CASE REPORT OLGU SUNUMU

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Pulmonary Tuberculosis Complication in Dental Workers' Pneumoconiosis

Diş Teknisyeni Pnömokonyozunda Akciğer Tüberkülozu Komplikasyonu

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ABSTRACT The interstitial lung disease caused by dusts and chemicals in dental technicians is classified as a specific group called dental technician pneumoconiosis. In the pathogenesis of dental technician pneumoconiosis, exposure to various dust and chemicals such as metal dusts, silica, plaster, waxes, resins, volatile liquids, methyl methacrylate, and their effects on the lung parenchyma play a significant role. Dental technicians may develop lung problems such as asthma, silicosis, and hypersensitivity pneumonitis. These individuals are at risk for tuberculosis and lung cancer in the long term. The most important factor in the development of occupational lung disease is multiple exposures in the workplace. When insufficient ventilation conditions in workplaces are combined with deficiencies in protective measures, the risk increases even further. A case followed with a diagnosis of dental technician pneumoconiosis during the pandemic period, in which tuberculosis was also diagnosed upon further investigation due to radiological suspicion, has been presented.

Keywords: Pneumoconiosis; silicosis; tuberculosis

ÖZET Diş teknisyenlerinde çeşitli toz ve kimyasal maddelerin neden olduğu interstisyel akciğer hastalığı diş teknisyeni pnömokonyozu olarak özel bir grupta incelenir. Diş teknisyeni pnömokonyozu patogenezinde metal tozları, silika, alçı, mum ve reçineler, likit uçucular, metil metakrilat gibi çeşitli toz ve kimyasallara maruziyet ve bunların akciğer parankimine olan etkileri rol oynamaktadır. Diş teknisyenlerinde astım, silikozis ve hipersensitivite pnömonisi gibi akciğer problemleri gelişebilmektedir. Bu bireyler uzun vadede tüberküloz ve akciğer kanseri için risk taşımaktadırlar. Mesleksel akciğer hastalığı gelişimi için iş yerindeki çoklu maruziyet en önemli faktördür. İş yerlerindeki yetersiz havalandırma koşulları ve korunma önlemlerindeki eksiklikler eklendiğinde risk daha da artmaktadır. Pandemi döneminde diş teknisyeni pnömokonyozu tanısıyla takip edilen ve radyolojik şüphe üzerine yapılan incelemelerde ayrıca tüberküloz tanısı konulan bir olgu sunulmuştur.

Anahtar Kelimeler: Pnömokonyoz; silikoz; tüberküloz

Individuals working in dental laboratories are exposed to different chemicals and dust, such as molybdenum, beryllium, chromium, cobalt, aluminum and nickel, silica particles, and methyl methacrylate. For this reason, dental technician pneumoconiosis (DTP) is a complex form of pneumoconiosis.[1,2] Inadequate ventilation and lack of prevention policy can cause to health problems. Depending on the duration of exposure, dental technicians may develop occupational lung diseases such as asthma, hypersensitivity pneumonitis, and pneumoconiosis. DTP is an important cause of mortality because it can be complicated by diseases such as tuberculosis and lung cancer.[2,3] Tuberculosis, a common complication of pneumoconiosis, is an infectious bacterial disease caused by *Mycobacterium tuberculosis (Mtb)*. Among occupational exposures, silicosis ranks first as a major risk factor for tuberculosis.[3] A case that was followed up with the diagnosis of DTP and was diagnosed with tuberculosis after

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further examination due to radiological suspicion of tuberculosis is presented. To our knowledge, DTP with tuberculosis has not been reported in the literatures.

