Occupational respiratory diseases among dental laboratory technician: Review

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Abstract: Dental technicians as other dental personnel are exposed to many occupational hazards in working place which results in diseases and affects the wellbeing of dental technicians.

Aims: The aims of this review paper are to identify the prevalence and predisposing factors that relates with occupational respiratory diseases among dental technicians' practitioners.

Method: The data for this review were collected by An electronic search of English dental literature was performed through Google Scholar to obtain all the relevant studies and reviews as well as case reports pertaining to occupational chemical hazards and respiratory diseases. The review concentrate most common respiratory diseases resulted from exposures at work place, and itself began with the search of relevant key words linked with the dental technician occupational health, occupational disease. The search also targeted in this paper tracked and arranged the occupational hazards, prevalence of respiratory diseases, pathogenesis and management strategies.

Key words: Dental laboratory technicians, occupational hazards, Pneumoconiosis.

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Introduction

Every occupation has its related risks and hazards which are negatively affect the health of workers. The dental environment is associated with exposing to multiple risks as chemical hazards and physical, biological and ergonomic risks which are finally represented by different occupational diseases[1]. The senior scientific staff of National institute for occupational safety and health in US1982 suggested occupational lung diseases within the list of 10 leading work related diseases and injuries in the United States .[2]. In dental laboratory, there are many chemical hazards such as denture base materials, metallic or acrylic resins, and additives containing methyl methacrylate monomer, polymer, colorants as well as porcelain which is extensively used for denture teeth, metallic bridges and inlays. Silica dusts are generated during sand blasting, polishing and porcelain building up are specifically concerned for dental technicians’ health.[1] All mentioned chemical hazards putting laboratory technicians at risk to develop respiratory disease like pneumoconiosis.[3]. Furthermore these hazardous materials increase the risk of asthma , pneumoconiosis.
chronic obstructive pulmonary diseases, cancer, fibrosis and pulmonary granulomatosis in dental technician[4]. Occupational induced respiratory disease due to inhaled dental dusts are clinically manifested by cough, enhanced mucous secretion, and decreased respiratory capacity[5].

Pušk T et al, 2011 reported that, the dental dusts categorized as extremely dangerous fine sized particles which can penetrate deep into the lungs, causing serious damage. Most inhaled fine particles with an aerodynamic diameter of less than 2.5 m reach the terminal bronchioles and alveoli of the lungs, in which no mucociliary clearance takes place. [17]. Further more damages of alveolar macrophages will occurs and macrophage cannot digest long fiber which as crystalline silica, stainless steel, gold alloys, titanium, chrom cobalt alloys, porcelain and Zirconia resulting in fibrosis and the formation of the nodular lesions.[8]. There is strong epidemiological evidence to support an association between occupational crystalline silica exposure and several diseases such as silicosis, lung cancer, pulmonary tuberculosis, and chronic obstructive pulmonary disease.[9].

Many cases of pneumoconiosis caused by silica, heavy metals, or beryllium have been reported.[10][11]. Chromium exposure in some epidemiological studies was associated with the incidence of lung cancer. Because it could increase Reactive Oxygen Species formation which triggered mutations in the P53 gene and increased expression of Tumor Protein p53 (TP53) mutant level.[12] A case report in Denmark showed a case of adenocarcinoma in a dental technician who worked on cobalt-chromium alloy for 20 hours / week. Another studies by Sorahan et al, 1998 in the UK and Beveridge et al, 2010 in Montreal, suggested that workers exposed to nickel and chromium increase the risk of lung cancer. Choudat D, 1994 reported on the relation between inadequate local exhaust and ventilation age of employment, size of dental laboratory, number of employers, working position and the risk of developing respiratory disease during preparation of plaster and refractory material, wax modeling, fusion of alloys, sanding, and hand finishing [10]. Although several cross sectional studies have been carried out to investigate pneumoconiosis and lung function abnormalities among dental technicians. In reviewed literature, long-term follow-up studies in terms of pneumoconiosis in dental technicians were rarely found. However, several cohort studies had been carried out among workers involved in occupations with similar exposure to inorganic dust. The results showing progression of pneumoconiosis with radiological progression 38% among Scottish colliery workers after 20 years of employment and 37% among granite workers exposed to silica with employment period 2-17 years. [13]. The association between the prevalence of pneumoconiosis and metal dusts were reported among different types of epidemiological studies. A case control study among Sweden dental technicians with a minimum of five years of technicians' exposure to Chrom Cobalt dust with 16% and no case of pneumoconiosis was observed among technicians not exposed to Chrom Cobalt dust. However, the absence of a significant difference in lung function between cases of dental technician's pneumoconiosis and the remainder of the study group [14]. Similar finding has been reported among Turkish dental technicians evaluated at 2005 and re-evaluated in 2012. The prevalence of pneumoconiosis was 13.8% with reported respiratory symptoms was as follows: dyspnea, cough, and phlegm. This study also reported incidence of new cases of pneumoconiosis at the end of 7 years.
There significant increase in pneumoconiosis among participant due to continuous exposure to dusts at work place. Selden et al showed that pneumoconiosis occur among dental laboratory technicians with at least 5 years of exposure to dust from cobalt- chromium-molybdenum alloys.

