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Association among work exposure, alcohol intake, smoking and Dupuytren's disease in a large cohort study (GAZEL)

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ABSTRACT

Objectives: In view of the debate of factors in Dupuytren's disease, we aimed to describe its relationship with certain occupational factors, alcohol intake and smoking.

Setting: The French GAZEL cohort (employees of Electricité de France and Gaz de France).

Participants: Participants of the cohort who answered a questionnaire in 2012, that is, 13 587 participants (73.7% of the questionnaire sent). In 2007, self-assessed lifetime occupational biomechanical exposure was recorded (carrying loads, manipulating a vibrating tool and climbing stairs), as well as alcohol intake, smoking and diabetes mellitus. Analyses were performed on high alcohol intake, smoking and duration of relevant work exposure, stratified by gender.

Primary and secondary outcome measures: From a specific question on Dupuytren's disease assessed in 2012, the outcome measures were self-reported Dupuytren's disease (yes/no) and disabling Dupuytren's disease (including surgery).

Results: A total of 10 017 men and 3570 women, aged 64–73 years, were included; the mean age for men was 68 years and for women was 65 years. Among men, the following were significantly associated with Dupuytren's disease: age (OR 1.03 (1.00; 1.06)), diabetes (OR 1.31 (1.07; 1.60)), heavy drinking (OR 1.36 (1.10; 1.69)) and over 15 years of manipulating a vibrating tool at work (OR 1.52 (1.15; 2.02)); except for diabetes, the association with these factors was stronger for disabling Dupuytren's disease (or surgery), with OR 1.07 (1.03; 1.11), 1.71 (1.25; 2.33) and 1.98(1.34; 2.91), respectively, for age, heavy drinking and over 15 years of manipulating a vibrating tool at work. Among the 3570 women included, 160 reported Dupuytren's disease (4.5%). The number of cases in the group of women was too low to reach conclusions, although the findings seemed similar for age, diabetes and vibration exposure.

Conclusions: In this large French cohort study, Dupuytren's disease in men was associated with high levels of alcohol consumption and exposure to hand-transmitted vibration. It is likely that the same applied to women.

Strengths and limitations of this study

- Limitation: Self-reported diagnosis, and possible residual confounding (genetic factors mainly).
- Strength: The longitudinal design the relatively large size of the cohort.
- Strength: Analyses on women.

Dupuytren's disease is characterised by chronic contracture of the fourth and fifth fingers of the hand towards the palm, usually accompanied by thickening of the palmar skin.[1] It has a clear genetic background.[2–4]

Since its description by Guillaume Dupuytren in 1831 following Henry Cline senior and Sir Astley Cooper, there has been controversy regarding biomechanical work exposure which might contribute to the development of this disorder.[5] An exhaustive review and a meta-analysis were conducted to address this controversy, and was concluded that there is good evidence of an association between vibration exposure and Dupuytren's disease.[6 7] However, some authors still consider that occupational exposure, including vibration, is not a risk factor for Dupuytren's disease in manual workers.[1 8 9] These authors argued there are still conflicting results and that evidence is based only on two longitudinal studies. The role of alcohol consumption and smoking are also a matter of debate,[9 10] although one large longitudinal study found a clear relationship between such exposure and Dupuytren's disease.[11]

We used data from a large cohort study to describe the prevalence of Dupuytren's disease, and to analyse its association with certain risk factors, including exposure to vibration, alcohol intake and smoking.

METHODS

Population

The GAZEL cohort comprises employees of Electricité de France (EDF) and Gaz de France (GDF), the French national utility for energy production and distribution (GAZEL stands for GAZ and ELectricité). The company employs workers in various trades and of different socioeconomic status. At baseline in 1989, the cohort included 20 625 volunteers, men aged 40–50 years and women 35–50 years, and 18 428 of them are still followed up. In January of each year since then, the participants have completed a general self-administered questionnaire about their lifestyle, health and occupational situation.[12]

In the present study, we included only the participants who answered the 2012 GAZEL questionnaire (which included a question about Dupuytren's disease).

