



A Review of Dental Technician's Pneumoconiosis: Three Case Reports

Üç Olguyla Diş Teknisyeni Pnömokonyozu

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Abstract

Dental technician's pneumoconiosis is a newly described, rare, and distinct type of pneumoconiosis. It is a result of direct exposure to dental alloy, acrylic resin, quartz, carbon, silica, and hard metal dust that are abundant in the air respired by dental technicians. We report herein three patients with respiratory complaints who were diagnosed with dental technician's pneumoconiosis.

Key words: Dental technician, pneumoconiosis, silica.

Özet

Diş teknisyeni pnömokonyozu yeni tanımlanan, nadir, farklı bir pnömokonyoz grubudur. Diş teknisyenleri tarafından kullanılan dental alloy, akrilik resin, kuvarz, karbon, silika ve ağır metal tozlarına doğrudan maruziyet ve soludukları havada fazla miktarda bulunmasının sonucunda gelişir. Solunum yakınmalarıyla başvuran ve diş teknisyeni pnömokonyozu tanısı konulan üç olguyu sunuyoruz.

Anahtar Sözcükler: Diş teknisyeni, pnömokonyoz, silika.

RESPIRATORY CASE REPORTS

Dental technicians are constantly exposed to various mineral dusts when polishing and grinding prosthetics and during casting operations while working on dental frameworks (prosthesis, crowns, dentures, and bridges). Various chemical hazards exist in their working environment, including solvents, mineral acids, gases and vapors released during polymerization, metal casting, and porcelain baking, as well as plaster, metal alloys, ceramics, and acrylic resins. Commonly implicated agents include alloys based on cobalt, chromium, nickel and small amounts of molybdenum, silica, boron, tantalum, and beryllium (1). This type of ex-

posure may directly result in pneumoconiosis, hypersensitivity pneumonia, asthma, and lung cancer (2). As dental technicians are constantly exposed to a variety of chemicals at work, a direct link between a specific causative agent and lung fibrosis cannot be readily established. The emergence of pneumoconiosis directly depends on the duration of exposure. The most common radiological finding of the disease is the development of micronodules in the lungs. While the early stage of the disease is characterized by small, irregular, round opacities, these lesions tend to increase in number and size, leading to a stage of massive fibrosis.

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The most common symptoms are dyspnea, cough, and sputum expectoration. Respiratory function tests may be either normal or may show signs of minimal obstruction or reduced diffusion capacity. Cases with massive fibrosis are characterized by a loss in respiratory function (3). The respiratory impairment is worsened by smoking. X-rays and computerized tomography of chest are important diagnostic modalities.

Pneumoconiosis among dental technicians has been reported since 1962 (4). The number of cases with dental technician's pneumoconiosis has recently increased in Turkey. Herein, we report three affected patients to draw attention to this potentially preventable disorder.

CASE

The current study reports three cases aged 45, 50, and 53 years who presented to our clinic with dyspnea.

Case 1: A 53-year-old man presented to the department of chest disease with dyspnea upon exertion and sputum expectoration for two years. His history was notable for working as a salaried dental technician in a private laboratory for 31 years. He had a smoking history of 25 packs/year. He had no history of lung tuberculosis nor did he have any contact with infected persons.

Upon physical examination, the patient's vital signs were as follows: body temperature: 36°C, blood pressure: 130/75 mmHg, pulse rate: 90 beats/minute (rhythmic), respiratory rate: 18 breaths/minute, SaO₂ 95% (on room air). The respiratory system appeared normal on physical examination.

Respiratory function tests revealed the following: FVC: 3.15 L (80%), FEV₁: 2.50 L (78%), and FEV₁/FVC: 67. A diffusion test revealed a DLCO of 78% and a DLCO/VA of 80%.

Chest x-rays revealed an increase in reticular density and millimetric nodules in both lungs (Figure 1). The ILO profusion score was p 2/2. Thoracic CT revealed mediastinal lymph nodes smaller than 1 cm. Additionally, basal portions of both lungs contained widespread micronodules with ground glass density. The nodules tended to coalesce in the upper lobes. Additionally, soft tissue lesions appeared in the subpleural space (Figure 2).

The patient was able to walk 485 meters without signs of arterial desaturation in a six-minute walking test.

