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Awareness About Dental Amalgam Among Turkish Dentists and Patients: A Questionnaire and Search Engine Based Cross-Sectional Study

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ABSTRACT

Objectives: There has been considerable controversy concerning the health risks and benefits of using mercury-containing amalgam. This study aimed to evaluate the Turkish dentists' and patients' preference and opinion about amalgam and to assess Internet search trends about amalgam.

Methods: The study consists of three stages. The first two stages of the study are cross-sectional studies to verify both the patients' perception with amalgam restorations and dentists' attitudes regarding the use of dental amalgam. The third stage of the study evaluated the Internet search trends of Turkish people about mercury and amalgam related concerns between 2004 and 2018.

Results: A total of 320 patients (180 female, 140 male) and 1,211 dentists (533 female, 678 male) participated in this study. Majority of the patients have no idea about the type of dental restorations and effect of dental materials on their health. 188 (58.8%) participants stated that they would not prefer amalgam restoration in their teeth as amalgam is unaesthetic. A total of 24% (291) of the dentists used amalgam routinely; 9.5% (156) of them used amalgam rarely, and 63.1% (764) did not use amalgam at all. The reason for not using amalgam included the patients' desire and unaesthetic properties. According to the Internet search trends, Turkish people do not know as much about amalgam as people in the rest of the world.

Conclusion: Awareness about dental amalgam is low among patients studied. Although dentists do not use dental amalgam frequently, they disagree on banning dental amalgam.

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Introduction

Dental amalgam has been used in clinical practice for over 150 years and contains mercury, copper, silver, tin and zinc. As a restorative material, amalgam is an inexpensive and effective material for many dental conditions, and it can withstand some moisture during placement and setting¹. The biocompatibility and durability of amalgam are rated from good to excellent in stress-bearing restorations; however, amalgam has poor esthetic properties because of its silver component². Of late, significant controversy has arisen

regarding the use of amalgam³. The concern regarding the toxicity of amalgam arises from the fact that amalgam contains 50% mercury, which presents occupational hazards to dental practitioners and staff who provide amalgam restorations⁴. Furthermore, elemental mercury vapor can be released from amalgam restorations during chewing⁵. However, the advent of predosed amalgam capsules has decreased mercury content and the risk of contamination⁶. It may also raise issues for government policy makers with regard to mercury's impact on the environment. The use of amalgam-free alternative restorative materials has also been advocated for by individuals opposed to the use of amalgam-containing products and by amalgam-free product manufacturers⁷.

In 2013, the Minamata Convention emphasised that mercury contamination is dangerous for the environment and

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public health. Despite the widespread use and benefits of amalgam fillings, there are ongoing efforts to reduce the production and use of mercury-containing products worldwide because of concerns about the human health risk, environmental damage and waste management⁸. Adhesive materials have been continuously replacing amalgam restorations because of its conservative approach, aesthetic, biocompatibility and comparable success rates. However, amalgam is still preferred by many dentists because of its economic advantages and certain indications in high caries risk populations⁹. Because the use of amalgam is a worldwide controversy, researchers have investigated the opinions of targeted populations³. Faraj et al.¹⁰ conducted a survey study and found that 33% of dentists thought that dental amalgam was not safe for dentists and patients, and 57.8% of dentists frequently use dental amalgam in the posterior teeth. In some countries, patients required the replacement of their amalgam fillings^{11,12}. Overall, the amalgam controversy has caused dentists around the world to react in various ways¹³. Amalgam is no longer the first choice for dental restorations among instructors, students or patients¹⁴. In parallel with the controversy regarding the use of amalgam, factors such as the importance of preserving healthy tooth structure during removal of caries¹⁵, novel restorative materials¹⁶ and the desire for more esthetic restorations¹⁷ have led to changes in dentist and patient preferences for amalgam-free restorative materials.

