Dental Technician's Pneumoconiosis: Case Report

Diş Teknisyeninde Pnömokonyoz

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ABSTRACT Pneumoconiosis is an interstitial lung disease due to dust and mineral exposure. Pneumoconiosis can be seen in dental technicians due to chronic exposure to inorganic dusts such as silica, silicon carbid, asbest and metalic dusts such as cobalt, molibden, berilium and nickel. A 59-year-old male, a dental technician worked in dental laboratory for 20 years, was admitted with chest pain, fever and dyspnea. He had rales and ronchi in the base of the lungs, bilaterally. Bilateral diffuse micronodular densities were found on the chest radiogram. Bilateral millimetric nodular lesions more striking in the upper lobes were seen in the thorax high resolution computerized tomography. There was a restrictive pattern in the pulmonary function tests. There was no endobronchial lesion in bronchoscopy. Zinc, chlorine, nickel, chromium, titanium and barium elements were isolated in the bronchoalveolar lavage. The case is presented together with the literature as a complex pneumoconiosis case due to inhalation of multiple mineral particles.

Key Words: Occupational diseases; pneumoconiosis; dental technicians

ÖZET Pnömokonyoz, toz ve madensel maddelere maruz kalma sonucu oluşan bir intertisyel akciğer hastalığıdır. Silika, silikon karbid, asbest ve metalik tozlar gibi inorganik tozlarla kronik temas sonucu diş teknisyenlerinde de görülebilmektedir. Göğüs ağrısı, ateş ve dispne şikâyeti olan 59 yaşındaki erkek hasta kliniğimizce kabul edildi. Hasta 20 yıldır diş laboratuvarında teknisyen olarak çalışmaktaymış. Akciğer her iki alt bölümlerinde ronküs ve raller işitilmekteydi. Akciğer grafisinde her iki taraflı yaygın mikronodüler yoğunluk artışları görüldü. Yüksek çözünürlüklü akciğer tomografisinde, her iki taraflı milimetrik nodüler lezyonların daha çok üst loblarda görülmesi dikkat çekici idi. Solunum fonksiyon testlerinde restriktif (kısıtlayıcı) bulgular mevcuttu. Bronkoskopide bronş içi lezyon saptanmadı. Bronkoalveolar lavaj örneğinden bakır, klorin, nikel, kromiyum, titanyum ve baryum maddeleri izole edildi. Bu çalışmada diğer literatür bilgileri ile birlikte, birçok madensel maddenin solunmasına bağlı olarak gelişen bileşik haldeki bir pnömokonyoz vakası sunulmuştur.

Anahtar Kelimeler: Meslek hastalıkları; pnömokonyoz; diş teknisyenleri

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Dental technicians are exposed to dusts and minerals which may cause pneumoconiosis and occupational pulmonary disease. Pneumoconiosis rate is high in this occupation and frequency is directly related to the exposure duration. According to the results of three epidemiological studies, pneumoconiosis is seen 15% more in dental technicians whose exposure exceeds 20 years.[1] Pneumoconiosis was first defined among dental technicians in 1939. The first patient was silicotuberculosis, therefore the studies were concentrated on silicosis; however, many minerals containing

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chromium (Cr), cobalt (Co), molybdenum (Mo) mixtures were isolated.[2,3] Samples obtained from the pulmonary system are examined by an electron microscope and then etiological elements can be isolated.[4] A dental technician who worked for 20 years in a dental laboratory and whose element analysis revealed complex mineral structure is reported together with the literature.

