Pneumoconiosis and work-related health complaints in Turkish dental laboratory workers

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ÖZET

Diş laboratuvarı çalışanlarında pnömokonyoz ve iş ile ilişkili yakınmalar

Diş teknisyenleri, diş hekimlerinin ölçümlerine göre eksik diş, tamamlayıcı protez ve köprü yapımında çalışmaktadır. Üretim sürecinde silikayı da içeren birçok madde kullanılmaktadır. Bu maddelere maruziyet solunum sistemi de dahil multisistemik sağlık sorunlarına yol açabilir. Bu çalışmada iş öyküsü, çalışma durumu yanında pnömokonyoz da dahil olmak üzere sağlık sorunlarının sıklığını değerlendirmeyi planladık. Dokuz iş yerinden toplam 214 olgu değerlendirildi. Demografik özellikler standart bir anket ile yüz yüze görüşme yöntemiyle değerlendirildi. Standart akciğer grafileri ILO 1980 standartlarına göre uzman okuyucu tarafından değerlendirildi. Olguların ortalama yaşı 28.1 ± 8.3 yıl bulundu. Yetmiş dört olgu hiç sigara içmemişti. Çalışanların günlük ortalama çalışma süresi 11.0 ± 1.6 saat, diş laboratuvarında ortalama toplam çalışma süresi 12.1 ± 9.0 yıl olarak hesaplandı. Yüz olgunun en az bir solunumsal yakınması vardı. Otuz üç (%23.6) olgunun akciğer grafisinde pnömokonyoz ile uyumlu radyolojik bulgular saptandı. Kumlamacılık öyküsü olan olgularda pnömokonyoz sıklığı %50 idi. Pnömokonyoz ile öksürük, balgam, dispne, vizing, fizik muayene bulguları ve çalışma süresi arasında anlamlı bir korelasyon bulunmadı. Türkiye'de diş teknisyenleri mesleksel koşullardan kaynaklanan dermal, kas-iskelet sistemi de dahil olmak üzere ciddi solunumsal riske sahiptir. Diş laboratuvarlarındaki iş koşulları düzeltilmeli, çalışanlar bilgilendirilmeli, iş yerleri düzenli olarak kontrol edilmelidir.

Anahtar Kelimeler: *Mesleksel akciğer hastalığı, silikozis, diş teknisyeni, pnömokonyoz.*

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SUMMARY

Pneumoconiosis and work-related health complaints in Turkish dental laboratory workers

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Dental technicians make the missing tooth and complementary prosthesis and bridges according to the dentist's measurements. They use various materials including silica. Exposure to these materials increases the multi-systemic health problems in addition to respiratory health problems related with work. We planned to evaluate the work history, working conditions and frequency of health problems including pneumoconiosis. Two hundred and fourteen cases in total from 9 workplaces were evaluated. A face to face questionnaire was used to determine the demographic features of workers and standard chest X-rays were evaluated by an expert reader according to ILO 1980 standards. Mean age of the workers was 28.1 ± 8.3. Seventy four cases were non-smoker. Mean daily working time was 11.0 ± 1.6 hours. Mean total working period in this sector was 12.1 ± 9.0 years. One hundred cases had at least 1 respiratory complaint. Radiological findings were correlated with pneumoconiosis in 33 (23.6%) workers. Pneumoconiosis frequency was 50.0% in cases with sandblasting history. There was not any significant correlation between pneumoconiosis and cough, sputum, dyspnea, wheezing, physical examination findings and tenure. Dental technicians have serious respiratory risks including dermal and muscle-skeleton system arising from occupational setting in Turkey. Working conditions in dental laboratories must be improved by informing the workers and workplaces must be regularly controlled for worker health and hygiene.

Key Words: *Occupational lung disease, silicosis, dental technicians, pneumoconisis.*

Dental technicians work to complete the missing teeth by making the appropriate prosthesis and complementary materials. They make a prosthesis model by using the negative model which was prepared by dentists. Foundry-work is necessary to make a comfortable and long-lasting prosthesis. Palatal region is shaped by using modeling wax and polishing is always necessary. These procedures need expertise in every step. Because of this, workers are specialized in different fields such as modeling, foundry-work, porcelain implantation and modern prosthesis. During these procedures, many chemical materials either in liquid or in powder form; hand tools, metals, modeling wax, porcelain powders are used. Dental technicians exposed to various materials by inhalation; such as silica, heavy metals or acrylic resin. This exposure causes the dermatological and other systemic health problems as well as pneumoconiosis. Asthma and lung cancer risks related with occupational exposure is also increased (1-4).

As the importance and popularity of dental health and cosmetics are increasing, numbers of dental laboratories are increasing too. The development in this market is due to the increase of demand from Turkey and European Union Countries. Small scaled companies with less than 50 workers control the sector as in other occupations in Turkey.