As the Internet has become a popular source of information, approximately 60% of adults have made Internet searches for healthcare information. Search engines provide web-based information quickly and efficiently¹⁸. The Google search engine is the most commonly used search engine; Google Trends is a free service that provides trend data regarding the number and geographic origin of searches for particular keywords. The service facilitates the analysis of a cross section of Google web searches; thus, the number of searches for particular terms in a given period can be computed relative to the total number of Google searches made in the same period¹⁹. The aim of this three-step study was to evaluate the preferences and opinions of Turkish dentists and patients regarding dental amalgam and assess the trends in Turkish Internet searches about amalgam.

Methods

This study was approved by the Baskent University Institutional Review Board (project D-KA18/30) and conducted between December 2018 and May 2019. The study consisted of three stages. The first two stages of the study were cross-sectional studies to identify both patient perception and the attitude of dentists toward the use of dental amalgam. The third stage of the study evaluated the trends of Turkish Internet searches for amalgam-related concerns between 2004 and 2018.

Patient perception of amalgam restorations

A Turkish-language questionnaire was developed to solicit the opinions of patients about dental restorative materials.

Patients who were referred to the Baskent University Department of Restorative Dentistry from January 2019 to May 2019 were asked to complete the questionnaire. The first four questions asked about the socio-demographic characteristics of the patients. They were asked whether they had any previous knowledge about the type and/or composition of the restorative materials in their mouth. Their opinions on the effects of amalgam and tooth-colored restoratives on their well-being were also requested. The next two questions asked patients whether or not they preferred amalgam as a restorative material and the reason for their preference. Patients were also asked about their awareness of the amalgam controversy. If so, they were asked about their sources of information for this debate. Finally, patients were asked whether the replacement of clinically satisfactory amalgam restorations should be required.

Dentist attitudes toward the use of dental amalgam

The second part of this study investigated the opinions of dentists working in Turkey. A Turkish-language questionnaire was developed and validated on a preliminary group of dentists. Any issues with the meaning or flow of the questionnaire were addressed before developing the final questionnaire. Online surveys were sent to all dentists with e-mail addresses registered at the Turkish Dentists Association (TDB). A reminder e-mail was sent 15 days later. The questionnaire did not include any information that could lead to the identification of any participant.

The first four questions of the questionnaire requested the socio-demographic information and educational status of the dentist. The next two questions inquired about the amount and timing (graduate or postgraduate) of their posterior resin composite education. Following this, two questions inquired about the frequency of, and indications for, amalgam restoration use in their clinical practice. The dentists were also asked about the reasons for avoiding amalgam usage as well as where and how they follow the concerns and debate about amalgam usage. The dentists' opinions about the hazards of amalgam were also requested, with regard to both patients and themselves (as an occupational risk factor). The last question inquired about their opinions on abandoning amalgam usage.

Internet search trends of amalgam-related concerns

The third part of this study examined Internet search trends. 'Amalgam' was a popular search term around the world and in Turkey between January 2004 and December 2018. The spelling of amalgam in all languages is the same. Data were retrieved as comma-separated value (CSV) files from the open source Google Trends page.

Statistical analysis

The responses of the participants were recorded electronically in Statistical Package for the Social Sciences (SPSS) for Windows version 22.0 (SPSS Inc., Chicago, IL). The data were analysed using chi-square tests to compare the differences in distribution between groups. *P* values of <0.05 were considered statistically significant.