CASE REPORT

A 64-year-old male patient, who had no known medical condition and was a non-smoker, was presented with a 1-year history of progressive dyspnea with intermittent cough and sputum. There was no history of contact with a tuberculosis patient. He had been using oxygen therapy for nearly 6 months. He had worked as a dental technician for approximately 35 years and had not used personal protective equipment during working hours. On examination, he appeared dyspneic and his vital signs are temperature of 36,8 °C, blood pressure of 120/70 mmHg, pulse rate of 95 beats/min and oxygen saturation of 80% under room air. Physical examination revealed inspiratory crackles at bilateral subscapular areas. His chest X-ray (CXR) (Figure 1) showed bilateral middle zone reticulonodular opacities. Chest computed tomography (CT) revealed a mosaic perfusion, interlobular septal thickening in all zones, tree-in-bud appearances in the upper lobe, and honeycombing in the lower lobes (Figure 2a, 2b). Pulmonary function test showed obstructive lung disease forced expiratory volume/forced vital capacity (FEV_1/FVC: 63.7%) with reduced FEV_1 (1.17 L, 41% of predicted) and FVC (1.84 L, 51% of predicted). He had leucocytosis white blood count (white blood count: 13.82×10^9/L, neutrophil 85.5%) and normal erythrocyte sedimentation rate (14 mm/hour). In investigations of interstitial lung disease, other etiologies were ruled out, and DTP was considered in the multidisciplinary council. Due to the patient's high oxygen requirements and respiratory distress, treatment with methylprednisolone at a dosage of 120 mg per day was initiated. At the same time, due to the presence of a small area with a tree-in-bud finding on the chest CT (Figure 2a), tuberculosis examinations were planned. Meanwhile, as the patient's oxygen need decreased, the methylprednisolone dose was gradually reduced. Acid-fast bacilli direct smear was found positive in sputum 3 times on 3 different days. Following this, the patient received 4-drug tuberculosis treatment (isoniazid 300 mg, rifampicin 600 mg, ethambutol 1500 mg, pyrazinamide 2000 mg) for the first 2 months, followed by 4 months of treatment

FIGURE 1: Significant increase in reticular density in the right lower-middle zone on posteroanterior chest X-ray

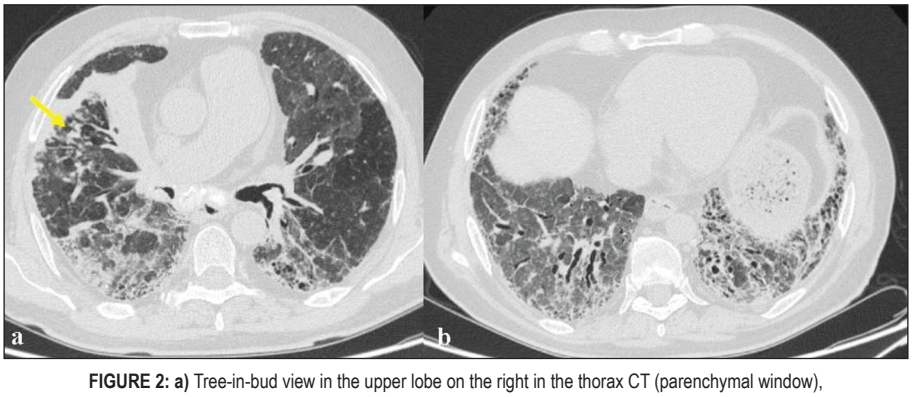

FIGURE 2: a) Tree-in-bud view in the upper lobe on the right in the thorax CT (parenchymal window), **b)** Honeycombing and fibrosis appearances in the lower lobes on thorax CT (parenchymal window)

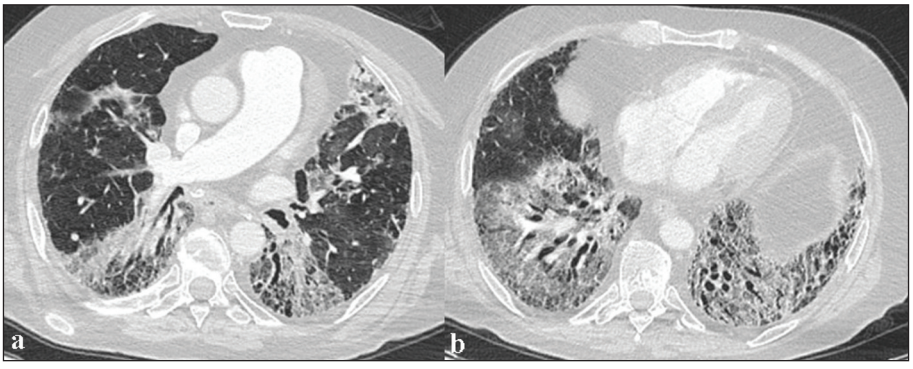

FIGURE 3: a, b) Fibrosis and ground glass appearance (parenchymal window) in the lower lobes on thorax CT

with isoniazid and rifampicin, completing a total of 6 months of tuberculosis therapy. When approximately 2 months of treatment were completed, *Mtb Complex* grew in mycobacterial culture and was found to be sensitive to isoniazid and rifampin. After tuberculosis treatment, the patient showed partial clinical improvement and a decrease in oxygen requirements. During outpatient follow-ups, the patient was evaluated for lung transplantation and was placed on the transplant list. However, the patient was admitted due to coronavirus disease-2019 pneumonia to the intensive care unit, nearly after 2 years (Figure 3a, 3b). The patient was intubated as respiratory failure progressed. Despite broad-spectrum antibiotics and supportive treatments, the patient died on the 23rd day of hospitalization. The patient gave written consent for this case report to be published while he was alive.