Serum autoantibodies (rheumatoid factor, antinuclear antibody, and anti-histone antibody) and serum angiotensin converting enzyme (ACE) levels were normal. Tuberculin skin testing produced an induration diameter of 12 mm (consistent with previous BCG). The sputum ARB test

was negative three times. No signs of malignancy or TB were evident in the TBNA sample from the bronchial lavage obtained via fiber optic bronchoscopy. The examination of a BAL sample taken from the middle lobe of lung revealed a total cell count of 700,000/ml, of which 87.5% were macrophages, 11.5% lymphocytes, and 1% neutrophils. The ratio of helper-to-suppressor T-cells was low (CD4/CD8: 0.2).

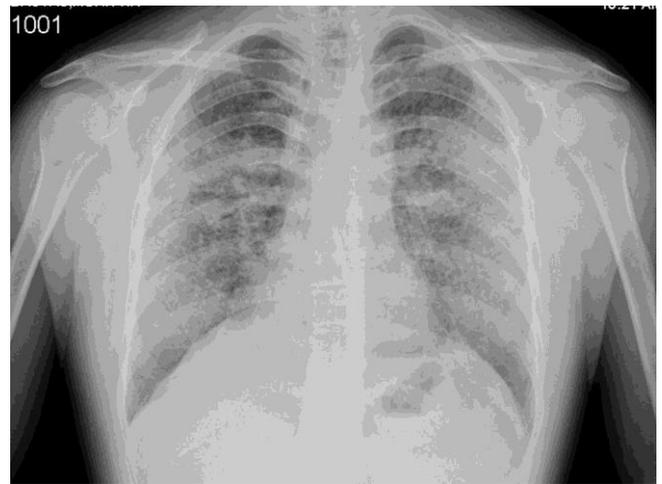


Figure 1: The first patient's chest x-ray shows linear reticular densities, millimetric nodules, and a cystic appearance that is more prominent in upper lobes of both lungs

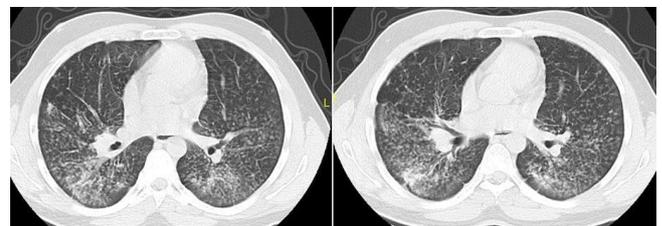


Figure 2: The first patient's thoracic computed tomography demonstrates micronodules and cysts that tend to coalesce in the upper lobes of both lungs

Case 2: A 50-year-old man presented with dyspnea on exertion for six months. He had been working as a salaried dental technician in a dental laboratory for 25 years. He also had a smoking history of 20 packs/year. He had no history tuberculosis, contact with individuals with tuberculosis, or any other systemic or local disease. The physical examination revealed a body temperature of 36°C, blood pressure of 120/85 mmHg, pulse rate of 80 beats/minutes, respiratory rate of 17 breaths/minute, and a SO₂ of 96% (on room air). The patient's respiratory system was normal on physical examination.

Pulmonary function testing showed normal spirometer and diffusing capacity (FVC: 4.25 L (91%), FEV₁: 3.97 L (88%), FEV₁/FVC: 86, DLCO: 90%, and DLCO/VA: 84).

Chest x-rays revealed bilateral linear reticular densities and nodules of millimetric size (Figure 3). The ILO profusion score was p1/1. Thoracic CT showed mediastinal and bilateral hilar lymph nodes, most of which were calcified. There was also an irregularly bordered nodule measuring approximately 1 cm in the upper lobe of the left lung. The upper lobes of both lungs were characterized by pleural thickenings and retractions. The upper lobes of both lungs also contained parenchymal and subpleural millimetric nodules, some of which were calcific, that tended to conglomerate (Figure 4). The six-minute walking test was completed with a walking distance of 450 m and without arterial oxygen desaturation. Serum autoantibodies (rheumatoid factor, antinuclear antibody, and anti-histone antibody) and serum angiotensin converting enzyme level were within normal ranges. The tuberculin skin test revealed an induration diameter of 14 mm (consistent with previous BCG). Sputum ARB search was negative. No signs of malignancy or TB were evident in the TBNA sample from the bronchial lavage obtained via fiber optic bronchoscopy. The examination of a BAL sample obtained from the middle lobe revealed a total cell count of 950,000/ml of which 84.4% were macrophages, 13.6% were lymphocytes, and 2% were neutrophils. The ratio of helper-to-suppressor T-cells was low (CD4/CD8: 0.8).