Potential risk factors

Information on gender and age (in 2012) was collected through the general questionnaire. Occupational risk factors were assessed in the 2007 questionnaire. Data on nine different types of biomechanical exposure were available, including the number of years of exposure during their working lives (carrying loads, bending trunk, drive a vehicle, kneeling, climbing stairs, climbing ladder, working with arm over the shoulder, carrying load on the shoulder and manipulating a vibrating tool). In this study of Dupuytren's disease, we analysed the potential role of manipulating a vibrating tool. As information about forceful activity was not available, carrying loads was considered to be a proxy for forceful work and was also taken into account. Climbing stairs, an irrelevant exposure for Dupuytren's disease, was also used as a 'control exposure' to check the lack of relationship. For these variables, three categories were considered for men based on duration of exposure: that is, never exposed, exposed but for less than 15 years and exposed for 15 years or more. In view of the number of exposed women in the cohort, the exposure for women was only considered as yes or no. In addition, at inception of the cohort in 1989, a 'yes or no' question about manipulating vibrating tools was also available, and computer work was used as control exposure.

Data for alcohol consumption were available for each year since 1992, and three categories were also considered on the basis of the distribution observed. Only heavy drinkers were taken into account based on the results of a previous study[13]: less than 3 glasses a day of any alcohol, 3–4 glasses of wine or beer, 5 or more glasses of wine/beer or 3 glasses or more of spirits a day. If a participant had increased his alcohol consumption between 1992 and 2012, the highest category was taken into consideration. Data on smoking had been collected at inception in 1989 and grouped into three categories: non-smoker or former smoker, 1–20 cigarettes/cigars or pipes per day and over 20 cigarettes/cigars or pipes per day. As for alcohol consumption, the highest alcohol-intake category was taken into consideration if the participant had increased consumption during the study period.

Diabetes mellitus was self-reported every year from 1989.

Outcomes

In 2012, a specific question on Dupuytren's disease was asked: "(1) Have you ever had Dupuytren's disease (thickening of the palmar skin, nodes or contracture of the fourth finger of the hand)? (2) if yes, do you have any limitations because of it? (3) Have you had surgery for it?"

We considered two outcomes, that is, Dupuytren's disease (yes or no) based on the answer to the first question; and a three-category variable: no Dupuytren's disease (reference), Dupuytren's disease without surgery and without limitations and Dupuytren's disease with surgery or limitations.

Analyses

Univariate and multivariate analyses were stratified on gender for both outcomes. For the multinomial regression model, all the risk factors previously described were included, except 'control exposure' variables. Statistical Analysis Software was used for all statistical analyses (SAS, V.9.3, SAS Institute Inc, Cary, North California, USA). Associations were considered statistically significant if the p value was less than 0.05. OR and their 95% CI were computed.

RESULTS

The 13 587 participants who answered the GAZEL questionnaire in 2012 constituted the sample (10 017 men and 3570 women). The participation rate was 73.7% (18 428 questionnaires sent in 2012). The participants were aged 59–73 years (mean age 68 years for men and 65 years for women).

Of the 10 017 men included, 839 reported Dupuytren's disease (8.4%), including 342 who reported surgery or limitations (3.4%). Age, diabetes mellitus, heavy drinking and over 15 years of manipulating a vibrating tool at work were significantly associated with self-reported Dupuytren's disease, with a dose-effect relationship (table 1). Similar results were found when a yes/no question was used at the inception of the cohort in 1989. As expected, none of the 'control exposure' variables were associated with Dupuytren's disease. Reported durations of exposure to carrying loads and smoking habits were not found to be associated with Dupuytren's disease. The associations were stronger when considering disabling Dupuytren's disease (or surgery) than for Dupuytren's disease without reported surgery or disability (table 2). Figure 1 shows a clear dose effect in relation to duration of exposure, using a 5-year step.

