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Danger Awaiting the Dental Technicians (Search Results of 6 Dental Laboratories in Istanbul)

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Abstract

Dental technicianship is a common health-related occupation especially in metropolitan areas of Turkey. Dental technicians are exposed to ceramic, metal and similar dusts which might lead to pneumoconiosis in occupational environment. The aim of this study was to investigate the incidence and factors related with developing of pneumoconiosis among dental technicians. All of 31 dental technicians employed in six laboratories in Istanbul were enrolled into the study. Detailed medical history, physical examination, chest x-ray, high resolution computed tomography (HRCT) was performed in all participants. HRCT findings were scored and investigated for relation with duration of practice. Mean age and male/female ratio of the study population were 43,2 ± 9,6 years and 27/4 respectively. Mean duration of practice of the technicians was 25,2 ± 9,4 years. Eight subjects complained of dyspnea and cough and out of whom 4 (13%) had HRCT findings compatible with pneumoconiosis. Additionally, four technicians had pulmonary tuberculosis their occupational practice. We have concluded that dental technicianship might be a significant risk factor for pneumoconiosis. The problem might be greater than thought and preventive measures against dust exposure and pneumoconiosis should be revised in dental laboratories.

Keywords: Dental technicians; Pneumoconiosis; Tomography

Introduction

Nowadays, the importance given to occupational diseases is increasing globally and nationally. Despite this, up to the results of ILO data (International Labour Office), only 2% of occupational diseases in the world are reported in the world [1-3]. This situation is not different in our country. The organs that occupational diseases are mostly seen are lungs [1-6].

The SWORD (Surveillance of Work Related and Occupational Respiratory Disease) surveillance scheme uses systematic reporting from physicians to provide a picture of the incidence of occupational respiratory disease in the United Kingdom. According to this research, 40% of cases (1000 annually) are of occupational asthma or inhalation accidents occupational asthma related to a wide range of agents in many occupations [7-9].

Dental technicianship is an integral part of dentistry. It is a common health-related occupation especially in metropolitan areas of Turkey. Dental technicians are exposed to generate airborne dust (eg. mixing powders, removing casting from molds, grinding and polishing casting and porcelain, and silica sand for abrasive blasting) which might lead to pneumoconiosis in occupational environment during their working [6,10,11]. These cases have been known since 1939 [7]. Up to the Chamber of Dental Technician; there are 15000 registered dental technicians in our country. Even though dental technicianship is a health profession, it is not a group that has been researched as much as textile and coal workers [2,11,12]. As a profession group which provides good income and which doesn't have unemployment problem, should get attention for its long durage of working. It is known that this profession which is generally coming as a family job has a lot of average weekly work hours [11]. Dental technicians should work with a special filtered mask and in a wide enough laboratory where air is sufficiently cleaned and with a table aspirator [1,2,12,13].

The purpose of this study is to search penumoconiosis frequency in dental technicians, to show the High Resolution Computed Tomography (HRCT) findings and examine the factors that affect these.

Materials and Methods

Study design

The most developed 6 dental laboratories in Istanbul's 3 central districts were chosen. All technicians (31 technicians) were enrolled in this study. Patients were informed about the details of the study and their informed consent was taken. Permission for the study was taken from Gulhane Military Medical Academy Human Research Ethics Committee (2012-46). Detailed personnel and occupational anamnesis were taken from all participants, and physical examinations of all of them were made by a Chest Diseases Specialist. Chest X-Ray, HRCT, Pulmonary Fubction Tests and Diffusion Test were performed. HRCT findings were scored and investigated for relation with duration of practice. Participants with significant clinical findings and HRCT findings were diagnosed with pneumoconiosis.

Data collection

Radiologic examination was made by a Radiology Specialist. In order to score the HRCT findings, 10 lesions which include the radiologic lesions seen in pneumoconiosis were defined. Each lung was separated into 3 parts in the HRCT; 1) Upper part of Carina, 2) Carina (included) – between inferior pulmonary vein (included), 3) Lower part of inferior pulmonary vein. Every lesion was scored with 0-4 points up to each lung area (Tables 1 and 2). By this way, a total

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Radiographic Lesions	Abbreviations
Band	B
Bronchial lesions	BL
Ground Glass View	GGV
Inter lobuler septal thickening	ILST
Consolidation	CON
Micronodules	MN
Nodule	N
Emphysema panasiner	EP
Paraseptal emphysema	PSE
Centrilobuler emphysema	CLE

Table 1: Abreviations used for scoring radiagraphic lesions and dental technician pneumoconiosis.