Table 1 – Patient knowledge and attitude with respect to demographic variables

	Gender		Age ^{*,§}							Education status														
	Female (n = 180) (%)/(n)	Male (n = 140) (%)/(n)	15–20 (n = 24) (%)/(n)	21–30 (n = 83) (%)/(n)	31–40 (n = 83) (%)/(n)	41–50 (n = 61) (%)/(n)	50 and over (n = 69) (%)/(n)	Primary school graduate (n = 11) (%)/(n)	Middle school graduate (n = 13) (%)/(n)	High school graduate (n = 57) (%)/(n)	University graduate (n = 164) (%)/(n)	Postgraduate/ doctorate (n = 75) (%)/(n)												
Frequency of visit to dentist																								
Once in 6 months (17.2%)	61.8	34	38.2	21	7.3	4	49.1	27	21.8	12	12.7	7	9.1	5	1.8	1	1.8	1	14.5	8	56.4	31	25.5	14
Once in a year (30.3%)	59.8	58	40.2	39	4.1	4	17.5	17	25.8	25	24.7	24	27.8	27	4.1	4	4.1	4	11.3	11	49.5	48	30.9	30
Every few years (19.7)	47.6	30	52.4	33	1.6	1	23.8	15	23.8	15	25.4	16	25.4	16	1.6	1	4.8	3	20.6	13	55.6	35	17.5	11
Never goes unless there is no problem (32.8%)*	54.8	58	45.2	47	14.4	15	23.1	24	29.8	31	13.5	14	19.2	21	4.8	5	4.8	5	24	25	47.1	50	19.2	20
Knowledge about dental fillings																								
Yes (33.1%)	60.4	64	9.6	2	2.8	3	25.5	7	26.4	28	18.9	20	26.4	28	2.8	3	3.8	4	15.1	16	9.1	52	29.2	31
No (66.9%)	54.2	116	45.8	98	9.8	21	26.2	56	25.7	55	19.2	41	19.2	41	3.7	8	4.2	9	19.2	41	52.3	112	20.6	44
Knowledge about the type of fillings in their mouth																								
Yes (35%)	61.6	69	38.4	43	2.7	3	25.9	29	25	28	20.5	23	25.9	29	1.8	2	1.8	2	13.4	15	52.7	59	30.4	34
No (65%)	53.4	111	46.6	97	10.1	21	26	54	26.4	55	18.3	38	19.2	40	4.3	9	5.3	11	20.2	42	50.5	105	19.7	41
Opinion about amalgam safety																								
Unsafe (27.5%)	65.9	58	34.1	30	2.3	2	25	22	18.2	16	19.3	17	35.2	31	2.3	2	2.3	2	4.8	13	52.3	46	28.4	25
Safe (13.8%)	52.3	23	47.7	21	4.5	2	27.3	12	29.5	13	25	11	13.6	6	6.8	3	4.5	2	15.9	7	50	22	22.7	10
No benefit or harm (10%)	59.4	19	40.6	13	9.4	3	25	8	25	8	28.1	9	12.5	4	0	0	0	0	28.1	9	43.8	14	28.1	9
No idea (48.8%) [§]	51.3	80	48.7	76	10.9	17	26.3	41	29.5	46	15.4	24	17.9	28	3.8	6	5.8	9	17.9	28	52.6	82	19.9	31
Opinion about composite safety																								
Unsafe (0.9%)	66.7	2	33.3	1	33.3	1	0	0	33.3	1	0	0	33.3	1	0	0	0	0	0	0	100	3	0	0
Safe (32.8%)	58.1	61	41.9	442	6.7	7	26.7	28	21.9	23	21.9	23	22.9	24	1.9	2	2.9	3	14.3	15	48.6	51	32.4	34
No benefit or harm (17.8%)	63.2	36	36.8	1	7	4	26.3	15	26.3	15	19.3	11	21.1	12	3.5	2	0	0	29.8	17	42.1	24	24.6	14
No idea (48.4%)	52.3	81	47.7	74	7.7	12	25.8	40	28.4	44	17.4	27	20.6	32	4.5	7	6.5	10	16.1	25	55.5	86	17.4	27

Similar letters indicate statistical difference.

* P < 0.001.

§ P < 0.05.

Table 2 – Patient knowledge and preference about dental amalgam

Would you prefer amalgam filling on your teeth? (n = 320)	Yes, only on my nonvisible teeth 16.9%	Yes, in any tooth 2.5%	No 58.8%	No idea 21.9%
			If no, what is your reason? Not esthetic (29.4%) Harmful for health (16.9%) Other (1.3%)	
Do you know that dental amalgam contains mercury? (n = 320)	Yes 45.3%	No 54.7%		
Would you like to replace the amalgam fillings in your mouth that you use without any problem? (n = 320)	Yes 32.8%	No 30.3%	No idea 36.6%	