Table 1 Univariate and multivariate analyses of Dupuytren's disease (yes vs no) and available factors assessed in the previous period in men

	N (total)	N	Per cent	OR (univariate analyses, 95% CI)	OR (multivariate analysis logistic model, 95% CI)*
Age†				*1.03 (1.01 to 1.06)*	*1.03 (1.00 to 1.06)*
Diabetes					
No	8581	692	8.06	1	1
Yes	1436	147	10.24	*1.30 (1.08 to 1.57)*	*1.31 (1.07 to 1.60)*
Smoking habits (pack/day)‡					
Non-smoker (or former smoker)	6055	488	8.06	1	1
Smoker <1	2670	229	8.58	1.07 (0.91 to 1.26)	1.05 (0.88 to 1.24)
Smoker ≥1	1246	117	9.39	1.18 (0.96 to 1.46)	1.05 (0.83 to 1.32)
Drinking habits (glass/day)‡					
<3	2551	174	6.82	1	1
3 or 4 glasses of wine/beer	4864	411	8.45	*1.26 (1.05 to 1.52)*	*1.22 (1.01 to 1.48)*
≥5 glasses of wine/beer or ≥3 glasses of spirits	2577	249	9.66	*1.46 (1.19 to 1.79)*	*1.36 (1.10 to 1.69)*
Carrying loads (assessed in 2007), number of years of exposure					
No	6812	565	8.29	1	1
1–15 years	1026	89	8.67	1.05 (0.83 to 1.33)	0.95 (0.74 to 1.22)
>15 years	1393	129	9.26	1.13 (0.92 to 1.38)	0.91 (0.71 to 1.16)
Climbing stairs (assessed in 2007), number of years of exposure					
No	7281	618	8.49	1	
1–15 years	810	63	7.78	0.91 (0.69 to 1.19)	
>15 years	1147	102	8.89	1.05 (0.85 to 1.31)	
Manipulating vibrating tools (assessed in 2007), number of years of exposure					
No	7630	614	8.05	1	1
1–15 years	772	76	9.84	1.25 (0.97 to 1.60)	1.25 (0.95 to 1.65)
>15 years	781	88	11.27	*1.45 (1.15 to 1.84)*	*1.52 (1.15 to 2.02)*
Carrying loads (assessed in 1989)					
No	8888	737	8.29	1	
Yes	1129	102	9.03	1.10 (0.88 to 1.36)	
Manipulating vibrating tools (assessed in 1989)					
No	9278	760	8.19	1	
Yes	739	79	10.69	*1.34 (1.05 to 1.71)*	
Computer work (assessed in 1989)					
No	5270	444	8.43	1	
Yes	4747	395	8.32	0.99 (0.86 to 1.14)	

Data in italics: p<0.05.
*Model included all variables shown.
†Age as continuous variable and OR associated with an increase of one unit.
‡Maximum consumption reached.

Of the 3570 women included, 160 reported Dupuytren's disease (4.5%), including 78 who reported surgery or limitations (2.2%). Associations were found to be weak, although age, diabetes and vibration exposure were still significant (tables 3 and 4); however, only a small number of women were heavy drinkers or occupationally exposed.

DISCUSSION

The study confirmed that Dupuytren's disease in men is associated with high levels of alcohol consumption and exposure to hand-transmitted vibration in this large French cohort study, after adjustment for age and diabetes, whereas smoking habits and other types of occupational exposure were not. This is one of the first studies to analyse risk factors among women, the number of exposed cases was too small to draw any conclusion, although associations appeared similar to those observed in men.