CASE REPORT

A 59-year-old male was admitted with chest pain, high fever for 2 days and dyspnea on exertion. He had coronary artery disease in his history and was on coronary vasodilator therapy. He worked in a dental laboratory for 20 years as a dental technician. His physical examination revealed arterial blood pressure: 140/80 mmHg, pulse: 96/min and temperature: 37.5°C, his general condition was good and there was inspiratory ralles in bilateral lower lungs regions as well as rare rhonchi on auscultation. Other system examinations showed no abnormalities. Laboratory findings were as follows: hemoglobin: 13.7 g/dL, hematocrit: 39.2%, WBC: 22900-7600/mm^3, PLT: 259000/mm^3, glucose: 91 mg/dL, BUN: 21 mg/dL, ALT: 38 U/L, AST: 33U/L, Ca: 9.2 mg/dL, LDH: 328, ALP: 126 U/L. Arterial blood analysis showed pO_2: 62 mmHg, pCO_2: 32 mmHg, pH: 7.49, O2 SAT: 93.7%. Bilateral diffuse micronodular densities and an increase in cardiothoracic ratio were seen in chest radiogram (Figure 1). Millimetric nodular lesions prominent in both upper lobes and infiltrations in the anterior segment of the left upper lobe were seen in the thorax high resolution computerized tomography (Figure 2). Restrictive pattern was found in the spirometric analysis. Spirometry diffusion capacity (DLCO) was decreased (58%). We abtained the patient's consent for bronchoscopy. No endobronchial lesion was seen in bronchoscopy. Bronchoalveolar lavage was performed from the lateral segment of the right medial lobe. Cytologic analysis of bronchoalveolar lavage fluid was normal. Mineral analysis of cytologically benign bronchoalveolar lavage fluid was performed in TÜBİTAK Marmara Research Center. In the spectrophotometric element analysis of the electron-microscopically scanned area, Cr, Co, P, Ni, Zn, Al, Cu and Ti and Ba elements were isolated

FIGURE 1: Bilateral micronodular densities in the chest radiogram.

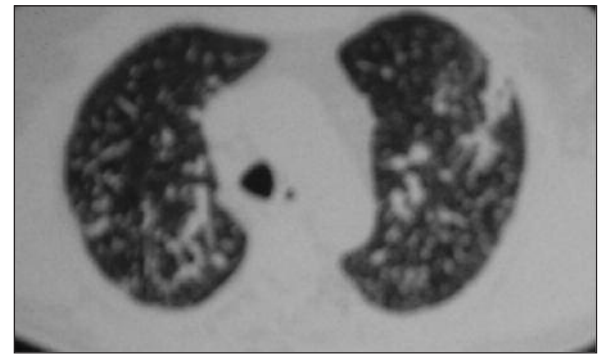

FIGURE 2: Bilateral milimetric nodules in thorax high resolution computerized tomography.

(Figure 3, 4). The patient was followed-up with the diagnosis of pneumoconiosis.

DISCUSSION

A number of studies have been published on dental technician's pneumoconiosis since 1962. Heavy metals silicon (Si), Co-Cr-Ni alloy, beryllium (Be) Co-Cr-Molybdenum (Mo) alloy exposure are among the causes.[1-7] Dental technicians are exposed to many dusts and fumes during dental prosthesis production. Wax is the main material used in the production of ceramic and fixed metallic prostheses. Moldings are formed out of wax and placed in a cylinder filled with an insoluble material. Wax is melted by heating and the empty mould is filled with Ni-Cr alloy. The mould is broken after cooling and the prosthesis is polished into its final shape.[1,5] When the ceramic layer is added to the