Results

Results of the patient survey

A total of 320 patients (56.3% female [$n = 180$]; 43.8% male [$n = 140$]) participated in the study. There were 11 (3.4%), 13 (4.1%) and 57 (17.8%) respondents with primary, secondary and high school level education, respectively. The majority of the respondents ($n = 164$; 51.2%) were university graduates and 75 (23.4%) had post-graduate or doctoral degrees. The distribution of patients according to the frequency of visits to a dentist was as follows: 55 (17.2%) patients visited a dentist once in a 6-month period, 97 (30.3%) patients visited a dentist once in a year, 63 (19.7%) patients visited a dentist once every few years and 105 (32.8%) patients never visited a dentist unless it was required.

Table 1 summarises the patient information with regard to frequency of dental visits, knowledge and attitude about amalgam and socio-demographic features. The majority of patients had no knowledge about dental restorations ($n = 214$; 66.9%) or the type of restorative material in their mouth ($n = 208$; 65%). There was a statistically significant difference between patient age and opinion about the safety of amalgam ($P < 0.05$). In addition, patients had no knowledge about the effect of amalgam ($n = 156$; 48.8%) or tooth-colored restorations ($n = 155$; 48.4%) on their health. A total of 35.2% ($n = 31$) of subjects 50 years and older stated that dental amalgam is unsafe. Overall, 88 (27.5%) respondents thought that amalgam fillings could cause health problems and 105 (32.8%) respondents stated that tooth-colored restorations did not pose health risks.

There was a statistically significant difference between age and frequency of dentist visits ($P < 0.001$). Patients between the ages of 21 and 30 visited the dentist more frequently. Most of the participants ($n = 105$; 32.8%) stated that they preferred to not visit the dentist unless they had a problem. Although there was no statically significant difference between educational status and knowledge of amalgam safety, only 3 (0.09%) participants (university graduates) stated that dental composite is unsafe. Table 2 summarises the patients' knowledge and preferences regarding dental amalgam. 188 (58.8%) participants stated that they would prefer not to have amalgam restorations in

their teeth as it is unaesthetic ($n = 94$; 29.4%) and harmful to their health ($n = 54$; 16.9%). 145 (45.3%) participants stated that they were aware of the presence of mercury in dental amalgam. 105 (32.8%) participants stated that they would demand replacement of amalgam restorations even though they were satisfactory.

Results of the dentist survey

A total of 1,211 (56% male [$n = 678$]; 44% female [$n = 533$]) dentists participated in this study. Table 3 shows the usage of, and opinions about, dental amalgam with respect to the gender, sector, experience and title of dentists. Most respondents were in private practice ($n = 1,065$; 87.9%) and were general practitioners ($n = 990$; 81.8%). The distribution according to experience was as follows: 0–5 years ($n = 370$; 30.6%), 6–10 years ($n = 162$; 13.4%), 11–20 years ($n = 242$; 20%), 21–30 years ($n = 221$; 18.2%) and 31 years or more ($n = 216$; 17.8%).

A total of 24% ($n = 291$) of the participants used amalgam routinely and 9.5% ($n = 156$) of them used it rarely. Amalgam was not used by 63.1% ($n = 764$) of respondents (Table 3). The reasons for not using amalgam were patient requests (43%), poor esthetics (30%), mercury content (17%) and lack of indications (7%; Table 4). A total of 33.5% of the participants usually used amalgam in large restorations (35%) or in patients with poor oral hygiene (34%), followed by simple restorations (11%), use as a core material (7%) and use as a build-up material (4%; Table 4). Most of the respondents ($n = 456$; 37.7%) stated that dental amalgam was safe for both the practitioner and the patient. In contrast, 22.4% ($n = 271$) of the respondents indicated that amalgam was unsafe for both the practitioner and the patient. Amalgam was viewed as unsafe for either the practitioner or the patient by 23.1% ($n = 280$) of participants. Finally, 16.8% ($n = 204$) of participants were uncertain about the safety of the amalgam (Table 3).