The study had some limitations. The major limitation came from the fact that the diagnosis was self-reported, without any confirmation by physical examination by a physician. In most cases, Dupuytren's disease is easily diagnosed, with no major differential diagnoses, although it might be a previous hand trauma, camptodactyly and tendovaginitis stenosans in a fixed flexion position, for example. In addition, we considered the fourth digit only.[14] This lack of confirmation may have led to an underestimation of the prevalence of the disorder but it was probably limited, considering that the prevalence of this disorder in our study was comparable with that observed for the same age category in the general population.[9 15] A possible residual confounding effect should also be discussed: information regarding

Table 2 Univariate and multivariate analyses of Dupuytren's disease (without limitations or surgery, with limitations or surgery, compared with reference class: no Dupuytren's disease) and available factors assessed in the previous period in men

		Dupuytren's disease without limitations or surgery				Dupuytren's disease with limitations or surgery			
	N (total)	n	Per cent	OR (univariate analyses, 95% CI)	OR (multivariate analysis logistic model, 95%CI)*	n	Per cent	OR (univariate analyses, 95% CI)	OR (multivariate analysis logistic model, 95% CI)*
Age†	10017	496	4.95	1.01 (0.98 to 1.04)	1.00 (0.97 to 1.04)	343	3.42	*1.07 (1.03 to 1.11)*	*1.07 (1.03 to 1.11)*
Diabetes									
No	8581	405	4.72	1	1	287	3.34	1	1
Yes	1436	91	6.34	*1.38 (1.09 to 1.74)*	*1.41 (1.10 to 1.82)*	56	3.90	1.19 (0.89 to 1.60)	1.18 (0.87 to 1.59)
Smoking habits (pack/day)‡									
Non-smoker (or former smoker)	6055	292	4.82	1	1	196	3.24	1	1
Smoker <1	2670	132	4.94	1.03 (0.83 to 1.27)	1.04 (0.83 to 1.30)	97	3.63	1.13 (0.88 to 1.45)	1.06 (0.81 to 1.37)
Smoker ≥1	1246	68	5.46	1.15 (0.88 to 1.51)	1.06 (0.79 to 1.43)	49	3.93	1.23 (0.90 to 1.70)	1.04 (0.74 to 1.46)
Drinking habits (glass/day)‡									
<3	2551	103	4.04	1	1	71	2.78	1	1
3 or 4 glasses of wine/beer	4864	264	5.43	*1.37 (1.08 to 1.73)*	*1.32 (1.03 to 1.68)*	147	3.02	1.11 (0.83 to 1.47)	1.09 (0.81 to 1.47)
≥5 glasses of wine/beer or ≥3 glasses of spirits	2577	125	4.85	1.24 (0.95 to 1.62)	1.12 (0.84 to 1.50)	124	4.81	*1.78 (1.32 to 2.40)*	*1.71 (1.25 to 2.33)*
Carrying loads (assessed in 2007), number of years of exposure									
No	6812	350	5.14	1	1	215	3.16	1	1
1–15 years	1026	48	4.68	0.91 (0.67 to 1.25)	0.88 (0.63 to 1.22)	41	4.00	1.27 (0.90 to 1.79)	1.06 (0.73 to 1.52)
>15 years	1393	61	4.38	0.86 (0.65 to 1.14)	0.79 (0.56 to 1.09)	68	4.88	*1.56 (1.18 to 2.07)*	1.08 (0.76 to 1.52)
Climbing stairs (assessed in 2007), number of years of exposure									
No	7281	358	4.92	1		260	3.57	1	
1–15 years	810	42	5.19	1.05 (0.75 to 1.45)		21	2.59	0.72 (0.46 to 1.13)	
>15 years	1147	58	5.06	1.03 (0.78 to 1.37)		44	3.84	1.08 (0.78 to 1.50)	
Manipulating vibrating tools (assessed in 2007), number of years of exposure									
No	7630	377	4.94	1	1	237	3.11	1	1
1–15 years	772	38	4.92	1.02 (0.72 to 1.43)	1.05 (0.72 to 1.52)	38	4.92	*1.62 (1.14 to 2.30)*	*1.56 (1.07 to 2.29)*
>15 years	781	40	5.12	1.07 (0.77 to 1.50)	1.20 (0.81 to 1.78)	48	6.15	*2.05 (1.49 to 2.82)*	*1.98 (1.34 to 2.91)*
Carrying loads (assessed in 1989)									
No	8888	437	4.92	1		300	3.38	1	
Yes	1129	59	5.23	1.07 (0.81 to 1.42)		43	3.81	1.14 (0.82 to 1.58)	
Manipulating vibrating tools (assessed in 1989)									
No	9278	453	4.88	1		307	3.31	*1*	
Yes	739	43	5.82	1.23 (0.89 to 1.69)		36	4.87	*1.51 (1.06 to 2.16)*	
Computer work (assessed in 1989)									
No	5270	262	4.97	1		182	3.45	1	
Yes	4747	234	4.93	0.99 (0.83 to 1.19)		161	3.39	0.98 (0.79 to 1.22)	