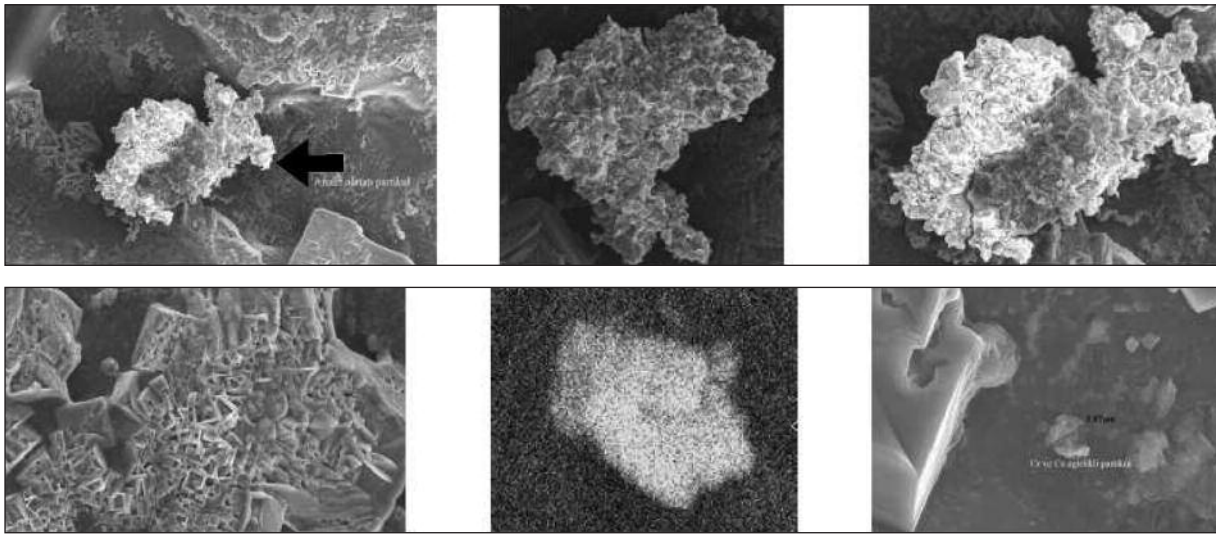

FIGURE 3: Bronchoalveolar lavage was examined under scanning electron-microscope.

alloy for ceramic prosthesis, framework made of Cr-Co alloy is used instead of wax. During the process, stucco and insoluble materials such as silica, wax, Cr-Ni-Co alloy, ceramic and resin are found in the air in high concentrations. Beryllium is used to harden the Cr-Ni alloy.[5]

The duration of exposure is important for pneumoconiosis. Following epidemiological studies, Choudat reported 15% more pneumoconiosis in technicians exposed for more than 20 years.[1] Studies in different countries showed rates of 12.9% in Denmark, 16.3% in Switzerland, 9.8% in Crete, 11.8% in France, and %16 in Sweden.[3,8,9] Cimrin et al. reported prevalence of radiological findings in dental technicians as 23.6% in Turkey.[10]

Coughing, sputum production and dyspnea after exercise are common symptoms.[11] In addition to dyspnea, our case also had fever as he had pneumonia concomitantly. Radiologically, bilateral nodular opacities are usually seen.[2,5,11] Restrictive pattern is marked in the pulmonary function tests and obstruction can be found due to smoking.[5] The diffusion capacity is reduced.[2] Our patient was an ex-smoker and had restrictive pattern in his pulmonary function tests and his diffusion capacity was decreased. Radiologically, bilateral micronodular densities were found. When samples taken from the pulmonary system are examined under the electron microscope, element analysis can be performed by

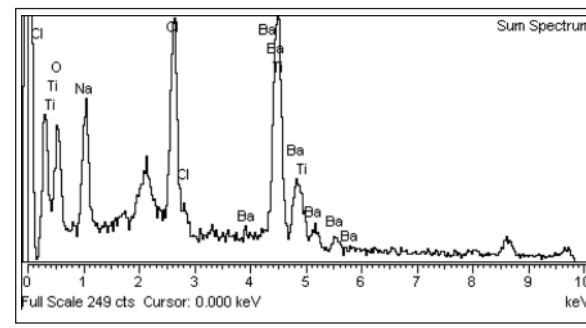

FIGURE 4: Spectrophotometric analysis of bronchoalveolar lavage fluid (Semiquantitative elemental analysis system).

using the energy dispersive X-ray microanalysis (EDX) and the electron energy loss spectroscopy (EELS) methods.[2,3] Bronchoalveolar lavage fluid taken by fiberoptic bronchoscopy was analyzed in Tubitak Marmara Research Center by using the EDX method and a complex mineral structure was found in the analysis. Co, Cr, Ni, Zn, Cu, Ti and Ba elements were detected. Ti and Ba are not the common elements found in the previous dental technician's pneumoconiosis cases. In literature, pneumuconiosis is defined in furniture and wall painters and Ti is seen substantially in the microanalysis.[12,13]

Dental technicians are at risk because they are exposed to considerable amounts of dusts and fumes. Risk increases with non-efficient ventilation systems.[2,4,8] Global precautions should be considered to solve this problem.

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