

ASSESSMENT OF HEALTH PROBLEMS AMONG PNEUMATIC HAND-HELD DRILL WORKERS

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ABSTRACT

BACKGROUND: Health problems among pneumatic hand held drill workers are very common. These occupational diseases are caused by permanent vibration exposures. Drilling into concrete or metal ceilings is associated with pain and musculoskeletal disorders at the wrist, forearm, shoulder and back. Osteoarthritis may develop in those workers who are predisposed to the disease. Objective of this study was to assess health problems among pneumatic hand held drill workers.

METHODS: This descriptive cross sectional study was done from September, 2011 till November, 2011 in the region of Barakaho and Taxila among the road builders using drilling devices. A sample of 100 drill workers was taken. The drill workers were selected with convenient sampling. The study tool was a structured questionnaire.

RESULTS: The results of the present study showed that the prevalence of health problems among hand held pneumatic drill workers was 82% out of 100 drill workers. Among 82% workers with health problems 22(26%) workers were between 22-27 years of age, 20 (24.39%) workers among 28-33 years of age and 40 (48.78%) workers were more than 33 years. Among those having health problem i.e 82%, 53% were having 5-8 years of work experience and 29% were having work experience more than 8 years.

CONCLUSION: Permanent vibration exposures cause negative physical effects that may lead to occupational diseases. There is lack of awareness about vibration hazard and its ill effects. In order to be protected against these technical and medical measures must be taken into account.

KEY WORDS: Pneumatic Drill Workers, Osteoarthritis, Musculoskeletal.

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INTRODUCTION

Equipment induced vibration is recognized as a health hazard. It is a physical stressor to those people who are exposed at workplace. Mining industry is of no exception. The first report of vibration syndrome caused by portable power tools appeared in Italy in Loriga in 1911 and the clinical picture was described in detail some-

what later in the USA in Hamilton in 1918. After these reports, many cases of vibration syndrome were presented in the literature of European and Asian industrialized countries. The huge production of load and hard working conditions in those industries resulted in many cases of occupational vibration syndrome after 1960s. The chief tools that originated these health hazards were leg like rock drills

in mining, chipping hammers in the metal and stone cutting and chain saws in the tree-felling operations¹.

In 1977, International Labor Office (ILO) listed vibration as an occupational hazard and recommended that measures should be taken to protect employees from vibration and the responsible authorities have to establish criteria to determine the danger; when necessary. The exposure limits must be defined by supervision of employees exposed to occupational hazard as a result of vibration at their work places must also include medical examination before the beginning of this particular job, as well as regular checkups later on².

In South Africa, prevalence rate of Hand Arm Vibration Syndrome (HAVS) is estimated at 15% of mine workers exposed to vibration in gold mines³.

The prevalence of HAVS in United States has been reported to be as high as 50%⁴.

Health problems among pneumatic hand held drill workers are very common. The clinical picture and the health outcomes of exposure to hand-arm vibration and whole body vibration are scantily documented in Pakistani context. In view of the health risk and the action taken in other countries, we submit that there is an urgent need to develop a practical management strategy for evaluation, monitoring and control of the equipment induced vibration.

Repeated exposure of hands to vibration may affect the peripheral circulation, peripheral nerves and musculoskeletal system⁵.

Vibration is defined as the oscillatory motion. Oscillatory motion involves alternate velocity in one direction and then in the opposite direction. This change of velocity means that the object is constantly accelerating, first in one direction and then in the opposite direction⁶.

The oscillatory motion from a source, e.g., a vehicle or a tool, may be simple harmonic wave or a multiple wave complex differing in frequency and acceleration; or complex waves of a random non-repeating series⁷.

Which parts of a body are most likely to be injured during an exposure to whole-body vibration (WBV) depends upon the magnitude of vibration, distribution of motion within the body, body postures and the frequency, direction and duration of vibration. Diseases of the spinal column are very common and associated with long-term exposure to the whole-body vibration. The back is especially sensitive to the vibration of 4-8 Hz range. WBV exposure has been linked to severe lower back pain (lumbar spine) and also degeneration, bucking/ slipping of lumbar discs⁴.