There was a statistically significant difference between gender and amalgam usage ($P < 0.001$). Although most of the practitioners indicated that they did not use amalgam routinely, male dentists used amalgam more frequently than female dentists. Furthermore, there was a statistically significant difference in the perception of the safety of amalgam between genders ($P < 0.001$): male dentists ($n = 296$; 43.7%)

Table 3 – Dentists’ usage and opinion about dental amalgam with respect to gender, sector, experience and title

	Gender		Sector				Experience						Title											
	Female (n = 533)		Male (n = 678)		Private (n = 1,065)		Public (n = 146)		0–5 years (n = 370)		6–10 years (n = 162)		11–20 years (n = 242)		21–30 years (n = 221)		31 years and over (n = 216)		General Dentist (n = 990)		Specialist (n = 106)		Doctor (n = 115)	
	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Routine usage of amalgam																								
Yes (24%)	31.6	92	68.4	199	77	224	23	67	23.7	69	10	29	18.2	53	16.8	49	31.3	91	86.6	252	5.8	17	7.6	22
No (63.1%)	48.7	372	51.3	392	93.1	711	6.9	53	34.2	261	15.1	115	21.5	164	17.9	137	11.4	87	79.2	695	9.9	76	10.9	83
Rarely (12.9%)	44.2	69	55.8	87	83.3	130	16.7	26	25.6	40	11.5	18	16	25	22.4	35	24.4	38	85.3	133	8.3	13	6.4	10
Evaluation of dental amalgam in terms of general health																								
Safe for practitioner and patient (37.7%)	35.1	160	64.9	296	88.4	403	11.6	53	29.2	133	12.5	57	20.4	93	14.5	66	23.5	107	81.6	372	9.2	42	9.2	42
Not safe for practitioner and patient (22.4%)	49.8	135	50.2	136	93.7	254	6.3	17	26.6	72	14.4	39	24.4	66	21.4	58	13.3	36	81.2	220	8.9	24	10	27
Safe for patient, not safe for practitioner (21%)	46.9	119	53.1	135	82.7	210	17.3	44	37	94	13	33	13	33	19.7	50	17.3	44	85.8	218	3.9	10	10.2	26
Safe for practitioner, not safe for patient (2.1%)	30.8	8	69.2	18	92.3	24	7.7	2	23.1	6	19.2	5	30.8	8	23.1	6	3.8	1	76.9	20	15.4	4	7.7	2
Uncertain (16.8%)	54.4	111	45.6	93	85.3	174	14.7	30	31.9	65	13.7	28	20.6	42	20.1	41	13.7	28	78.4	160	12.7	26	8.8	18
Ban dental amalgam																								
Positive (26.7%)	41.2	133	58.8	190	96	310	4	13	26	84	15.2	49	23.5	76	22.3	72	13	42	80.2	259	9.3	30	10.5	34
Negative (66.1%)	44.2	354	55.8	447	85	681	15	120	32.1	257	12.5	100	18.9	151	16.5	132	20.1	161	82.4	660	8	64	9.6	77
No idea (7.2%)	52.9	46	47.1	41	85.1	74	14.9	13	33.3	29	14.9	13	17.2	15	19.5	17	14.9	13	81.6	71	13.8	12	4.6	4

Comparisons are made in a vertical column/horizontal row. There are statistically significant differences when compared ‘routine usage of amalgam with ‘gender’, ‘routine usage of amalgam’ with ‘sector’, ‘routine usage of amalgam’ with ‘experience’, ‘evaluation of dental amalgam in terms of general health’ with ‘gender’ and ‘ban dental amalgam’ with ‘sector’ ($P < 0.001$). Also, statistically differences are occurred when compared ‘evaluation of dental amalgam in terms of general health’ with ‘sector’, ‘evaluation of dental amalgam in terms of general health’ with ‘experience’ and ‘ban dental amalgam’ with ‘experience’ ($P < 0.05$). There were no statistically significant differences based on the type of provider (“Title”).