Dental technicians begin working at young ages and usually start learning period with sandblasting. However, in recent years employment of children is prevented. According to modern employment principles in Turkey, basic occupational education is divided into three categories: apprenticeship education at Occupational Education Centers of Ministry of National Education; dental prosthesis branch of Health Profession Schools of Ministry of Health and 2 years license programs of dental prosthesis of different universities (5).

We had a dental technician as an index case for pneumoconiosis and found that Izmir is the most important center in Turkey and almost 1500 workers are working at this sector (6). Workers work in very small rooms, side by side and in sitting po-

sition. Although the work places have air conditioners, none of them were running and none of the cases were using personal prevention materials. All procedures of dental prosthesis is manually manipulated. Thus, most of the process is held in respiratory zone (between the nose level and hands) (Figure 1,2). The materials are uncovered and they are diffused in the room air by evaporation. Since most of the laboratories use residences (buildings which are projected as houses) as work place, it's nearly impossible to make effective arrangements for the prevention from noise and the other ergonomic problems. Because of the same reason, prevention measures for the exposure to chemical materials are insufficient.

We planned to evaluate the working history, working conditions and frequency of health problems among the dental technicians in Izmir city. We also made physical examination of all cases and had their chest X-rays. Finally, we evaluated the chest X-rays according to the ILO 1980 standards to understand the relationship between the working conditions and pneumoconiosis existence.

Figure 1. A scene of a dental laboratory_ porcelain smoothing division.

Figure 2. A scene of a dental laboratory_ metal smoothing division.

MATERIALS and METHODS

According to the records of Local Health Administration, there are 106 registered dental prosthesis laboratories in Izmir. 10% of the dental laboratories have more than 50 workers, 60% have 10 to 50 workers and 30% have less than 10 workers. With the approval of Professional Association of Dental Technicians, we planned to evaluate all the workers of the dental laboratories in Konak district of Izmir between February 2006 and March 2006.

All cases were informed about the study and written consents were taken. A face to face questionnaire was used to determine the demographic features, smoking history, employment history and; respiratory and other systemic complaints. Subsequently, respiratory system examination had been done for each case.

Chest X-rays of workers were evaluated by an expert reader, according to ILO 1980 standards (7). Our expert reader was certificated by Ministry of Labor. Small densities with profusion ≥ 1/0 were accepted as having pneumoconiosis.

SPSS 11.0 program is used for the statistical analysis of the data. Arithmetic mean and standard deviation was calculated for all values. Pearson correlation coefficients were used for correlation analysis. Chi-square analysis was used to analyze the numeric variable differences between the groups. Significance limit was $p < 0.05$.

RESULTS

Nine laboratories were evaluated. All of them were working in the places which were built as houses. The worker numbers were < 10 in 4 dental laboratories, between 10 and 50 in 4 dental laboratories and > 50 in 1 laboratory. Mean number of workers was 23.7 per each laboratory. Totally 214 cases completed the question-

naire and physical examination. Distribution of workers according to working fields are as follows; 15 polishing, 42 porcelain smoothing, 38 metal flattening, 14 porcelain trampling, 6 plastic work, 61 modeling, 16 prosthesis, 17 casting, and 5 sandblasting.

One hundred and ninety two were men, 22 were women. Mean age was 28.1 ± 8.3. Seventy four cases were non-smoker, 119 were smoker and 21 were ex-smoker. Mean age of beginning to smoke was 17.3 ± 3.7 and mean cumulative smoking amount was 11.3 ± 11.0 pack-year. All were working 6 days a week. Mean daily working time was 11.0 ± 1.6 hours. Mean total working period in this sector was 12.1 ± 9.0 years. One hundred and eighty eight cases reported that there is air conditioning in the laboratory they have been working.

There were respiratory, dermatological and skeleton-muscular symptoms. One hundred cases had at least 1 respiratory complaint, 29 reported that they had bronchitis, asthma and pneumonia previously (Table 1). Pulmonary auscultation was normal in 147 cases. At 58 of cases, pulmonary auscultation was conformable with simple chronic bronchitis and at 9 of the cases, it's conformable with significant airway disease.

Because of the poor quality of 9 chest X-rays; 140 of the 149 chest X-rays could be evaluated. There were pneumoconiosis findings (profusion ≥ 1/0) in 33 cases (23.6%). Densities related with pneumoconiosis were located; 9.1% at upper-middle zones, 29.5% at middle-lower zones and 61.4% at all zones. In two of the cases; pleural thickening was observed (1 local, 1 diffuse) (Table 2). There wasn't any significant relation between pneumoconiosis and total working duration (Table 3).