Vibration applied to a part of the body is known as segmental vibration. When vibration is applied to the hand, it is termed as 'hand-arm vibration' or HAV. Raynaud's phenomenon and the sensory impairment of the fingers are the predominant adverse effects that can result from contact with almost any vibrating source if the vibration is sufficiently intense and within the range of 4 to 5000 Hz of frequency for a significant time period. The exposure time necessary may range from one month to 30 years, depending upon the intensity of vibration source, the transmissibility and the absorption of vibration into the hand and susceptibility of the individual. Workers with large, warm hands are seem to be less at risk. The most common tools causing hand-arm vibration syndrome (HAVS) are the pneumatic tools, such as fettling tools, grinders, riveting guns drills, jackhammers, riveting guns, impact wrenches, and chainsaws. In high-risk work the incidence and prevalence of HAVS is as high as 90%. The symptoms are more commonly reported in the cool climates and during the winter rather than in summer because of cold stress on the circulatory system. In some work situations, an increase in the work intensity, introduction of the new tools, or the extended work hours may cause HAVS epidemic.

Hand-arm vibration syndrome is a disease of the following separate peripheral components circulatory disturbances: cold-induced vasospasm with the local finger blanching "white finger"; sensory and motor disturbances: numbness, loss of finger

coordination and dexterity, clumsiness and inability to perform the intricate tasks and musculoskeletal disturbances: muscle, bone, and joint disorders¹.

Finger blanching is accompanied by the numbness. As the circulation is restored to the digits, hyperemia, tingling, and pain usually occur. Tingling and paresthesia usually precede the onset of blanching in many subjects. These sensory symptoms and signs may be the only complaint voiced by some patients. In advanced cases, peripheral circulation becomes sluggish and giving a cyanotic tinge to the skin of the digits, whereas in severe cases, tropic skin changes (gangrene) will occur at the fingertips. The toes may be affected if directly subjected to vibration from a local source, such as vibrating platforms, or they may be affected by reflex spasm in subjects with severe hand symptoms. Reflex sympathetic vasoconstriction also may account for increased severity of noise-induced hearing loss in HAVS subjects⁸.

Concrete or metal ceilings drilling is one of the most physically demanding tasks performed in construction. This work is done with rotary impact hammer drills that weigh up to 40 N. The work is associated with pain and musculoskeletal disorders at the wrist, forearm and shoulder joints and the back. During drilling, mechanism of injury is health thought to be the high forces and non-neutral shoulder and wrist postures. The harmful effects of the vibrating tools are due to the time length of the vibrating tools, increases the risk of health effects. The major health hazards related to the use of vibrating tools are Vibration Syndrome and Vibration-Induced White Fingers⁹.

Vibration Syndrome is a group of symptoms related to the use of vibrating tools e.g. muscle weakness, muscle fatigue, pain in the arms and shoulders, and vibration induced white finger. Many researchers believe that other symptoms like headaches, irritability, depression, forgetfulness, and sleeping problems should also be included in descriptions of Vibration Syndrome. Vibration-Induced White Finger (VWF), also known as "Dead

Finger" or "Dead Hand" is the result of impaired circulation. Hand-arm vibration is caused by the use of vibrating hand-held tools, such as pneumatic jack hammers, drills, gas powered chain saws, and electrical tools such as grinders. The nature of these tools involves vibration (a rapid back and forth type of motion) which is transmitted from the tool to the hands and arms of the person holding the tool. VWF may appear after only several months later¹⁰.

Dupuytren's contracture is a disease of the palmer fascia resulting in thickening and contracture of fibrous bands on the palmer surface of hands and fingers, is reported to be associated with hand-arm vibration¹¹.

Operation of a pneumatic drill may accentuate a tendency toward the development of osteoarthritis in those workers who are predisposed to the disease¹². The concrete drillers are at the risk of breathing silica dust and can developed silicosis and other silica related diseases such as pulmonary tuberculosis, kidney diseases, lung cancer, and chronic obstructive pulmonary disease¹³.

Repeated or prolonged exposure to the excessive noise levels will lead to hearing impairment. Potential sources of noise emissions include compressors, drilling machines, pick-hammers or the other mechanical equipment used at mine. Loud drills can put workers in danger of deafness. A pneumatic drill is so loud that it gives out eight times more noise than the standard level which requires ear protection in industry. Exposure to noise above 85 decibels (dB) may be hazardous for hearing even if it lasts for a short span of time. A hand drill measures 98dB, a hammer drill 114dB, a pneumatic percussion drill 119dB and a mining drill gives us 108 – 113dB which can surely make a person deaf after working continuously under that environment¹⁴.