Patient	CLE	B	BL	GGV	EP	CON	ILST	N	MN	PSE	TOTAL
1	2	1	0	3	0	3	0	3	24	0	36
2	0	1	2	1	0	4	6	6	12	0	32
3	0	3	4	4	0	8	0	10	0	0	29
4	0	0	0	0	0	0	0	0	20	0	20
5	0	0	4	3	0	5	1	6	0	0	19
6	5	1	0	7	0	0	0	0	0	0	13
7	10	2	0	0	0	0	0	0	0	0	12
8	3	5	2	1	0	0	0	0	0	0	11
9	2	1	0	5	0	0	0	0	0	0	8
10	0	4	0	2	0	0	0	0	0	1	7
11	0	2	0	0	3	0	0	0	0	0	5
12	0	2	1	1	0	0	0	0	0	0	4
13	0	3	0	0	0	1	0	0	0	0	4
14	0	1	0	2	0	0	0	1	0	0	4
15	3	0	0	0	0	0	0	0	0	0	3
16	0	0	0	0	1	0	0	1	0	1	3
17	0	1	0	0	0	0	1	1	0	0	3
18	0	0	0	2	0	0	0	0	0	0	2
19	2	0	0	0	0	0	0	0	0	0	2
20	0	1	0	1	0	0	0	0	0	0	2
Total	27	28	13	32	4	21	8	28	56	2	219
Total %	12,3	12,8	5,9	14,6	1,8	9,6	3,7	12,8	25,6	0,9	100
*A total of 11 technicians, is not lesion HRCT score of 0 were excluded in this table											

Table 2: Lesion HRCT score of 20 according to the distribution of lessions in radiological dental technician*.

score was maintained from 6 lung areas, 10 lesions and point between 0-4 for each lesion. Theoretically, the highest score that a patient could get would be 240 participants were divided into 2 groups up to the HRCT scoring: 10 points and higher ones were pneumoconiosis or pneumoconiosis candidates, lower than 10 points were the ones who require to be followed up.

PFT (Pulmonary Function Testing) was performed in every case. FEV_1 (Forced Expiratory Volume in 1 second), FVC (Forced Vital Capacity), FEV_1/FVC, FEF_{25-75} (Forced Expiratory Flow) (Maximal Flow at 25-75 Percent Expired Vital Capacity) FEF_{50} (Maximal Flow at 50 Percent Expired Vital Capacity), PEF (Peak Expiratory Flow) values were measured. In the DT (Diffusion Test), DLCO (Diffusing Lung Capacity for Carbon Monoxide) and DLCO/VA (Alveolar Gas Volume) values were found.

Statistical analysis

Correlations between the patient's age, occupational working time, each scoring of 10 lesions in HRCT or total scorring, 6 parameters in PFT and 2 parameters in DT were measured with Spearman correlation test. 2 groups which were divide up to HRCT scoring was examined with Mann-Whitney U test to see if there are any significant differences between them by means of age, working time, cigarette smoking time, DLCO, DLCO/VA, FVC, FEV_1 values and with Chi Square Test by means of the presence sypmtoms and tuberculosis. P value was smaller than 0.05 considered as statistically significant.

Results

Abbreviations used for scoring radiographic lesions and dental technician pneumoconiosis was demonstrated in Table 1. Totally 31 technicians were enrolled in this study (age average 43,2 ± 9,6 years, 4 women, 27 men). Mean duration of practice of the technicians was 25,2 ± 9,4 years. 4 cases were diagnosed with pneumoconiosis (Table 2). The chest x-rays of the technicians were examined and radiologic anomaly was found only in 14 of them (45.2%). There were lesions found in the HRCT of 6 technicians though their chest x-rays were normal. 4 technicians' (12.9%) HRCT score was 20 and more so they were diagnosed with pneumoconiosis. 12 technicians' HRCT score was between1-10 and 11 of them (35.5%) had no lesions. These 11 healthy technicians were significantly different than the 20 technician with HRCT lesion by means of mean age (37.2 ± 9.6 years) and mean duration of work (20.3 ± 9.9). Lesions in the group with more than 20 HRCT score were nodules and micronodules. Total HRCT score of, the technicians in this group was 117. 75 were nodules and micronodules (64.1%), 21 were centrilobuler emphysema, band, bronchial lesion and ground glass view. Despite this, total score of the other remaining 16 technicians were 102. 9 of this were nodules and micronodules (8.8%), 79 were (77.5%) centrilobuler emphysema, band, bronchial lesion and ground glass view (Table 1).