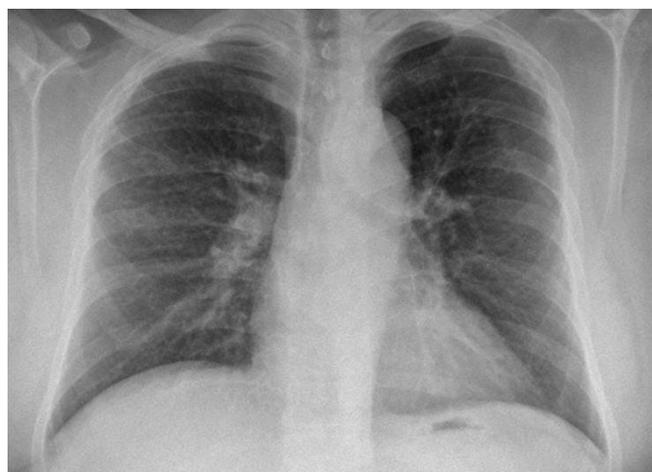


Figure 3: The second patient's chest x-ray shows bilateral linear reticular densities and micronodules

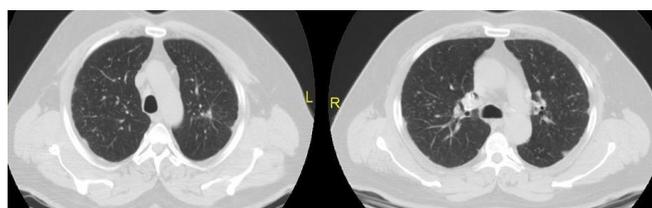


Figure 4: The second patient's thoracic computed tomography is characterized by bilateral micronodules, pleural thickenings, and retractions

Case 3: A 45-year-old man presented with dyspnea on exertion and cough for one year. He had been working as a self-employed dental technician for 16 years. He had also a smoking history of one pack a day for 30 years. He had no history of tuberculosis nor did he have any contact with any individuals carrying that disease. His vital signs were as follows: body temperature 36 °C, blood pressure: 110/70 mmHg, pulse rate: 84 beats/minute (rhythmic), respiratory rate: 16 breaths/minute, and SO₂ 95% on room air. The patient's respiratory system was normal on physical examination.

Chest x-rays demonstrated linear reticular densities and millimetric nodules in both lungs (Figure 5). The ILO profusion score was p 1/1. Thoracic CT demonstrated calcified mediastinal and bilateral hilar lymph nodes, as well as a diffuse micronodular pattern in both lungs, being more prominent in the basal segments. There were also millimetric nodules in the bilateral upper lobes, as well as irregularly-bordered fibrotic tissues and retractions in both apices. Both lungs also contained thin-walled cysts of variable size (Figure 6).

A respiratory function test was characterized by normal flow rates (FVC: 3.45 L (88%), FEV₁: 3.35 L (83%), and FEV₁/FVC: 82). The diffusion test was also normal (DLCO: 86% and DLCO/VA: 82). A six-minute walking test was completed with a walking distance of 540 meters and without arterial oxygen desaturation.

Serum autoantibodies (rheumatoid factor, antinuclear antibody, and anti-histone antibody) and serum angiotensin converting enzyme level were within normal ranges. The tuberculin skin test revealed an induration diameter of 15 mm (consistent with previous BCG). Sputum ARB search was negative three times. No signs of malignancy or TB were evident in the TBNA sample from the bronchial lavage obtained via fiber optic bronchoscopy. A BAL sample obtained from the middle lobe revealed a total cell count of 880,000 /ml, of which 84.6% were macrophages, 13.4% were lymphocytes, and 2% were neutrophils. The ratio of helper-to-suppressor T-cells was low (CD4/CD8: 1.2).

The three patients who had been working as a dental technician in separate laboratories and had no risk factors for respiratory disease other than smoking were diagnosed with dental technician's pneumoconiosis in light of the available clinical and radiological data. The first patient was characterized by mild obstruction and restriction in respiratory function test and a restricted diffusion capacity in a diffusion test. That patient had been working as a dental technician for a longer time than the

other patients and was started on a combination therapy of a bronchodilator and steroid. The patients were informed about the occupational exposure to and the protective methods against the causative agents, and were put under close clinical and radiological follow-up.