This study focus at health problems, awareness of health problems of pneumatic hand held drill workers and identification of risk factors with a view to recommend them protective measures to prevent these problems.

MATERIAL & METHODS

Descriptive cross sectional study survey carried out to assess health problems among pneumatic hand held drill workers in the region of Barakaho and Taxilla. Study was carried out in Barakho which is located in Isalmabad capital city of Pakistan and Texilla which is located in Punjab province near Islamabad. Study was carried out over 3 months from September to November 2011.

Pneumatic hand held drill workers in the region of Barakaho and Taxilla.

A total of 100 pneumatic hand held drill workers were selected through convenient sampling technique. Road building workers using drilling devices, working for more than 5 years in the areas of Barakaho and Taxila were included. Those workers whose experience was less than five years and with Joint deformities were excluded from the study. Information was collected by direct interviewing method through a structural questionnaire in Urdu which is also translated in English, containing both close ended and open ended questions. Questionnaire was developed in Urdu due to the language difficulties by the drill workers. Any queries regarding the questionnaire were clarified during the interview in a standardized way. All respondents were questioned following a written as well as verbal consent. All the workers were interviewed with the questionnaire which was in Urdu. All the interviews with questionnaire were conducted solely by researcher. Questions were asked from respondents with standardized explanation so that the questions should be comprehended equally without any variation in interpretation of questions by the drill workers. There were few non respondents which refused to give time for interview.

Data analysis was done by using Statistical Package for Social Sciences version 17 (SPSS version 17).Data spread sheet was created in SPSS according to the variables and coding used in data collection instruments which facilitated the transfer of data from questionnaire to data sheet on SPSS. A total of 32

variables were made and utilized for data processing. Other variables were also defined during statistical analysis. All the questions which were scored to examine the health problems among drill workers were collected. Proportions of groups in terms of age and groups duration of their work experience to health problems among pneumatic drill workers were compared.

RESULTS

Out of 100 study participants,32% were aged 22-27 yrs,25% were aged 28-33 yrs, while 43% were aged above 33 yrs.69% of study participants had 5-8 years of work experience while 31% had more than 8 years of work experience.82% of worker had relevant health problems while 18% did not have.

TABLE 1: FREQUENCY TABLE OF HAND ARM VIBRATION SYNDROME

Hand- Arm Vibration Syndrome	Numbness of fingers after 20 min (A)	Numbness of fingers at anytime (B)	wakeup with pain in hands at night (C)	Vibration induce White Fingers (D)	Grip (E)
Yes	71	54	37	46	19
No	29	46	63	54	81
Total	100	100	100	100	100

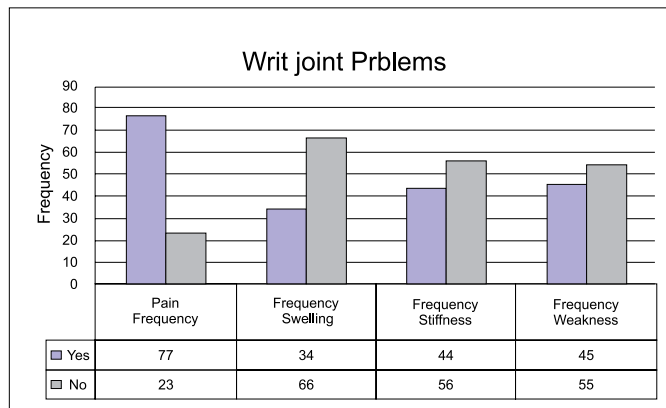


Fig 1:

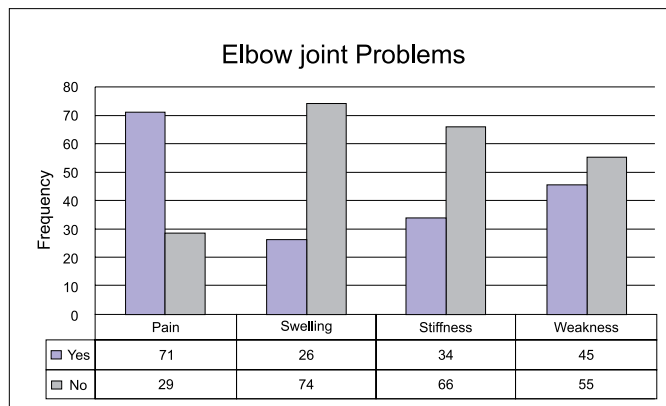


Fig 2:

DISCUSSION

Equipment-induced vibration is widely recognized as a health hazard.