Participants were divided into 2 groups up to their HRCT scores which are higher and lower than 10 points (value of the HRCT scoring) and were compared with each other. The age of technicians in the group with higher points were significantly more than the other group and DLCO, FVC ve FEV1 values were lower than the other group (Table 3). There were no differences between the two groups by means of cigarette smoking time, occupational working time, symptom existence and TB history.

All parameters from the participants were researched for correlation. The ones correlated with each other are given in the Table 4. It is remarkable tat as HRCT score increases FVC, FEV1, FEV1/FVC, FEF 25-75, FEF50 values decrease and as occupational working

Feature	Score of HRCT			Total
	≥10	P=	<10	
n (%)	8 (25,8)		23 (74,2)	31 (100)
Age (year)	50,4	0,01	40,6	43,2
Cigarette (package/year)	20,2	No differences	15,6	16,7
Occupational working time	28,8	No differences	23,8	25,2
The presence of symptoms	%37,5	No differences	%21,7	%25,8
The story of tuberculosis	%12,5	No differences	%13	%12,9
DLCO (%)	74,8	0,024	89,8	85,9
DLCO/VA (%)	105,4	No differences	102,5	103,6
FVC (%)	79,6	0,002	95,8	91,4
FEV_1 (%)	72,2	0,001	91,9	86,6
FVC: Forced vital capacity, FEV_1: Forced expiratory volume in 1 second, *The difference between the two groups in terms of symptoms and history of tuberculosis, Chi-square, Mann-Whitney U test were compared with others.				

Table 3: HRCT scoring groups in terms of other features.

Parameters	Significant correlation
Total HRCP score	FVC, FEV_1, FEV_1/FVC, FEF 25-75, FEF50
DLCO	No
DLCO/VA	ILST
FVC	Total score
FEV_1	BL, CON, Nodule, Total score
Occupational working time	BL, CON, Nodule
Age	DLCO/VA, FVC, FEV1, BL, GGV, CON, Nodule

FVC: Forced vital capacity, FEV_1: Forced expiratory volume in 1 second, FEV_1/FVC: Forced expiration rate, PEF: Peak expiratory flow, FEF: Maximal flow at 25-75 percent expired vital capacity.
*Smoke-independent

Table 4: Significant correlation between the operating parameters*.

time increases, bronchial lesion, nodules, ground glass view and consolidation increases in HRCT correlatively ($p<0.05$).

4 participants were diagnosed with pneumoconiosis radiologically and clinically. Chest x-rays and HRCT of these participants are in Figures 1-6.

8 participants among the ones diagnosed with pneumoconiosis had different levels of dispnea and coughing complaints and 4 participants had history of tuberculosis.

Discussion

It has been known for many years that working in a dusty environment cause different levels of various pulmonary diseases. Pneumoconioses have been described associating heavy metals and silica, cobalt and beryllium, or beryllium and aluminium. There are national and international studies conducted to identify the different types of risk encountered in denture manufacturing workshops [1,2,12,14]. Inadequate ventilation, essentially for the preparation of wax modeling, refractory material, fusion of alloys, sanding, and hand finishing are associated the risk [15]. The proportion of crystalline silica in mold and porcelain materials, by weight, can range up to 70%, during polishing operations that exceeded exposure limit of 0.05 mg/m^3. Some of the occupations that are exposed to dust are discussed by the public, but some other occupations are not. We believe important reason for this is whether employees complain or not. Dental technicianship is an occupation which brings good income, in which a person can work extra hours voluntarily and which can be worked even in elderly times. It is an occupation that mostly all of the family members work together. This can be seen clearly in our study too. Mean age of the technicians in our study is 43,2 ± 9,6 years old. 12 of the 31 technicians in our study are from 4 families. The Ministry of Health is trying to make better working conditions and environment for the past 6 years by circulars and directives. Even though these directives show obligations of having chest x-ray in the entrance of the work and in every 2 years while working, these procedures are generally not performed and has no sanction.

