

EVALUATION OF TEETH LOSS AMONG WORKERS IN THE LAMINATE AND COMPOSITE MATERIALS DEPARTMENT OF AIRCRAFT FACTORY

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Abstract: Liquid epoxide resins, solvents and solvent-modified epoxide resins, as well as hardeners for epoxide resins, appear to be skin and mucosa irritants of different intensity and possibly have allergenic properties. Therefore, it is required that the employees are qualified and industrial safety rules are followed when these substances are in use in the manufacturing process. Our study evaluated the state of dentition and analysed the loss of teeth in the workers of the laminate and composite materials department of aircraft factory. The research has been carried out in a group of 114 workers, which consisted of 88 men and 26 women 20 to 61 years old. The control group consisted of 41 workers of the administration department in the aircraft factory who did not have any contact with chemical compounds. The workers in the studied group are characterised as having an unsatisfactory state of dentition, as shown by the high rate of lost teeth (74%). Statistically significant difference between the studied group and the control was found when the relationship between the number of lost molar teeth in women in the studied group and those in the control group is taken into consideration, a statistically significant difference appears to refer to teeth 46 and 27. The same statistically important correlation between men in the control and studied groups concerns teeth 16. The research data shows that incisor teeth are the least frequently extracted teeth in the whole population studied. Statistically significant differences can be noted for teeth 21 and 23 between the women in the control group and those in the studied one. Future studies are necessary to assess the potential relationship between the loss of teeth among workers of the department of laminate and composite materials of aircraft factory and their workplace.

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INTRODUCTION

Epoxide resins were introduced to the market in the years 1948–1950. They are obtained through condensation of epichlorohydrin and multi-hydroxide phenols. The products of the condensation, which are liquid or fusible micromolecular basic resins, are converted into insoluble infusible macromolecular plastics in the process of hardening. Owing to very little

shrinkage during the hardening process the resin takes the exact shape and overall dimensions of a mould used in the industrial production.

The distinguishing features of hardened epoxide plastic are its strength, high chemical resistance and high adhesion to metals, glass and ceramics. Properties of epoxide resins can be modified by chemical methods, such as the application of hardening agents, chemical processing, mixing with other types of resins and use of

fillers, softening agents or diluters. There are various epoxide compounds produced at present and they are used as adhesives, cast resins, lacquer, laminated plastic bonds and foamed plastics. The process of coating solid materials like aluminium or glass with epoxide resins is called lamination.

Distinguished by considerable strength comparable to the strength of steel but with a 4 times smaller specific gravity, laminated plastics strengthened with glass fibre are a valuable constructional material used in aircrafts, cars, boats, rockets, etc. High adhesive properties of epoxide resins to glass allow us to obtain laminates whose characteristic feature is high chemical and mechanical resistance as well as a limited number of internal stresses. Glass in laminates has the form of thin fibres whose mechanical resistance is incomparably higher than that of glass. Another method applied in laminate production is mixing epoxide resins with other fibric materials, for instance asbestos.

Liquid epoxide resins, solvents and solvent-modified epoxide resins, as well as hardeners for epoxide resins, appear to be skin and mucosa irritants of different intensity and possibly have allergenic properties. Therefore it is required that the employees are qualified and industrial safety rules are followed when these substances are in use in the manufacturing process.

As described in the literature, the workplace has influence on health condition, among others, on the masticatory organ [2, 3]. The aim of this study is to evaluate the state of dentition and to analyse the loss of teeth in the workers of the laminate and composite materials department of aircraft factory.

MATERIALS AND METHODS

The research has been carried out in State Aircraft Factory, Świdnik, Poland, in a group of 114 workers,

which consisted of 88 men and 26 women 20–61 years old; a group of 73 workers had contact with epoxide resins, polyurethane paints, hardening agents and diluters in their place of work.

The control group consisted of 41 workers of the administration department in the aircraft factory who did not have any contact with chemical compounds.

The examination was performed by means of a diagnostic set of hand instruments under artificial light. All the data considering the state of dentition as well as recommended therapy were recorded in the WHO research charts.

The analysis covered the number of extracted incisors, canines, premolar and molar teeth both upper and lower and made taking into account the sex, both in the study and control groups.

The collected data were compiled in Tables 1–3 and their statistical interpretation carried out by Chi-square test of significance for qualitative variables.

RESULTS AND DISCUSSION

The age of the examined workers ranged from 20–61 years. In the group studied, the average age of women was 46.3 years and of men - 38.3 years. The average age of all the members of the studied group was 42.3 years. In the control group, the average age of women was 43.8 years and of men - 47.8 years. The average age of the control group was 45.8 years.

The lowest value of DMF (decay, missing, fillings) - 16.79 - was observed in the men in the studied group and the highest - in the women in this group.

Loss of molar teeth was the most frequent type of missing teeth within the whole group studied.

Table 1 present the number of upper and lower molar teeth lost, considering particular teeth in both studied and control groups in men and women.

Table 1. Number of upper and lower molar teeth lost in both studied and control groups in men and women.