It is a physical stressor to which many people are exposed at workplace. There are many occupational diseases which are caused by permanent vibra-

tion exposures. Drilling into concrete or metal ceilings is associated with pain and musculoskeletal disorders at the wrist, forearm, shoulder and back. A review of the available scientific literature showed that in the last 80 years about 20 epidemiological surveys of vibration induced disorders among stone workers have been performed. In spite of extensive research undertaken in the developed countries, information on the magnitude of the problem in Pakistan is not available.

The results of the present study are showing that the prevalence of health related problems among hand held pneumatic drill workers are 82% out of total study population 100(drill workers). The duration of exposure to vibration observe is between 5 to 12 years and the ages were from 22 to 42 year. The study shows that the prevalence of wrist joint and elbow joint problems (pain, swelling, stiffness and weakness), Hand-Arm Vibration Syndrome (specially vibration induced white fingers) increases with increase in duration of vibration exposure and also are also related to the ages of the drill workers.

In another study in conducted in India in November 1996, 38(57.57%) out of 66 drill workers were having the musculoskeletal abnormalities including muscles weakness, soft tissue wasting, pain and stiffness and the signs and symptoms of vibration induce white fingers¹⁵.

The findings of another study showed a greater occurrence of upper limb disorders in quarry drillers and stone carvers exposed to vibration. Hand-arm vibration syndrome and dose response relation for vibration induced white finger among quarry drillers and stone carvers than in control stone workers performing only manual activity. As well as vibration, ergonomic stress factors are likely to have played a part in the development of carpal tunnel syndrome and musculoskeletal disorders among the stone workers who use hand held vibrating tools.

Another study showed that there is evidence of an association between work with hand-held vibrating tools

of the percussive, low frequency type (less than about 40 Hz) - such as chipping hammers and scalers and a higher than normal, although very low, prevalence of premature elbow and wrist osteoarthritis. This excess work related risk is, however, not specific to vibration exposure. Instead, the major etiologic factors appear to be the joint load associated with the manipulation of any tool in heavy manual work, repetitive movements of the hand and arm (often together with minor traumatization), loading of the joint surfaces in extreme positions (such as occurs in awkward postures), and static work . All these factors are prominent in work with hand-held vibrating tools of the percussive type. Against this background it is, however, obvious that the following vibration-specific factors may also be incriminated: damage to the articular cartilage from shocks from pneumatic tools with low frequency vibration, additional articular load (and consequent strain) associated with a vibration-induced increase in the need for joint stabilization and higher gripping and pressing forces to work with and guide the tools optimally, the tonic vibration reflex (which increases muscle contraction), and a stronger grip on the tool handle induced when tactile sensibility is diminished by vibration. So far, no investigations have even begun to take into account the great complexity of possible confounders and effect modifiers¹⁶.

Another study was conducted in south Africa, which shows that the prevalence of HAVS in vibration-exposed gold miners was 15%, with a mean latent period of 5.6 years. Among the non-exposed comparison group, 5% had signs and symptoms indistinguishable from HAVS. This difference was statistically significant ($P < 0.05$). All the cases of HAVS gave a history of exposure to rock drills¹⁷.

International standards and regulations are based on the research work done in developed countries, where working conditions are different and susceptibility of an individual to external stimuli may considerably vary because of racial and climactic factors. In a warm environment like Pakistan, the prevalence of symptom

complexes for HAV is suggestive of the existence of peripheral neuropathy and musculoskeletal abnormalities rather than any peripheral circulatory disorders. The biodynamic response of Pakistani workers to vibration energy requires detailed studies. The regulations should be framed in consonance with this data.

CONCLUSION

Occupational health professionals, workers, and employers should consider the seriousness of vibration syndrome, wrist joint, elbow joint and carpal tunnel syndrome. I recommends that engineering controls, medical surveillance, work practices, and personal protective equipment be used to help reduce exposure to vibrating hand tools and to help identify vibration syndrome in its early stages among workers likely to be at risk.

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CONFLICT OF INTEREST

None declared.

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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.