Sample number in our study was not enough for occupational diseases prevalence. However, determination of penumoconiosis in 4 of 31 technicians in our study is remarkable. This ratio was 13.8% in the study of Doğan et al. [12] and 23.6% in the study of Çımrın et al. [11] and 12.9% in the study [7]. As our study was in registered and developed laboratories, we predict that this ratio would rise if a study with more participation was made.

If you have a look at the literature, you will see that all pneumoconiosis determinations were made by certificated ILO readers with chest x-ray and ILO classification [13,16-18]. As our study group doesn't have ILO readers, we couldn't make such classification. 6 of 31 technicians (19.4%) had no lesions in the chest x-ray but their lesions were easily seen in the HRCT. We presume that this new pneumoconiosis determination and radiologic scoring proposal that we mentioned in the material and method section will be valid. In fact it is indicated in the ILO publications that HRCT is more sensitive in defining occupational diseases like pneumoconiosis [19]. However, chest x-ray is more widespread, with less cost and its standardization is clearer, chest x-ray is recommended. As tomography technology

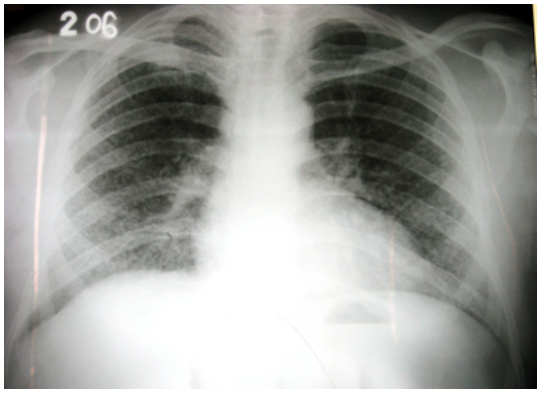

Figure 1: Number 1 technician's chest X-ray.

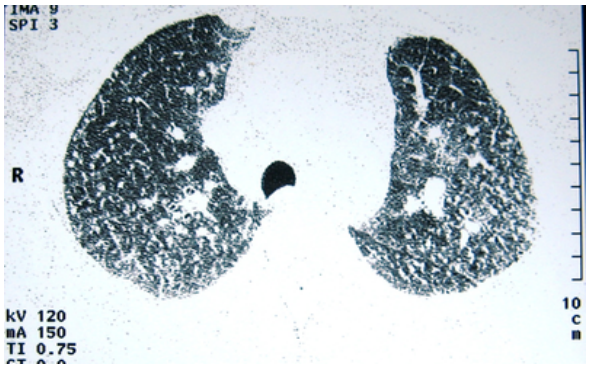

Figure 2: Number 1 technician's pneumoconiosis diagnosed HRCT.

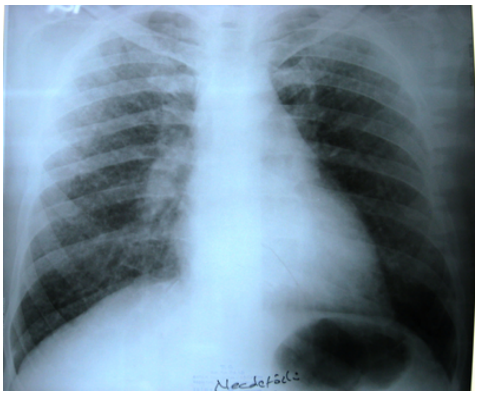

Figure 3: Number 2 technician's chest X-ray.

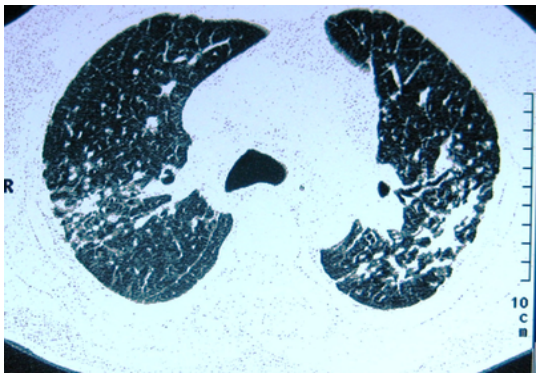

Figure 4: Number 2 technician's pneumoconiosis diagnosed HRCT.