		N	n	%	n	%	n	%	n	%	n	%	n	%
Upper molar teeth lost:			18		17		16		26		27		28	
Studied group	Women	10	7	70	6 ^a	60	6	60	6 ^a	60	7 ^{a, b}	70	7	70
	Men	63	34	54	14 ^a	22.2	21 ^b	33.3	17 ^a	27	15 ^a	23.8	37	58.7
	All	73	41	56.2	20	27.4	27	37	23	31.5	22	30.1	44	60.3
Control group	Women	16	13	81.3	6	37.5	7	43.8	4	25	4 ^b	25	13	81.3
	Men	25	16	64	10	40	15 ^b	60	7	28	7	28	15	60
	All	41	29	70.7	16	39	22	53.7	11	26.8	11	26.8	28	68.3
Lower molar teeth lost:			38		37		36		46		47		48	
Studied group	Women	10	6	60	7 ^a	70	9 ^a	90	10 ^{a, b}	100	5	50	7	70
	Men	63	31	49.2	12 ^a	19	25 ^a	39.7	34 ^a	54	19	30.2	33	52.4
	All	73	37	50.7	19	26	34	46.6	44	60.3	24	32.9	40	54.8
Control group	Women	16	8	50	9	56.3	10	62.5	9 ^b	56.3	9 ^a	56.3	13	81.3
	Men	25	17	68	9	36	10	40	11	44	4 ^a	16	17	68
	All	41	25	61	18	43.9	20	48.8	20	48.8	13	31.7	30	68

N - number of examined workers; n - number of teeth lost; ^astatistically significant difference between women and men in the group, $p < 0.05$; ^bstatistically significant difference between studied and the control group.

Table 2. Number and percentage of lost upper and lower premolar teeth in both the studied and control groups with regard to sex.

		N	n	%	n	%	n	%	n	%
Lost upper premolar teeth:			15		14		24		25	
Studied group	Women	10	5	50	6 ^a	60	6 ^a	60	5	50
	Men	63	19	30.2	16 ^a	25.4	17 ^a	27	20	31.7
	All	73	24	32.9	22	30.1	23	31.5	25	34.2
Control group	Women	16	6	37.5	8	50	7	43.8	5	31.3
	Men	25	6	24	8	32	8	32	8	32
	All	41	12	29.3	16	39	15	36.6	13	31.7
Lost lower premolar teeth:			35		34		44		45	
Studied group	Women	10	2	20	1	10	1	10	3	30
	Men	63	12	19	7	11.1	8	12.7	9	14.3
	All	73	14	19.2	8	11	9	12.3	12	16.4
Control group	Women	16	4	25	2	12.5	3	18.8	5	31.3
	Men	25	3	12	2	8	1	4	4	16
	All	41	7	17.1	4	9.8	4	9.8	9	22

N - number of examined workers; n - number of teeth lost; ^astatistically significant difference between women and men in the group, $p < 0.05$

In the study group, a loss of 287 teeth (sixth, seventh and eighth) was found in male workers of the production department and a loss of 77 teeth was observed in women. In the control group, the loss of 138 teeth was observed in the men, and in the women the number of teeth lost amounted to 105.

In both groups, the highest percentage of extracted teeth (approximately 60%) were the eighth teeth, so-called 'wisdom teeth'. There were more maxillary third molars extracted (142 teeth) than mandibular third molars (132 teeth). The examined workers from the control group had more III molar teeth extracted (approx. 67%) than the workers from the studied group where the percentage was as high as 55%. The wisdom teeth were most frequently extracted 18, 28 and 48. The first and the second molar teeth are the next to follow when the number of lost teeth is to be taken into consideration, and loss of these amounts to 44% and 32% respectively.

Observations and interviews with patients show that there are 2 major reasons for extractions of III molar teeth: difficult eruption often associated with inflammatory conditions in that region, and their hard accessibility for cleaning which infrequently results in quick loss of those teeth. Frequent loss of I molar teeth is a result of bad oral hygiene at the time of their eruption at the age of 6–7 years, and the necessity of recurrent dental interventions which lead to their extraction.

The analyse of extracted molar teeth found a statistically significant difference in the number of extracted teeth 17, 26, 27 and 37, 36, 46 between women and men in the studied group. In the control group, the difference concerned teeth 47 alone. When the relationship between the number of extracted molar teeth in women in the studied group and those in the control group is taken into consideration, a statistically significant difference appears to refer to teeth 46 and 27. The same statistically important correlation between men in the control and studied groups concerns teeth 16.

Table 2 present the number and percentage of lost premolar teeth in both the studied and control group with regard to sex. The men in the studied group had 108 molar teeth missing and the women in this group had 29 teeth missing. In the control group, the number of extracted molars was as high as 40, both in men and women.

In the studied group the most frequently extracted premolar teeth were maxillary premolars II 49 teeth, which constitute 52% of all the maxillary premolar lost. In the mandible, 26 extractions were found, which constitute 60% of all the mandibular premolars lost. In the control group, the most frequently extracted were maxillary premolars I 31 teeth, which constitute 55% of all the lost premolar maxillary teeth of this group and mandibular premolar II 16 teeth, which constitute 66% of all the premolar mandibular teeth lost in this group.