Table 4 – Dentist usage and preference of dental amalgam

	Yes (24%)/Rarely (12.9%) (n = 447)	No (63.1%) (n = 764)
Do you use amalgam restorations routinely?	Indications Large restorations (35%) Patients with poor oral hygiene (34%) Simple restorations (11%) Other* (9%) Core material (7%) Build-up material (4%)	Reasons for not using Patients' request (43%) Non-esthetic (30%) Contains mercury (17%) No indications (7%) Other [§] (3%)

* In cavities under the gingival margin; in cases where adequate isolation is not achieved; pulp capped teeth, and apical resection.

[§] Induce fractures and cracks in teeth; not their expertise; require over-preparation; and composite/porcelain inlay-only choice.

Table 5 – Dentist and patient sources of information on the controversy about dental amalgam

	Dentists (%)	Patients (%)
How do you become aware of the controversy about dental amalgam?	Science publishing (40%) Internet/social media (30%) Social relations (15%) Printed media (10%) TV (5%)	Internet/social media (30%) Social relations (23%) TV (16%) Printed media (14%) Science publishing (13%) Other (4%)

stated that amalgam is safe for both practitioner and patient more frequently than female dentists ($n = 160$; 30%).

There was a statistically significant difference between sector and amalgam usage ($P < 0.001$). Practitioners involved in private sector do not use dental amalgam as routinely as public sector dentists. Additionally, private sector practitioners stated that dental amalgam is unsafe for both practitioner and patient more frequently than public sector practitioners ($P < 0.005$). There was also significant difference in opinion on banning the use of amalgam between sectors: 63.9% ($n = 681$) of private sector practitioners and 32.4% ($n = 120$) practitioners among public health participants do not agree with banning the use of amalgam.

Comparisons between awareness of the risks of dental amalgam and years of experience are shown in Table 3. Regardless of experience, dentists do not routinely use dental

amalgam; only those dentists with 31 years of experience or more stated that they used dental amalgam routinely. Approximately two-thirds of the participants disagreed with banning amalgam. Practitioners with 0–5 years or 31 years or more of experience preferred amalgam.

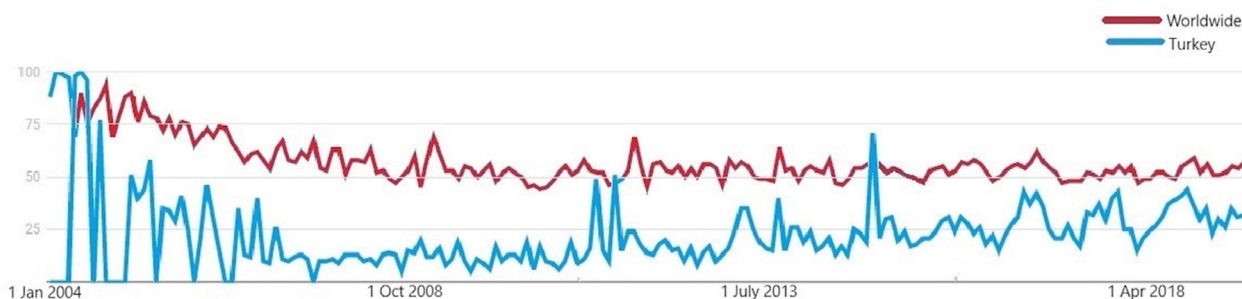
There were no significant differences between amalgam usage, amalgam safety or opinion on banning the use of amalgam and practitioner title. General dentists used dental amalgam more frequently than specialists, and 37.5% ($n = 372$) of the general dentists stated that dental amalgam is safe for both practitioner and patient. Although 66.6% ($n = 660$) of the general dentists disagreed with banning the use of dental amalgam, 26.1% ($n = 259$) of the general dentists agreed with banning amalgam.

Source of information about dental amalgam controversy

The sources of information about the amalgam controversy, as stated by both dentists and patients, are provided in Table 5. Of the dentists, 40% stated that they obtained information about amalgam through scientific publications. The Internet and social media were also a popular source of information (30%), followed by social relations (15%), printed media (10%) and television (5%). The majority of the patients (30%) stated that they obtained information from the Internet and social media, followed by social relations (23%), television (16%), printed media (14%) and scientific publications (13%).

