, working hours/day, length of working. It can be concluded that those variables had balanced distribution and no effect in reducing complaints of musculoskeletal disorders among oral health therapists. Measurement of pain complaints was carried out through the Nordic Body Map sheet (questionnaire) used to determine level of discomfort or pain in the body. This standardized examination was reliable and valid, NBM using a body map was a subjective examination to assess severity of disorders to skeletal muscles in more detail [17,18]. Pain is a personal experience expressed differently by each person with a certain pain impression and scale according to what a person feels [19]. While VAS (Visual Analog Scale) was a measuring instrument used by physiotherapists to define level of pain in each complaint, guidelines for perceived complaints was based on filling out the NBM questionnaire by dental assistants, then a follow-up examination was performed using the VAS measuring tool.

Aim of present study was to evaluate effectiveness of ergonomic interventions with model "EI" among oral health therapists as dental assistants to relieve musculoskeletal diseases and pain (MSDs). This study was important because dental assistants had potential occupational risk for developing MSDs even this profession was more susceptible to MSDs compare to dentists [20]. Result of present study showed that the ergonomic model "EI" was more effective in reducing pain

complaints and level of pain among dental assistants. Training with Ergonomic model "EI" was conducted by a physiotherapist explaining proper work postures (sitting position; neck, arm and shoulder position; standing position) and how to do body stretch at work place (workplace stretching exercise). The result of this study was in accordance with researches conducted by [21] and [17]. Work postures were determining point in analyzing the effectiveness of a job. Work posture not ergonomic lead decreased job satisfaction, work-related accident and occupational disorders [17]. While a study research conducted by [21] stated that training about ergonomics position may reduce fatigue at work and prevent risk of musculoskeletal disorders.

According to [22], Ergonomics was viewed as a discipline and profession centered on systems, utilizing systems philosophy and approaches while the International Ergonomics Association (IEA) defines Ergonomics as the scientific discipline focused on comprehending interactions among humans and various components of a system. It is also a profession that applies theory, principles, data, and methods to design with the aim of enhancing well-being and the overall performance of the system.

Regarding to ergonomic intervention in workplace, in present study education with ergonomic model "EI" was successful in reducing pain complaints and level, the training process was carried out through virtual meeting (zoom) then continued discussion for approximately 60 minutes (1 hour). Participants of treated group implemented this model independently every day for 14 days under supervision of researcher and physiotherapist. It was in line with result of research conducted that there was a decrease in musculoskeletal complaints after being given treatment to do work place stretching movements for 10 days carried out on side lines of working time [23]. Application of proper work position and workplace stretching by participants might reduce muscle tension, prevent muscle cramps and cause muscle relaxation. Training was essential for health professional to control possible risks of improper work position [24]. While some studies stated that ergonomic interventions in preventing MSDs among in dental care practitioners [25-30]

Findings of the present study elaborate some implication for policy marker, health worker and dental assistant. Provide scientific information, as a reference source and guideline on the application of Ergonomic model "EI" to reduce complaints of

musculoskeletal disorders in health worker and dental assistant. There is limitation of this study, even though the researchers selected participants with inclusion and exclusion criteria, number of patients served every day needs to be considered related to developing ergonomic intervention.

Conclusion

Oral health therapist is one of the recognized professions in Indonesia, as a dental assistant has potential occupational risk for developing musculoskeletal diseases and pain (MSDs). The Ergonomic interventions with model "EI" is effective to relieve MSDs among oral health therapists as dental assistants. This model is appropriate as a guideline used to reduce pain complaints and level pain of MSDs.

Acknowledgements

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