As far as the premolars are concerned, there is a statistically significant difference between the number of extracted teeth 14, 24 in women and men in the studied group.

The research data presented in table 3 show that incisor teeth are the least frequently extracted teeth in the whole population studied. In the studied group, men were found to have 62 incisor teeth extracted and women had 17 extractions. In the control group, the number of extracted incisors amounted to 29 teeth in men and 11 teeth in women. Statistically significant differences can be noted for teeth 21 in men and women in the control group, although also for the same type of teeth, i.e. 21 and 23 between the women in the control group and those in the studied one. Neither among the members of the control group nor those of the studied group did the research reveal loss of teeth 43.

Wide-ranging interest in the research shown by the workers of the factory points to the fact that they do not neglect oral health and that they are familiar with the rules of dental prophylaxis.

Table 3. Number and percentage of lost upper and lower incisor teeth in both the studied and control groups with regard to sex.

		N	n	%	n	%	n	%	n	%	n	%	n	%
Lost upper incisor teeth:			13		12		11		21		22		23	
Studied group	Women	10	2	20	4	40	2	20	3b	30	2	20	3b	30
	Men	63	6	9.5	12	19	8	12.7	11	17.5	12	19	7	11.1
	All	73	8	11	16	21.9	10	13.7	14	19.2	14	19.2	10	13.7
Control group	Women	16	1	6.3	2	12.5	1	6.3	0a, b	0	1	6.3	0b	0
	Men	25	2	8	5	20	2	8	6a	24	6	24	4	16
	All	41	3	7.3	7	17.1	3	7.3	6	14.6	7	17.1	4	9.8
Lost lower incisor teeth:			33		32		31		41		42		43	
Studied group	Women	10	0	0	0	0	0	0	0	0	1	10	0	0
	Men	63	1	1.6	0	0	1	1.6	2	3.2	2	3.2	0	0
	All	73	1	1.4	0	0	1	1.4	2	2.7	3	4.1	0	0
Control group	Women	16	0	0	2	12.5	2	12.5	2	12.5	0	0	0	0
	Men	25	1	4	1	4	0	0	1	4	1	4	0	0
	All	41	1	2.4	3	7.3	2	4.9	3	7.3	1	2.4	0	0

N - number of examined workers; n - number of teeth lost; ^astatistically significant difference between women and men in the group, $p < 0.05$; ^bstatistically significant difference between studied and the control group.

The average number of DMF for all the examined workers amounted to 20.23 and turned out to be higher in women (21.96) than in men (18.49). Witek *et al.* [13] quote 17.09 as the average number of DMF in adults examined by them within the province of Gdańsk. As in the results presented in this analysis, the average number was higher in women (18.77) than in men (15.41). Taking into account the division of our populations into 2 groups (studied and control), the lowest rate of DMF number was noted in men in the studied group (16.79), while the highest percentage was observed in women in the same studied group (22.50).

The data published abroad show similar and higher values of the average DMF number. The value of the average DMF published by Ramon *et al.* who had carried out their research in the population of hospitals patients in Israel is one of the highest recorded in available literature [12]. The research carried out by Osborne *et al.* among prisoners in Australia reveals the value of the average DMF to be within the range of 20.4 [9].

Poor oral condition, especially in the lateral regions, which provide "support zone", which in our study amounted to 74% molars and premolars lost, results in stomatognathic impairment. Similar loss of molar and premolar teeth, i.e. 68.59% was found by Pellowska-Piontek *et al.* [10] in 35–44-year-old inhabitants of the province of Gdańsk; the evaluation, however, did not include III molar teeth. A high percentage (over 75%) of extracted teeth was noted in the province of Warsaw, despite the fact that the examined were older (over 55 years of age) [6].

The lowest rate of the extracted teeth (49%) was noted by Lukes and Miller who had examined immigrants working on farms in the region of Illinois in the USA [8].

Most of the research published in Poland and abroad reveal similar percentages of extracted teeth, ranging from 70% to 75% [9, 12].

The number of teeth lost, mainly in lateral sections, as well as higher value of DMF in women than men, are consistent with the results of Polish and foreign epidemiologic investigation concerning population and its dependence upon the environment and type of work [1, 4, 5, 7, 8, 9, 11, 12, 13].

CONCLUSIONS

The workers in the studied group are characterised as having an unsatisfactory state of dentition, as shown by the high rate of lost teeth (74%).

Statistically significant difference between the studied group and the control was found when the relationship between the number of lost molar teeth in women in the studied group and those in the control group is taken into consideration, a statistically significant difference appears to refer to teeth 46 and 27. The same statistically important correlation between men in the control and studied groups concerns teeth 16. The research data shows that incisor teeth are the least frequently extracted teeth in the whole population studied. Statistically significant differences can be noted for teeth 21 and 23 between the women in the control group and those in the studied one.

Future studies are necessary to assess the potential relationship between the loss of teeth among workers of the department of laminate and composite materials of aircraft factory and their workplace.

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