Data in italics: p<0.05.
*Model included all variables shown.
†Age as continuous variable and OR associated with an increase of one unit.
‡Maximum consumption reached.

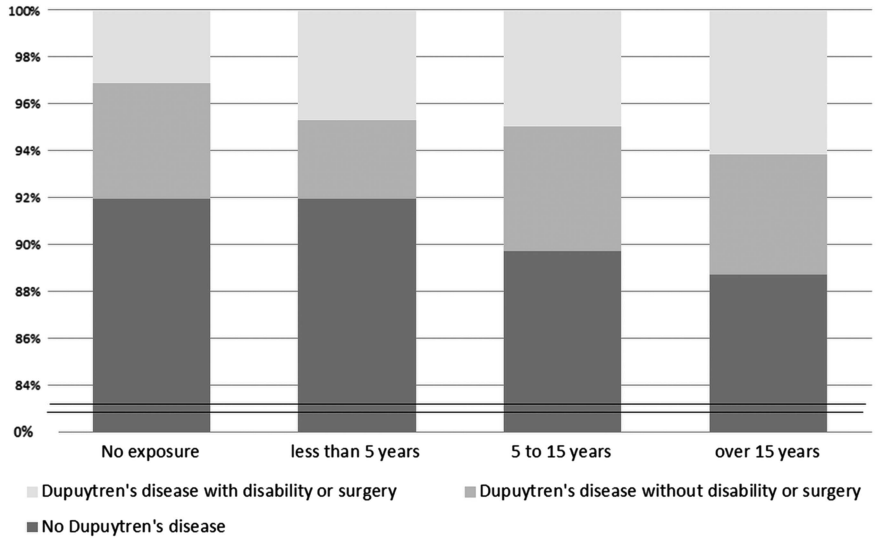

Figure 1 Proportion of Dupuytren's disease depending on duration of vibration exposure in the working life (5-year step).

Table 3 Univariate and multivariate analyses of Dupuytren's disease (yes vs no) and available factors assessed in the previous period in women