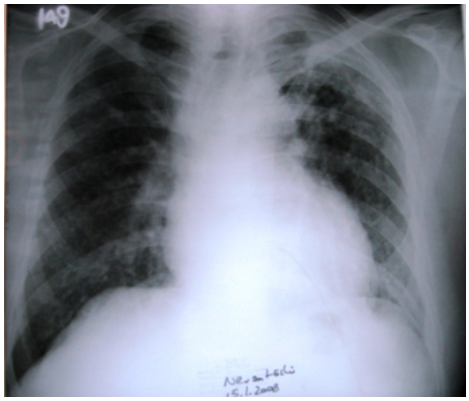

Figure 5: Number 3 technician's chest X-ray.

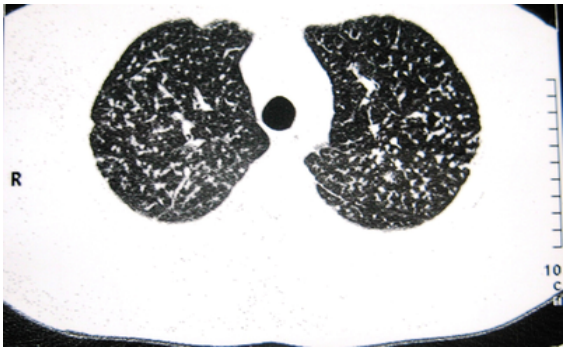

Figure 6: Number 2 technician's pneumoconiosis diagnosed HRCT.

improves and the radiology received is less, we believe that HRCT will be used more in pneumoconiosis diagnosis.

Mean age and occupational working years in our study were generally compatible with the literature. 11 participants, who had no lesions in the HRCT, were different than the group which stayed at the back for age and occupational working years as can be predicted. There were similar results in the other studies that we examined [2, 18,20,21]. But as you can see in the Table 3, there was a significant 10 years difference between 2 groups which are under and over 10 points in the HRCT in age, and 5 years of occupational working time difference which is in the statistical significance border. We predict that this difference will pass the significance border when the number of the participants increases. It is very natural to presume that as the time spent in a dusty environment increase, disease rate would also increase. Besides that, the wideness of the working environment, the presence of vacuum table, usage of masks and different materials are factors that affect this. One of the important findings of our study is that some of statistically significant radiologic lesions in the HRCT are in early period and some are after pneumoconiosis has started. As you can see in Table 3, centrilobuler emphysema, bronchial lesion, ground glass view and band lesions were seen, and in the participants with pneumoconiosis diagnosis nodules and micronodules were more evident.

A significant difference was found between the two groups which has HRCT score lower and higher than 10 in DLCO values. This finding was compatible with the literature. But there was no statistically significant difference between the groups in cigarette smoking time. In fact, as you can understand from the Table 4, there is a numerical difference between the groups. But the minority of technician number in the first group prevents this difference from being statistically significant.

Correlation existence was searched between the parameters in our study. There was a negative but significant correlation between HRCT score, age and PFT parameters. There was positive correlation found between age, occupational working time and consolidation, nodule formation in HRCT.

Conclusion

As a result, we think that we have given an important message about dental tecnhicianship. We are pointing out a giant problem standing right next to us in these studies which was held in our country's biggest and most developed city Istanbul's 2 central district's most advanced dental laboratories. We care about determination of pneumoconiosis in dental technicians with the ratio of 12.9% in the working environments which are supposed to be controlled and good. Only vacuumed table and basic aspirators does not provide enough protection for this occupation. Besides these protections, special protective masks for special working cabins are needed. An active and close support should be maintained for the employees and everything should be recorded. Basic chest x-ray cannot detect the pneumoconiosis as an occupational disease in the early period. That's why tomography should be preferred which is easily reached under the working conditions of our country. Comprehensive prevalence studies are needed in order to examine the subject in details.

Samples that were enrolled in the study were few. Dental technicianship is an occupation that all family members are participating and that generally goes with master-apprentice system. In this occupation which brings good income, it is not really possible to find time for other activities. That's why the technician number who participated was limited. But the findings with even this number surprised our team so we wanted to publish this study.

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