

# THEORETICAL AND PRACTICAL ASPECTS OF THE ILLNESSES THAT ARE OR ARE NOT CLASSIFIED AS OCCUPATIONAL DISEASES IN THE DENTAL LABORATORY – PRELIMINARY STATISTICAL ANALYSIS (PART I – POWDERS)

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**Keywords:** dental laboratory, dental technicians, risk factors, powders  
**Abstract:** The aim of this material is to make aware of the potential risk factors those who work in the laboratory, dental technicians, risk factors, powders or will work there (both dental technicians and students); these external risk factors may be toxic and biologic, being able to cause diseases regarded or not as professional: potentially harming solid substances (powders), liquids and gases.

## INTRODUCTION

As it is well known, there are multiple occupational diseases to which dental technicians are exposed. There have been a lot of discussions regarding the occupational illnesses associated with the dental laboratory. However, little has been done in this respect. In 2015, the dental laboratory technician certification programme is an independent speciality providing diploma within the universities of medicine and pharmacy in Romania. In the country, such programmes are affiliated to the faculties of dental medicine. In Bucharest, it is affiliated to the Faculty of Midwifery and Nursing within “Carol Davila” University of Medicine and Pharmacy. The university dental technician certification programme curriculum includes special courses on labour protection, but unfortunately, in our opinion, they do not insist enough on the factors that actually cause occupational diseases in the dental laboratory. We also consider useful that in the future, a compulsory course in occupational medicine should be introduced in the university curriculum so that future dental technicians can be provided with the appropriate medical notions to help them become really sensitive to occupational health and safety.

## PURPOSE

The purpose of the present paper is to focus the attention of those working in dental laboratories on some extremely important risk factors of toxic and biological nature that may cause illnesses that are or are not classified as occupational diseases: solid (powder), liquid or gaseous hazardous substances. Because of the limited space we enjoy, in the first part of the paper we will focus only on solid hazardous substances. The liquid and gaseous ones will be treated in the second part of the paper. We consider that, before presenting the topic, the clarification of some concepts mentioned in the paper is necessary:(1-4)

- occupational medicine is a branch of medicine that analyses the risk factors in the work environment and their impact on the health of the people exposed, establishing technical and organisational, individual and educational prevention measures, as well as treatment and rehabilitation measures in case of illnesses caused by working conditions;
- occupational diseases are the disorders directly caused by

the physical, chemical and biological risk factors related to labour processes as well as by the overstrain placed on different body organs, apparatuses and systems while fulfilling the job duties;

- occupational diseases are determined by many factors, work environment and conditions representing an important percentage of the possible etiological factors;
- occupational risk factors are chemical waste, powders, and biological agents in the work environment, as well as the activity-specific physical and psychological strain that is over the level of adaptability having thus short and long-term pathological effects;
- health protection in the context of professional activity covers several stages: choice of a profession, education and training; transfer or transition to other activities; adaptation period; regular intervals depending on risk factors, their aggressiveness, and adaptation possibilities; after a longer period of time (even after leaving the job by transfer or retirement), if risk factors can act for a long period of time as in the case of silicosis or occupational cancer, diseases that have affected even dental technicians over time).

## MATERIALS AND METHODS

As it has been already mentioned, in the first part of the paper there are addressed only the toxic powders that can cause diseases that are or are not classified as occupational diseases in dental laboratories. The powder particles that are typically less than 5 microns in diameter, also referred to as “respirable dust” are not very harmful to human health. In contrast, larger powder particles with a diameter between 7 and 100 microns, also called “inhalable dust”, can deposit being very harmful to human health especially by toxicity. The powder particles under 0.1 microns in diameter do not deposit, causing no harm to human health.(5)

Of the multitude of materials used in dental laboratories we have considered the most usual ones as follows:(5-8)

- nickel metal powder (metal casting and prosthetic restorations) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 1 mg/m<sup>3</sup>; excess exposure can result in allergies, cancer etc.];