Google trends data

In the third phase of the study, search trends were examined through Google Trends. The term 'amalgam' was searched around the world and in Turkey between January 2004 and December 2018. Figure 1 shows the timeline of the search popularity over the past 15 years. In this figure, the numbers show the search interest relative to the highest point on the graph for a given region and time period. A value of 100 means that the term has the highest popularity, a value of 50 means that the term is half as popular and a value of 0 means that there is insufficient data for the searched term. In 2004, searches for 'amalgam' were at their maximum level in Turkey; since then, 'amalgam' has lost its search popularity. In 2014, around 75% of the peak number of searches for 'amalgam' was made, which may be related to the Minamata Convention in 2013. The incidence of searches for 'amalgam' worldwide decreased gradually over time but has maintained more consistent popularity than in Turkey.

**Fig. 1 – Presentation of the term of 'amalgam' search trends by timeline**

Discussion

This study evaluated the awareness and attitudes of Turkish dentists and patients regarding dental amalgam fillings. The results demonstrated that patients were largely unaware of the nature of dental fillings. From the results for the dentists, it was found that although they do not prefer to use amalgam in their clinical practice, they disagree with banning it completely.

Every patient is unique and requires a custom treatment plan, which is influenced by several factors⁹. These factors include not only the patient's demands but also the dentist's professional background. Thus, this questionnaire- and Internet search-based research had two aims. To the authors' knowledge, this is the first study that evaluates both Turkish patient preferences and knowledge as well as dentist attitudes with regard to amalgam use in Turkey.

According to the results of the patients' questionnaires, 66.9% of respondents stated that they were unaware of the filling materials used in dentistry. Furthermore, 65% of respondents were unaware of the nature of the filling material in their mouth. This is similar to the results of previous work. Bamise et al.³ reported that 65% of surveyed Nigerian people did not know that amalgam contains mercury, and the majority of participants did not know the material of their own fillings. This implies that patients may not have been well informed about the dental materials used in their treatment. Similarly, in 2006, a poll of 2590 adults living in the United States revealed that 72% of the respondents were not aware that mercury is the main component of amalgam, and 92% of the respondents would have preferred to be told about the mercury³. Additionally, in the present study, 48.8% of respondents stated that they did not know about the safety risks of amalgam, although 27% of participants believed that dental amalgam was unsafe. Similar to this result, the study by Bamise et al.³ showed that 26% of participants believed that mercury could cause health problems in humans.

Among the studied group, esthetics was the major reason to prefer tooth-colored fillings over silver fillings. This result is similar to the study of Faraj et al.¹⁰; in that study, patients also preferred tooth-colored fillings over amalgam fillings for esthetic reasons. Only a small portion of the respondents in our study reported that they preferred amalgam fillings in any tooth. Burke and Crisp²⁰ reported that their surveyed patients rated the esthetic significance of the anterior and posterior teeth as 9.6 and 7.6 out of 10, respectively. Similarly, in our group, the esthetics of the posterior teeth was also important; one-third of the participants stated that they would prefer to replace the amalgam fillings, even if they did not have any problems. However, it has been previously noted that dentists must emphasise the potential risks of amalgam removal to patients³.

The results of the dentist questionnaire showed that the majority of the respondents do not use amalgam fillings routinely. This was mainly because of patient requests and poor esthetics, which supports the patient survey results. Likewise, amalgam was found to be unsafe for either the practitioner or the patient by 23.1% of the participants. However, the results also revealed that 33.5% of the dentists still use amalgam in

large restorations (35%) or in patients with poor oral hygiene (34%), followed by simple restorations (11%), use as a core material (7%) and use as a build-up material (4%). Similar to our study, 80.7% of dentists in a study by Alkhudhairy²¹ do not routinely use dental amalgam and stated their reasons as esthetic (77.1%) and patient requests (58.6%). Among participants, a significantly greater number of public sector dental practitioners used dental amalgam frequently compared to private sector practitioners. In this study, the number of public sector participants was less than private sector participants; however, those in the public sector used amalgam.