	N (total)	n	Per cent	OR (univariate analyses, 95% CI)	OR (multivariate analysis logistic model, 95% CI)*
Age†	3570	160	4.48	*1.05 (1.01 to 1.09)*	*1.05 (1.01 to 1.10)*
Diabetes					
No	3252	140	4.31	1	1
Yes	318	20	6.29	*1.49 (0.92 to 2.42)*	*1.71 (1.04 to 2.81)*
Smoking habits (pack/day)‡					
Non-smoker (or former smoker)	2626	115	4.38	1	1
Smoker <1	711	34	4.78	1.10 (0.74 to 1.62)	1.16 (0.76 to 1.77)
Smoker ≥1	187	8	4.28	0.98 (0.47 to 2.03)	0.96 (0.43 to 2.11)
Drinking habits (glass/day)‡					
<3	2423	103	4.25	1	1
3 or 4 glasses of wine /beer	843	39	4.63	1.09 (0.75 to 1.59)	0.83 (0.54 to 1.27)
≥5 glasses of wine/beer or ≥3 glasses of spirits	271	17	6.27	1.51 (0.89 to 2.56)	1.17 (0.64 to 2.12)
Carrying loads (assessed in 2007)					
No	2995	131	4.37	1	
Yes	151	11	7.28	1.72 (0.91 to 3.25)	
Climbing stairs (assessed in 2007)					
No	3024	137	4.53	1	
Yes	116	6	5.17	1.15 (0.50 to 2.66)	
Manipulating vibrating tools (assessed in 2007)					
No	3163	142	4.49	1	1
Yes	4	2	50.0	*21.28 (2.98 to 152.19)*	*17.17 (2.35 to 125.62)*
Carrying loads (assessed in 1989)					
No	3433	153	4.46	1	
Yes	137	7	5.11	1.15 (0.53 to 2.51)	
Manipulating vibrating tools (assessed in 1989)					
No	3555	159	4.47	1	
Yes	15	1	6.67	1.53 (0.20 to 11.67)	
Computer work (assessed in 1989)					
No	885	39	4.41	1	
Yes	2685	121	4.51	1.02 (0.71 to 1.48)	

Data in italics: p<0.05.
*Model included all variables shown.
†Age as continuous variable and OR associated with an increase of one unit.
‡Maximum consumption reached.

Table 4 Univariate and multivariate analyses of Dupuytren's disease (without limitations or surgery, with limitations or surgery, compared with reference class: no Dupuytren's disease) and available factors assessed in the previous period in women

		Dupuytren's disease without limitations or surgery				Dupuytren's disease with limitations or surgery			
	N (total)	n	Per cent	OR (univariate analyses, 95% CI)	OR (multivariate analysis logistic model, 95% CI)*	n	Per cent	OR (univariate analyses, 95% CI)	OR (multivariate analysis logistic model, 95% CI)*
Age†	3570	82	2.30	1.04 (0.98 to 1.09)	1.04 (0.98 to 1.10)	78	2.18	*1.06 (1.01; 1.12)*	*1.07 (1.01 to 1.13)*
Diabetes									
No	3252	75	2.31	1	1	65	2.00	1	1
Yes	318	7	2.20	0.97 (0.45; 2.13)	1.18 (0.53 to 2.61)	13	4.09	*2.09 (1.14 to 3.83)*	*2.27 (1.22 to 4.24)*
Smoking habits (pack/day)‡									
Non-smoker (or former smoker)	2626	62	2.36	1	1	53	2.02	1	1
Smoker <1	711	16	2.25	0.96 (0.55 to 1.67)	0.99 (0.54 to 1.82)	18	2.53	1.26 (0.73 to 2.16)	1.36 (0.76 to 2.41)
Smoker ≥1	187	3	1.60	0.68 (0.21 to 2.19)	0.78 (0.24 to 2.55)	5	2.67	1.32 (0.52 to 3.35)	1.15 (0.41 to 3.27)
Drinking habits (glass/day)‡									
<3	2423	51	2.10	1	1	52	2.15	1	1
3 or 4 glasses of wine/beer	843	23	2.73	1.30 (0.79 to 2.14)	1.06 (0.60 to 1.87)	16	1.90	0.89 (0.50 to 1.56)	0.63 (0.33 to 1.20)
≥5 glasses of wine/beer or ≥3 glasses of spirits	271	8	2.95	1.43 (0.67 to 3.05)	1.30 (0.57 to 3.00)	9	3.32	1.58 (0.77 to 3.25)	1.04 (0.46 to 2.39)
Climbing stairs (assessed in 2007)									
No	3024	69	2.28	1		68	2.25	1	
Yes	116	2	1.72	0.76 (0.18 to 3.14)		4	3.45	1.54 (0.55 to 4.31)	
Manipulating vibrating tools (assessed in 2007)									
No	3163	70	2.21	1	1	72	2.28	1	1
Yes	4	1	25.00	*21.57 (1.93 to 240.79)*	*18.69 (1.61 to 216.66)*	1	25.00	*21.00 (1.88 to 234.10)*	*15.87 (1.36 to 184.70)*
Carrying loads (assessed in 1989)									
No	3433	78	2.27	1		75	2.18	1	
Yes	137	4	2.92	1.29 (0.47 to 3.59)		3	2.19	1.01 (0.31 to 3.24)	
Manipulating vibrating tools (assessed in 1989)									
No	3555	81	2.28	1		78	2.19	1	
Yes	15	1	6.67	2.99 (0.39 to 23.05)		0	0.00	0.00 (0.00; Not calculable)	
Computer work (assessed in 1989)									
No	885	20	2.26	1		19	2.15	1	
Yes	2685	62	2.31	1.02 (0.61 to 1.70)		59	2.20	1.02 (0.61 to 1.73)	