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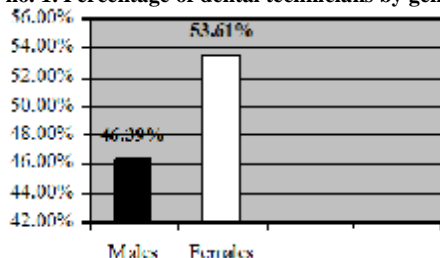
- chromium metal powder (metal casting and prosthetic restorations) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 1 mg/m<sup>3</sup>; excess exposure can result in allergies, dermatitis, cancer etc.];
- cobalt metal powder (metal casting and prosthetic restorations) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 0.05 mg/m<sup>3</sup>; excess exposure can result in allergies, heart failure in time, cancer etc.];
- beryllium metal powder (metal casting and prosthetic restorations) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 0.002 mg/m<sup>3</sup>; excess exposure can result in allergies, severe lung disorders, cancer etc.];
- copper metal powder (metal casting and prosthetic restorations) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 1 mg/m<sup>3</sup>; excess exposure can result in allergies, neurological disorders, cancer etc.];
- silica powder (sanding, ceramics processing etc.) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 0.2-0.4 mg/m<sup>3</sup>; excess exposure can result in severe lung diseases – silicosis, cancer etc.];
- gypsum powder (calcium sulphate) (casting and plaster models) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 10 mg/m<sup>3</sup>; excess exposure can result in allergies, lung disorders etc.];
- methyl methacrylate powder (obtaining acrylic dentures) [acceptable exposure dose (calculated for 8 hours/day for 5 days a week) is about 100 ppm; excess exposure can result in severe allergies, cancer].

The method of investigation used in the study was the questionnaire. The questionnaire comprised 8 questions (8 items). It was administered to 97 subjects, dental technicians that work not only in Bucharest but also in other randomly chosen 14 counties in Romania: Ilfov, Giurgiu, Prahova, Galați, Teleorman, Argeș, Dâmbovița, Brăila, Ialomița, Constanța, Vâlcea, Gorj, Dolj and Mehedinți.

The selected dental technicians were both males and females, aged between 40 and 68, working for minimum 10 years and maximum 40 years. The statistical analysis resulting from the present preliminary study is very brief being suggestively represented through graphs.

Of the 97 investigated dental technicians, 45 subjects, representing 46.40% were males, and 52 subjects, representing 53.60%, were females (figure no. 1).

Figure no. 1. Percentage of dental technicians by gender



The questionnaire administered to the 97 dental technicians is presented below:

Questionnaire

1. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of nickel-base alloys (through the product leaflets, specialised articles or other scientific materials)?

2. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of chromium-base alloys (through the product leaflets, specialised articles or other scientific materials)?
3. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of cobalt-base alloys (through the product leaflets, specialised articles or other scientific materials)?
4. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while using alloys containing beryllium?
5. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of copper-base alloys (bronze) (through the product leaflets, specialised articles or other scientific materials)?
6. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing sanding or processing ceramic materials being thus exposed to doses of silica powder over the usual ones?
7. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while casting and processing plaster models (calcium sulphate)?
8. Have you been informed about the diseases that are or are not classified as occupational you are exposed to while using methyl methacrylate powder (through the product leaflets, specialised articles or other scientific materials)?

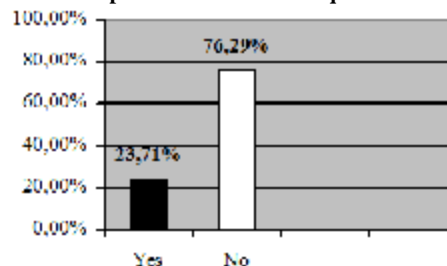
For the questions (items) 1, 2, 3 and 4 in the questionnaire, the used alloys were those based on nickel-chromium or cobalt-chromium, also containing beryllium, but the questionnaire was designed so that a direct relationship between a question and a compound could be established.