DISCUSSION

The workplace environment is one of the main sources of exposure to harmful substances to health. In the literature, the prevalence of DTP reported between 4.5% and 46%. The difference in prevalence among these studies is attributed to factors such as the duration of exposure, the level of metal dust in dental laboratories, the presence of environmental ventilation, and the use of different radiological methods for diagnosing pneumoconiosis. In a study published by Alici et al. in 2018, it was shown that among a total of 70 dental technicians between 2013 and 2016, 46 (65.7%) were diagnosed with pneumoconiosis.[4,5]

Although various alloy types are used in the dental technician sector, the most commonly used form consists of cobalt, chromium, molybdenum and smaller amounts of other metals. The pathophysiology of fibrosis caused by cobalt-chromium-molybdenum is not yet fully understood, but it is believed that cobalt may induce fibrosis by stimulating lymphocytes.[6] Cough, sputum, and shortness of breath are common respiratory symptoms in DTP. In the radiological evaluation of patients with DTP, parenchymal densities were detected in 31% of cases on CXR and in 69% on tomography. The most common findings are nodular, reticular or linear opacities, emphysema and pleural effusion or thickening.[7] The widespread interlobular septal thickening in all zones, honeycombing in the lower lobes, and traction bronchiectasis in the upper lobes were found in our case. Additionally, there were tree-in-bud appearances observed in a small area of the right lung, raising suspicion for tuberculosis.

Several studies have shown abnormal lung function test measurements in patients with DTP. Measurements such as FVC, FEV_1, FEV_1/FVC, and PEF have been found to be lower in cases of DTP. Our case had a very long occupational exposure of 35 years and had never smoked. The pulmonary function test showed mixed ventilator impairment. In a study conducted in our country, the incidence of pneumoconiosis increased from 13.8% to 47% over a 7-year follow-up period. In these cases, the disease can continue to progress even after exposure has ceased.[8] In our case, although the exposure had been

stopped for 8 years, the symptoms had progressed. Modern cobalt-chromium-molybdenum alloys used in the manufacture of metal-framed partial dentures contain cobalt, molybdenum, chromium and traces of some metals.[9,10]

In addition to the fibrosis caused by DTP in the lungs, patients with prolonged exposure may also develop complications such as secondary tuberculosis and lung cancer. Tan et al. reported a case presentation of DTP mimicking pulmonary tuberculosis in the literature.[3] However, the association of DTP and tuberculosis has not been described before in the literature and our case is reported as the first case on this subject. However, most individuals with DTP are exposed to silica, and it has been reported that the risk of developing pulmonary tuberculosis in patients with silicosis is 2.8 to 3.9 times higher compared to healthy controls.[11] Evidence from experimental studies suggests that silica alters the immune response of the lungs, disrupts the metabolism/function of pulmonary macrophages, and can lead to macrophage apoptosis with frequent exposure.[12]

For early diagnosis of DTP in dental technicians, periodic chest X-ray and respiratory function tests should be performed. However, as with all cases of pneumoconiosis, adequate ventilation in the laboratory can help reduce the incidence of DTP. DTP is a rare occupational disease. Additionally, due to the complex dust exposure, the risk of tuberculosis in this group may be higher compared to other pneumoconiosis. Therefore, especially in countries with high tuberculosis incidence, tuberculosis should be considered in the follow-up of this patient group.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Emine Argüder;* ***Design:*** *Emine Argüder, Beyzanur Karlıdağ;* ***Control/Supervision:*** *Emine Argüder;* ***Data Collection and/or Processing:*** *Oğuzhan Şen;* ***Analysis and/or Interpretation:*** *Emine Argüder;* ***Literature Review:*** *Beyzanur Karlıdağ, Oğuzhan Şen;* ***Writing the Article:*** *Beyzanur Karlıdağ, Oğuzhan Şen, Emine Argüder;* ***Critical Review:*** *Emine Argüder;* ***References and Fundings:*** *Emine Argüder;* ***Materials:*** *Emine Argüder.*

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