Data in italics: p<0.05.
*Model included all variables shown.
†Age as continuous variable and OR associated with an increase of one unit.
‡Maximum consumption reached.

genetic factors, such as family history of Dupuytren's disease, hand trauma, epilepsy and anticonvulsant drug intake, that are considered to be associated with Dupuytren's disease, was not available. However, an association between these factors and vibration exposure and alcohol intake seems unlikely.

One of the strengths of our study is the relatively large size of the cohort. Since we had only one measure of Dupuytren's disease in 2012, that is, the number of reported cases of Dupuytren's disease, we studied factors associated with prevalent cases. However, assessment of work exposure 5 years before evaluation of the outcome, and the regular evaluation of alcohol intake and smoking throughout the follow-up period enabled us to be confident about the associations observed. Those were confirmed by information collected at inception, that is, 23 years before.

One important finding was confirmation in a large study of the association between alcohol consumption and Dupuytren's disease among men, with a dose-response relationship.[11 13 16] Although we might discuss the arbitrary cut-off,[17] the association with reported limitations (or surgery) was a new finding because it has been described by clinicians before, but rarely reported in large cohort studies.[1 18 19] Diabetes seemed to be related to the occurrence of Dupuytren's disease but not with limitations in men. Interestingly, it was associated with limitations in women. Ever smoking and heavy smoking were not found to be associated with Dupuytren's disease, which was unexpected considering the possible ischaemic aetiology of Dupuytren's disease, and the contrary findings in some recent studies.[11 16] Absence of a relationship could be due to the small number of very heavy smokers (61 men and 26 women smoked 2 packs/day or more).

In terms of occupational exposure, only vibration was found to be related to Dupuytren's disease. Previous studies have shown that high cumulative occupational exposure to vibration (intensity x duration) was associated with Dupuytren's disease.[13 20–23] Although exposure to vibration during the working life was self-reported, it corresponded to a very specific exposure, probably with a low memory effect (workers tend to remember correctly this type of precise exposure). Hand-vibration transmitting tools in our cohort were mostly screw tools, common drills and (infrequently) pneumatic drills, where strenuous hand grip increases vibration damage. The role of high levels of vibration exposure is plausible, especially as a result of the local hypoxia and chronic ischaemia hypothesised in Dupuytren's contracture.[4] Similar figures for the strength of the association found in published studies support the plausibility of a possible causal relationship.[7] Carrying loads was studied because, with some tasks, such exposure is associated with manual work, and heavy forceful exposure during the working life was not available in the GAZEL cohort. However, no relationship was found here.

In addition to the well-established genetic factors, and despite the limitations discussed, this study emphasised the role of occupational hand-transmitted vibration exposure and alcohol consumption in Dupuytren's disease. The question of compensation in some cases with documented high levels of exposure should be reviewed, as should improvements of working conditions with a view to prevention.

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