RESULTS

Following the administration of the questionnaire to the batch of dental technicians, the results were as follows:

To the 1<sup>st</sup> item in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of nickel-base alloys (through the product leaflets, specialised articles or other scientific materials)?*, 23 subjects, representing 23.71%, responded affirmatively, while 74 subjects, representing 76.29%, responded negatively (figure no. 2);

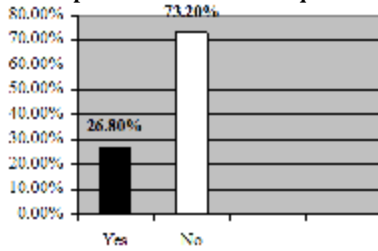
Figure no. 2. Graphic results for the 1<sup>st</sup> question



To the question no. 2 in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of chromium-base alloys (through the product leaflets, specialised articles or other scientific materials)?*, 26 subjects, representing 26.80%, responded affirmatively, while 71 subjects, representing 73.20%, responded negatively (figure

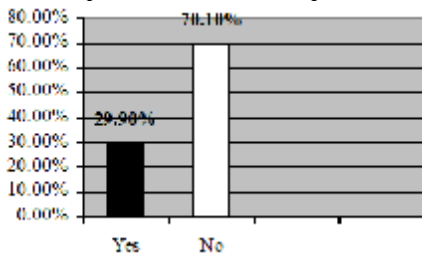
no. 3);

Figure no. 3. Graphic results for the 2<sup>nd</sup> question



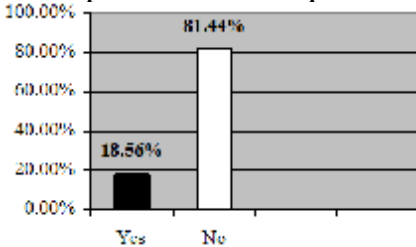
To point no. 3 in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of cobalt-base alloys (through the product leaflets, specialised articles or other scientific materials)?*, 29 subjects, representing 29.90%, responded affirmatively, while 68 subjects, representing 70.10%, responded negatively (figure no. 4);

Figure no. 4. Graphic results for the 3<sup>rd</sup> question



To the 4<sup>th</sup> item in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while using alloys containing beryllium?*, 18 subjects, representing 18.56%, responded affirmatively, while 79 subjects, representing 81.44% , responded negatively (figure no. 5);

Figure no. 5. Graphic results for the 4<sup>th</sup> question



To the question no. 5 in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing prosthetic restorations made of copper-base alloys (bronze) (through the product leaflets, specialised articles or other scientific materials)?*, 22 subjects, representing 22.68%, responded affirmatively, while 75 subjects, representing 77.32%, responded negatively (figure no. 6);

To point no. 6 in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while performing sanding or processing ceramic materials being thus exposed to doses of silica powder over the usual ones?*, 36 subjects, representing 37.11%, responded affirmatively, while 61 subjects, representing 62.89%, responded negatively (figure no. 7);

Figure no. 6. Graphic results for the 5<sup>th</sup> question

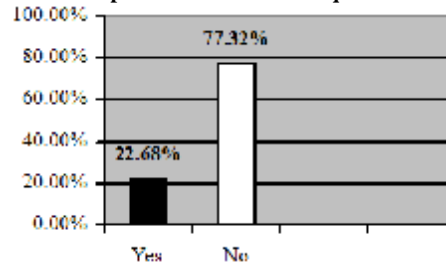
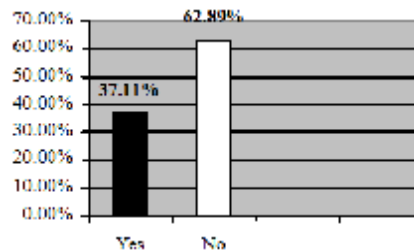
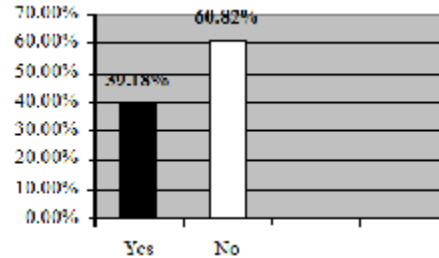