We evaluated 77 cases with sandblasting history as a special subgroup. Forty four of these cases had chest X-rays and 22 of them (50%) had radiological pneumoconiosis findings. We didn't find any relationship between pneumoconiosis existence and having respiratory symptoms such as cough, sputum, dyspnea and wheezing. There was no relationship between having physical examination findings and pneumoconiosis existence. Pneumoconiosis frequency was higher in metal flattening, sandblasting and casting sections. Distribution of the pneumoconiosis cases according to task groups is shown at Table 4.

Table 1. General characteristics of workers.

Age (years)	28.1 ± 8.3
Sex (male/female)	192 (89.7%)/ 22 (10.3%)
Daily working time (hours)	11.0 ± 1.6
Total working period (years)	12.1 ± 9.0
Smoking	
Starting age (years)	17.3 ± 3.7
Non-smoker (n)	74 (34.6%)
Smoker (n)	119 (55.6%)
Ex-smoker (n)	21 (9.8%)
Symptoms and findings	
Cough	57 (26.6%)
Sputum	65 (30.4%)
Dyspnea	39 (18.2%)
Wheeze	32 (15.0%)
Weakness	43 (20.1%)
Myalgia	42 (19.6%)
Dermal lesion	23 (10.7%)

Table 2. Characteristics of pneumoconiosis cases.

Radiographic pattern		n	%
Profusion	0/..	11	25.0
	1/..	28	63.6
	2/..	4	9.1
	3/..	1	2.3
Shape	p/..	18	40.9
	q/..	21	47.7
	r/..	1	2.3
	s/..	1	2.3
	t/..	3	6.8
Zone	Upper-middle	4	9.1
	Lower-middle	13	29.5
	All	27	61.4

Table 3. Distribution of pneumoconiosis cases according to total working time.

Working period (years)	Pneumoconiosis: No n	No %	Yes n	Yes %	Total n	Total %
0-5	29	85.3	5	14.7	34	100.0
6-10	25	71.4	10	28.6	35	100.0
11-15	21	84.0	4	16.0	25	100.0
16+	32	69.6	14	30.4	46	100.0
Total	107	76.4	33	23.6	140	100.0

Table 4. Distribution of pneumoconiosis cases according to branches.

Branch	Pneumoconiosis: No n	No %	Yes n	Yes %	Total n	Total %
Polishing	8	61.5	5	38.5	13	100
Porcelain leveling	24	92.3	2	7.7	26	100
Metal leveling	11	52.4	10	47.6	21	100
Porcelain pushing	7	100.0	-	-	7	100
Plastic	4	100.0	-	-	4	100
Modelling	40	78.4	11	21.6	51	100
Prosthesis	8	88.9	1	11.1	9	100
Plaster	4	66.7	2	33.3	6	100
Sandblasting	1	33.3	2	66.7	3	100
Total	107	76.4	33	23.6	140	100

DISCUSSION

Our study shows that, besides dermatological and skeleton-muscular risks; dental technicians are exposed to serious respiratory risks. Most of these risks are resulted from occupational conditions in Turkey. Prevalence of opacities related with pneumoconiosis of our study (23.6%) is higher than the rates of the other studies made by Radi, Choudat, Sherson and Rom et al. (8-11). Another important point is that; mean age of the workers and mean total working duration of them is less than, that are at the other studies.

Our study group was limited to 9 laboratories. We couldn't sample dust and gas levels in these workplaces. It can be thought that larger laboratories (employing more than 50 workers) would have better conditions. But, according to our observations; the conditions were similar to the smaller laboratories. As a result of not measuring dust and gas levels of workplaces; we couldn't comment on optimum workplace size and working conditions as in the study of Szadowski (12).

In this study, we aimed to evaluate the frequency of complaints and radiological pneumoconiosis findings rather than defining asthma, chronic obstructive pulmonary disease and other health issues. Many of the cases had dermatological problems such as contact dermatitis as a result of the intensive exposure to chemicals. Besides

this, most of them had skeleton-muscular complaints because of working at the same sitting position continuously. 46.7% of the cases had at least one respiratory complaint. This rate was 31% in Jacopsen's study supporting the similar work conditions in different countries (13). However, we should be aware of that, high ratio of smoking can be an other reason for respiratory complaints.

We found densities which can represent pneumoconiosis at 23.6% of workers. However, within the group of workers having sandblasting history in their working period, this rate was up to 50%. Other studies found pneumoconiosis prevalence between 4.5% and 16% for dental technicians (8-11,14,15). This high rate can be related with the insufficiency of prevention measures and the long period of exposure to different minerals including silica. Choudat et al. found that pneumoconiosis prevalence is 3.5% among workers who worked less than 30 years and 22.2% among workers who worked more than 30 years and the difference was significant (9).

In our study we could not find a statistically meaningful relationship between prevalence of pneumoconiosis and total working duration. The mean age of the workers that they started to work was not younger in the workers who had pneumoconiosis. You can see the detailed results at Table 5.