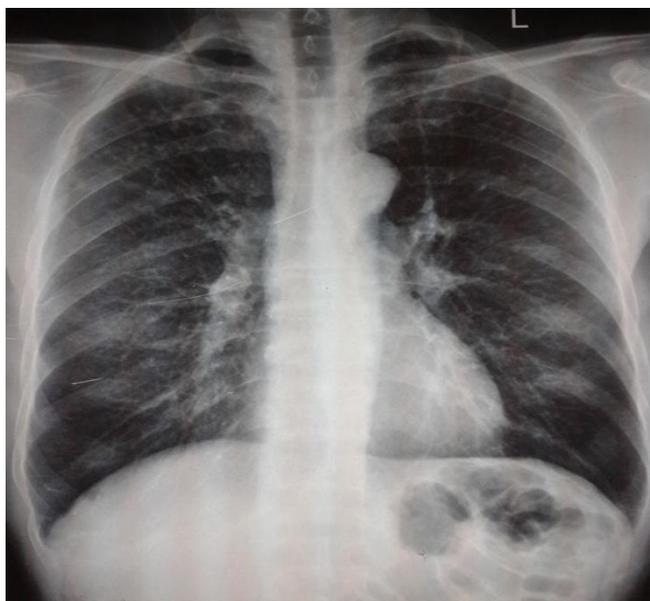


Figure 5: The third patient's chest x-ray is consistent with marked linear reticular densities and millimetric nodules in the upper lobes of both lungs

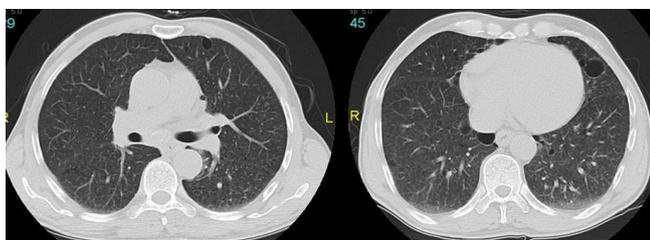


Figure 6: The third patient's thoracic computed tomography demonstrates a diffuse micronodular appearance with patchy ground glass density, as well as soft tissue appearances, suggesting massive fibrosis in the upper lobes of both lungs

DISCUSSION

Dental technicians are exposed to many types of chemical dusts. The advance of novel dental materials increases the potential risk of respiratory involvement. It is problematic to establish a solid link between pneumoconiosis and other lung pathologies and exposure to a single dust. Studies have attempted to determine the etiology of the disease by determining the tissue metal dust level, either from BAL fluid (5) or lung biopsy (6). In this study we did not perform such studies since they would not alter the diagnostic and therapeutic decisions of our patients. All three patients had normal cell distribution in the BAL fluid. No specific biopsy finding could be obtained, either.

The prevalence of pneumoconiosis is related to the duration of the exposure to causative agent. Epidemiological studies have revealed exposure to toxic agents for over 20 years results in a technician's pneumoconiosis prevalence of 15% (7). The prevalence of the disease has been reported in variable numbers, possibly due to different study conditions and population characteristics.

Dyspnea, cough, and sputum expectoration are the most common symptoms of dental technician's pneumoconiosis. However, not all symptoms of the disease are necessarily found in a given patient (8).

The first patient demonstrated a minimal reduction in the respiratory function, which was likely intensified by cigarette smoking. Former studies on respiratory function in dental technician's pneumoconiosis have yielded variable results. Froudarakis et al. (9) reported no significant loss in respiratory function, while Choudat et al. (2) showed significant decreases in all mean indices of lung function, particularly in smokers.

As for the exercise capacity, we also observed a decrease in walking distance in the first case. The limitation of exercise capacity has been linked to loss of respiratory function. Exercise tests should also be used as supplementary tests to respiratory function tests in the assessment of pneumoconiosis cases.

Dental technicians are reportedly at risk for autoimmune disorders (2). Some previous studies demonstrated increased autoantibodies in dental technician's pneumoconiosis and suggested a connection with connective tissue disorders. Nevertheless, our cases had normal autoantibody levels.

Bilateral nodular lesions are the most common lesions observed in dental technician's pneumoconiosis. ILO scores are used to assess radiological extent and severity (10). Both ILO profusion scores and HRCT scores showed a positive correlation with employment duration and thus exposure to causative chemical agents.

In an ever-widening dental supply market, dental technicians are increasingly vulnerable for exposure to occupational health hazards. In addition to the introduction of new dental materials, there is an ever-growing need for occupational health practitioners to be aware of the work processes used, to recognize possible hazards, and to implement appropriate preventive measures to protect the workers' health in this profession. Dental laboratories must have excellent ventilation and enclosure systems to prevent exposure to airborne contaminants (11-13).