Figure no. 7. Graphic results for the 6<sup>th</sup> question



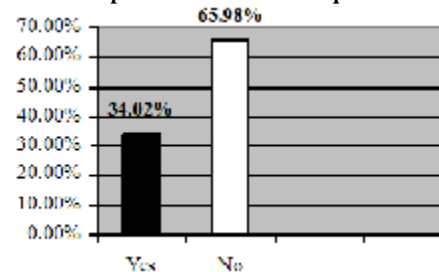
To the 7<sup>th</sup> item in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while casting and processing plaster models (calcium sulphate)?*, 38 subjects, representing 39.18%, responded affirmatively, while 59 subjects, representing 60.82%, responded negatively (figure no. 8);

Figure no. 8. Graphic results for the 7<sup>th</sup> question



To the question no. 8 in the questionnaire, *Have you been informed about the diseases that are or are not classified as occupational you are exposed to while using methyl methacrylate powder (through the product leaflets, specialised articles or other scientific materials)?*, 33 subjects, representing 34.02%, responded affirmatively, while 64 subjects, representing 65.98%, responded negatively (figure no. 9).

Figure no. 9. Graphic results for the 8<sup>th</sup> question



DISCUSSIONS

As it can be observed, to all the 8 questions in the

questionnaire, only a percentage of maximum 38% of the interviewed subjects responded affirmatively, showing that dental technicians are not only poorly educated in terms of the occupational diseases they are exposed to by being in contact with or inhaling the powder of some materials that are usually used in the dental laboratory but also little interested in reading the product leaflets, as well as in acquiring basic knowledge regarding these aspects, knowledge that can be found in the literature.(5-22)

Percentages under 30% responded affirmatively to the first 4 questions in the questionnaire, related to the occupational diseases that can be produced by being exposed to or inhaling metal powder, which is a dramatic aspect, considering the aggressiveness of the mentioned types of metal powder, highlighted in all treatises on dental materials.(5-22)

On the contrary, for the last 3 questions in the questionnaire, related to the illnesses that are or are not classified as occupational diseases caused by gypsum powder (calcium sulphate), silica or methyl methacrylate powder, a percentage between 34% and 40% of the interviewed subjects responded affirmatively, demonstrating their solid knowledge about the use and properties of these materials, which indicates the dental technicians vast experience in casting, sanding, and ceramics processing, as well as in performing partial or total acrylic dentures.(5-22)

Subsequently, following the presentation of the questionnaire results, a percentage of about 75% of the interviewed subjects admitted that they had solid knowledge about the allergic potential of nickel and methyl methacrylate powder, and a percentage of about 52% of the interviewed subjects admitted that they had knowledge of the carcinogenic potential of such metal powders.(5-22)

### CONCLUSIONS

The dental technicians education should be enhanced, since they are students, by introducing in the university curricula, along with occupational health and safety courses, highly specialised courses in occupational medicine, to present to future dental technicians as concise as possible notions related to both risk factors and occupational illnesses that are or are not classified as occupational diseases, which may affect the workers in the dental laboratory.(6-22) As for experienced dental technicians, they should be trained in the field of occupational diseases, professional organisations and colleges introducing certain compulsory courses in this respect.(6-22)

All producers of dental materials should be obliged to describe as thoroughly and intelligibly as possible all the side effects of using such materials by dental technicians and dentists, as service providers, and by patients, as beneficiaries (see metal alloys). The medical team (dentist-dental technician) should be obliged to inform the patients in writing about the risks they are exposed to while accepting the prosthetic restoration, in terms of the materials the restorations are made of. The workers in dental laboratories should be obliged to wear filter masks, and dental laboratories should be very well ventilated.

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