Prevalence of pneumoconiosis in our study seems to be the highest, among the other similar work-based studies. Workers usually begin their career with sandblasting. In the advanced period of their careers, they are transferred to the other sections from sandblasting. Actually, very few of the workers continue making the same job that they started with. Only 5 of the 77 cases stated that, they keep on making sandblasting which was their initial job. Most of the workers started learning this job in sandblasting section. After working a while, they are specialized in the other sections such as polishing, porcelain smoothing, metal flattening, porcelain trampling, plastic work, modeling. Job sections and working durations are different for each of the workers. Because of this specialization period, it's very difficult to comment on the work-related exposure and it's relation with job section and working duration.

However, two dental technician cases working at similar jobs reported by Kartaloglu and colleagues indicated that high levels of silica and many other minerals containing heavy metals could be found in the lung tissue by mineral analysis (16). This can be a clear proof of occupational exposure. When cases are classified according to their work sections; it can easily be seen that, high pneumoconiosis frequency is related with exposure type. But we could not show a statistically meaningful relationship with the mean work starting age and total working duration because of the reasons explained above (Table 3 and 5).

All these conditions show that, workers have serious risks for respiratory, dermatological and skeleton-muscular systems. They can also have other systemic occupational health problems.

Although, working in dental laboratories is known to cause pneumoconiosis and other serious health problems; we have limited knowledge about occupational lung diseases including pneumoconiosis in dental technicians. Further studies are necessary to clarify the other health problems related with chemicals.

Table 5. The mean of the work starting age of workers.

	Pneumoconiosis					
	Yes		No		Total	
	n	%	n	%	n	%
	33	23.6	107	76.4	140	100.0
Work starting age	21.6		19.9		20.36	

Dental technicians who have health problems must be determined and exposure must be prevented. All workers and workplaces must be informed about the health problems due to occupational exposure, and working conditions must be improved. Starting to work at very young ages must be prevented and basic occupational education should be obligatory.

REFERENCES

1. *Thorette C, Grigoriu B, Canut E, et al. Pulmonary diseases in dental laboratory technicians. Rev Mal Respir 2006; 23(Suppl 2): 7-16.*
2. *Scherpereel A, Tillie-Leblond I, Pommier de Santi P, et al. Exposure to methyl methacrylate and hypersensitivity pneumonitis in dental technicians. Allergy 2004; 59: 890-2.*
3. *Brancaleone P, Weynand B, De Vuyst P, et al. Lung granulomatosis in a dental technician. Am J Ind Med 1998; 34: 628-31.*
4. *Torbica N, Krstev S. World at work: Dental laboratory technicians. Occup Environ Med 2006; 63: 145-8.*
5. *www.iskur.gov.tr*
6. *Eyuboglu CK, Itil O, Gulsen A, et al. Dental technician's pneumoconiosis; a case report. Tuberk Toraks 2008; 56: 204-9.*
7. *Guidelines for the use of ILO international classification of radiographs of pneumoconiosis revised edition. Safety and Health Series, Geneva 1980; 22: 1-17.*
8. *Radi S, Dalphin JC, Manzoni P, et al. Respiratory morbidity in a population of French dental technicians. Occup Environ Med 2002; 59: 398-404.*
9. *Choudat D, Triem S, Weill B, et al. Respiratory symptoms, lung function, and pneumoconiosis among self employed dental technicians. Br J Ind Med 1993; 50: 443-9.*
10. *Sherson D, Maltbaek N, Olsen O. Small opacities among dental laboratory technicians in Copenhagen. Br J Ind Med 1988; 45: 320-4.*
11. *Rom WN, Lockey JE, Lee JS, et al. Pneumoconiosis and exposures of dental laboratory technicians. Am J Public Health 1984; 74: 1252-7.*
12. *Szadkowski D, Zietz M, Angerer J, et al. Gesundheitsgefahren durch Stäube in Dentallabor. Teil II: Befunde einer arbeits-medizinischen Untersuchung von Zahntechnikern. Arbeitsmed Socialmed Präventivmed 1987; 22: 29-33.*
13. *Jacopsen N, Derand T, Hensten-Pettersen A. Profile of work-related health complaints among Swedish dental laboratory technicians. Community Dent Oral Epidemiol 1996; 24: 138-44.*
14. *Froudarakis MF, Voloudaki A, Bouros D, et al. Pneumoconiosis among Cretan dental technicians. Respiration 1999; 66: 138-42.*
15. *Selden AI, Persson B, Bornberger Dankvardt SI, et al. Exposure to cobalt chromium dust and lung disorders in dental technicians. Thorax 1995; 50: 769-72.*
16. *Kartaloglu Z, Ilvan A, Aydilek R, et al. Dental technician's pneumoconiosis: Mineralogical analysis of two cases. Yonsei Medical Journal 2003; 44: 169-73.*