Many reports suggested the relation between occupationally induced pneumoconiosis and lung function capacity. Although Radi et al found that Korean dental technicians had significantly lower forced vital capacity and maximal flow rate than other control group. Furthermore, according to case control study conducted by ABAKAY A et al among Turkish dental technicians who had worked ≤10 years and >10 years. Pulmonary function test results showed that 65.9% had a normal pattern, 22.4% were restrictive, and 11.7% had obstructive type pulmonary function disorders. Similar finding was reported. However Rom et al conducted a case control study among dental technicians and Some of them with a mean duration of dental work of 28 years, were diagnosed as having a simple pneumoconiosis, related to past silica exposure or exposure to non-precious metal alloy dust. The pulmonary function of cases was within the normal range. In the literature there are different results about the prevalence of pneumoconiosis and dental technicians working time period. Increased work experience caused a significant reduction in respiratory parameters. S Radi et al, 2002 concluded high significant prevalence of pneumoconiosis in technicians with 20 or more years exposure (16.7%) than those with less than 20 years exposure (1.4%). No association between working time period and lung function abnormality was reported. The pneumoconiosis prevalence in dental technicians having an average of less than 10 years of working time was stated to be 24.2% in a study in Turkey. In another study, while pneumoconiosis prevalence in dental technicians having less than 30 years of working time was found to be 3.5% , and it was found to be 22.2% in those having a work history of more than 30 years. Despite advancement in dental material technology respiratory occupational diseases still reported among people handling engineered nonmaterial. Molecular epidemiological studies to date on workers suggest respiratory health impairment. Elevated pro-inflammatory markers, including-inflammatory cytokines, such as tumor necrosis factor and interleukin (IL) 6 and IL 8 in the biological fluids (blood) of workers, elevated antioxidant enzymes and cardiovascular markers in circulation, higher pro-inflammatory leukotrienes, and markers of oxidative stress in exhaled breath condensate and/or circulation.

**Discussion**

In the literature there are different results about the relationship between the working time of dental technicians and pneumocosis prevalence. The difference between these results might be based on both, the method difference of the studies and the difference in workplace design and ventilation system and health conditions of the technicians as well as education and awareness to hazards among dental technicians, availability of personnel protective equipment at work places and compliance with them among dental technicians. Another point is that, many studies reported no significant radiological finding was reported despite prevalence Pneumococcus's. However, many parenchymal structures overlap in a chest X-ray, limiting its specificity and sensitivity. Therefore,
pneumoconiosis in those with dust exposure cannot be ruled out using conventional radiographs whereas high radiographic resolution computed tomography as well as biopsy examination in suspected cases will plays an important role in disclosing early changes observed in occupational respiratory diseases.[4]

**Conclusion**
The results from literatures illustrate that, although respiratory occupational diseases (Pneumoconiosis) was first defined among dental technicians in 1939.[19] and despite the advancements in dental fields many occupational health hazards still prevailing, continuous exposures to manufacturing different dental dusts putting dental technicians from developed and developing countries at high risks of respiratory problems as well as other morbidities due to continuous exposure to dusts related to manufacturing procedures of removable, fixed and orthodontic prosthesis. Although Varying results have been obtained from the literature studies regarding prevalence of pneumoconiosis among dental technicians, but that address the relationship between dental technician’s pneumoconiosis in terms of respiration symptoms, physical examinations, and radiological findings. Although Occupational health hazards are unavoidable in many professions. However, they can be prevented in order to keep dental professionals one healthy. There is needs for Assessment of the occupational hazard awareness among dental students would help in motivating and planning preventive strategies at the training and teaching level. [18], Because occupational pneumococci were reported among dental technicians employed within working period less than 5 yeas year of work. [14]. Furthermore, strengthening of the knowledge of preventive practices during the curriculum, it will result in the use of effective practice of dentistry in future.[18]

**Recommendations**
Based on the findings of previous studies it is recommended that:

1- Dental laboratory environment should be improved in terms of providing safety precaution measures to dental technicians, air sampling assessment introducing and assessment as well as continuous improvement of air ventilation system.

2-All the personal protection measures must be available for the technicians with need for high compliance with them.

3-Dental technicians should regularly undergo specific medical examinations with primary emphasis on lung function, skin diseases, diseases of ear, throat and nose, disorder of hearing and periphery circulation.

4-There is an additional requirement for proceeding with dental instruction programs in dentistry so dental technicians can refresh themselves with the most recent and more up to date strategies and materials available.

5-There is need for implementation and re planning of smoking cessation programs.

6-Strong collaboration between public and private sectors to implement preventive strategies, since most dental technicians are highly employed at private sectors.

7-There is strong need to conduct researches among our dental technicians' professionals and students to assess prevalence of disease and to implement preventive strategies.

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