In conclusion, dental technician's pneumoconiosis is a preventable type of pneumoconiosis that is related to the

length of occupational exposure. Air flow limitation may be observed in this disorder and it may be more prominent in smokers. In symptomatic cases, exercise capacity should also be evaluated. Radiological modalities have an important diagnostic role for this entity. Dental technicians can be protected against this disorder by informing them about occupational lung diseases and taking preventive measures.

CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Concept - F.Ç., A.G.K., A.Ç., A.K.; Planning and Design - F.Ç., A.G.K., A.Ç., A.K.; Supervision - F.Ç., A.G.K., A.Ç., A.K.; Funding - F.Ç., A.G.K., A.Ç., A.K.; Materials - F.Ç., A.G.K., A.Ç., A.K.; Data Collection and/or Processing - F.Ç., A.G.K., A.Ç., A.K.; Analysis and/or Interpretation - F.Ç., A.G.K., A.Ç., A.K.; Literature Review - F.Ç., A.G.K., A.Ç., A.K.; Writing - F.Ç., A.G.K., A.Ç., A.K.; Critical Review - F.Ç., A.G.K., A.Ç., A.K.

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REFERENCES

1. Torbica N, Krstev S. World at work: Dental laboratory technicians. *Occup Environ Med* 2006; 63:145–8. [\[CrossRef\]](#)
2. Choudat D, Triem S, Weill B, Vicrey C, Ameille J, Brochard P, et al. Respiratory symptoms, lung function, and pneumoconiosis among self-employed dental technicians. *Br J Ind Med* 1993; 50:443-9. [\[CrossRef\]](#)
3. Kahraman H, Koksall N, Cinkara M, Ozkan F, Sucaklı MH, Ekerbicer H. Pneumoconiosis in dental technicians: HRCT and pulmonary function findings. *Occup Med (Lond)* 2014; 64:442-7. [\[CrossRef\]](#)
4. Ollagnier C, Tolot F, Perrin LF, Bognard G. Une observation de silicose chez un mécanicien dentiste. *Arch Mal Prof* 1962; 23:385–6.
5. Collins A, Burhan H, Davies P. Dental workers' pneumoconiosis complicated by Mycobacterium avium-intracellulare complex (MAIC) infection. *Occup Environ Med* 2011; 68:82. [\[CrossRef\]](#)
6. Kartaloglu Z, Ilvan A, Aydılek R, Cerrahoglu K, Tahaoglu K, Baloglu H, et al. Dental technician's pneumoconiosis: mineralogical analysis of two cases. *Yonsei Med J* 2003; 44:169-73. [\[CrossRef\]](#)
7. Berk S, Dogan DO, Gumus C, Akkurt I. Relationship between radiological (X-ray/HRCT), spirometric and clinical findings in dental technicians' pneumoconiosis. *Clin Respir J* 2014 (in press). [\[CrossRef\]](#)
8. Cimrin A, Kömüs N, Karaman C, Tertemiz KC. Pneumoconiosis and work-related health complaints in Turkish dental laboratory workers. *Tuberk Toraks* 2009; 57:282-8.
9. Froudarakis ME, Voloudaki A, Bouros D, Drakonakis G, Hatzakis K, Siafakas NM. Pneumoconiosis among Cretan dental technicians. *Respiration* 1999; 66:338-42. [\[CrossRef\]](#)
10. International Labour Organization (ILO). Guidelines for the use of ILO international classification of radiographs of pneumoconioses, revised edition 2000. Geneva: International Labour Office; 2002.
11. Abakay A, Atılğan S, Abakay O, Atalay Y, Guven S, Yaman F, et al. Frequency of respiratory function disorders among dental laboratory technicians working under conditions of high dust concentration. *Eur Rev Med Pharmacol Sci* 2013; 17:809-14.
12. Radi S, Dalphin JC, Manzoni P, Pernet D, Leboube MP, Viel JF. Respiratory morbidity in a population of French dental technicians. *Occup Environ Med* 2002; 59:398–404. [\[CrossRef\]](#)
13. Brancalone P, Weynand B, De Vuyst P, Stanescu D, Pieters T. Lung granulomatosis in a dental technician. *Am J Ind Med* 1998; 34:628–31. [\[CrossRef\]](#)