Most dental schools in the United States and Europe have focused on teaching composite restorations in pre-clinical courses and clinics^{22,23}. In this study by Al-Rabbah'ah et al.²⁴, it was shown that dentists with more than 15 years of experience were not trained in placing posterior composites. More experienced dentists use dental amalgam more frequently than recent dental graduates²¹. In contemporary operative dentistry curricula, composite-based adhesive materials have replaced amalgam restorations over time. In our study, only practitioners with 31 years of experience or more showed a tendency to use amalgam, because it was popular during their dental education. Dentists also prefer dental amalgam in patients with a high caries burden^{9,25}. In the Alkhudhairy study²¹, participants reported that they preferred using amalgam for large restorations followed by crown build-up. In the present study, dentists preferred using dental amalgam for large restorations (35%) and patients with poor oral hygiene (34%).

A study of Nordic dentists revealed that only a small number of participants were worried about the occupational risk of amalgam. Furthermore, in a study conducted by Pooja and Antony²⁶, general dentists often stated that amalgam was unsafe. In contrast, Alkhudhairy²¹ reported that most of the surveyed dentists and interns reported that dental amalgam is not an occupational risk factor. In a study conducted in Iraq¹⁰, 33% of the surveyed dentists stated that dental amalgam is not safe for the practitioner or the patient. In the present study, one-third of the participants reported that dental amalgam is safe for both practitioner and patient; approximately half of the respondents reported that dental amalgam is not safe for the practitioner and/or the patient.

Amalgam has long been a useful material that no other substance can currently replace²⁷, but there are some contradictory opinions on banishing amalgam between continents and countries. These contradictions are also seen in scientific publications. In Norway, amalgam usage was abandoned in 2008 and Norwegian dentists have since used only composite restorations²⁸. In contrast, Australian researchers determined that dentists are reluctant to abandon amalgam completely²⁹. The present study showed that the majority of the participants did not agree with banning dental amalgam as a restorative material. In the study conducted by Pooja and Antony²⁶, most participants stated that dental amalgam had longevity and mechanical properties and was more economical for patients than tooth-colored restorations. Dentists have been increasingly choosing composite and other esthetic materials for restorations in recent years, and very few dentists still prefer non-esthetic options in their own molar teeth³⁰.

Today, the Internet is widely used as a source of information for doctors and patients. Search engines are the most popular web pages, and their general purpose is to rank other pages by relevance and popularity. The Google search engine is one of the most popular search engines with over 3 billion daily searches. Trends in Internet search data represent a fast and inexpensive way to research trends in the dissemination of medical information³¹. The number of anti-amalgam websites is increasing¹⁰. According to the results of this study, the term 'amalgam' has maintained its popularity in Google searches for the last 15 years. In support of the findings of a previous study¹⁰, the Internet and social media were frequently used as a source of information by patients in this study.

The limitations of this study were the sampling methodology and the cross-sectional study design. Participants of this study were limited and may not represent all dentists and patients in Turkey. The targeted patients were those referred to the Restorative Dentistry Department without identifying the fillings in their mouths. The results could be affected by the presence of amalgam or tooth-colored fillings in their mouth. Furthermore, the patient sample size may not be sufficient to evaluate all Turkish centers. Future studies are required to reach more robust conclusions. Additionally, a web-based questionnaire was sent only to a limited group of dentists whose e-mail addresses were previously registered with the Turkish Dental Association. Finally, although the present study evaluated Google search trends to assess the opinions of a large group of people, some individuals do not use the Internet to search for specialised dental information.

In summary, this study concluded that patients were not aware of the nature of dental fillings. Generally, they prefer alternatives to dental amalgam for esthetic reasons. Furthermore, patients would prefer to replace their amalgam fillings, even without problems with the restorations. For the most part, dentists do not use dental amalgam routinely as per patients' requests. However, more experienced dentists prefer amalgam more than recent dental graduates. Finally, Turkish dentists disagreed about the banning of dental amalgam as a restorative material.

Conflicts of interest

The authors deny any conflicts of interest.

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