TURKISH JOURNAL of ORTHODONTICS

DOI: 10.5152/TurkJOrthod.2018.17036

ORIGINAL ARTICLE

Evaluation of the Compliance of Orthodontists to Infection Control Procedures in Turkey

Asuman Deniz Gümrü Çelikel[1], Hasan Ekmekçioğlu[2], Güven Külekçi[3], Sönmez Fıratlı[1]

[1]Department of Orthodontics, İstanbul University School of Dentistry, İstanbul, Turkey
[2]Department of Oral and Maxillofacial Surgery, İstanbul University School of Dentistry, İstanbul, Turkey
[3]Department of Microbiology, İstanbul University School of Dentistry, İstanbul, Turkey

ORCID IDs of the authors: A.D.G.Ç. 0000-0003-3450-6643; H.E. 0000-0001-9291-7331; G.K. 0000-0002-7391-1310; S.F. 0000-0003-1071-1255.

Cite this article as: Gümrü Çelikel AD, Ekmekçioğlu H, Külekçi G, Fıratlı S. Evaluation of the Compliance of the Orthodontists to Infection Control Procedures in Turkey. Turk J Orthod 2018; 31: 37-49.

ABSTRACT

Objective: Orthodontists do not perform surgical procedures, nevertheless they are obliged to practice appropriate sterilization techniques to prevent cross-infection. This is also important from an ethical and legal point of view. The aim of the present study is to evaluate the compliance of orthodontists to infection control procedures in Turkey.

Methods: A questionnaire with 36 items was delivered by e-mail to a total of 1152 orthodontists/residents between October 2014 and March 2015 by the Turkish Orthodontic Society. Various data from surveys were analyzed using the IBM SPSS statistics 22 software.

Results: The questionnaire was completed by 130 (11.28%) respondents. 95.4% of the orthodontists were immunized against hepatitis B. The usage rates of type B autoclave, non-type B autoclave, and dry-heat sterilizer were 40%, 17.7%, and 16.9%, respectively. A total of 24.6% of the orthodontists used disinfectant solutions for the sterilization of hand instruments and pliers; the rate of using disinfectants for the sterilization of dental handpieces was found to be higher (56.9%).

Conclusion: The infection control procedures in the field of orthodontics must be improved in Turkey. Training on compliance with the infection control principles should be included in education programs, and these programs should be repeated on a regular basis.

Keywords: Orthodontics, sterilization, disinfection, infection control procedure

INTRODUCTION

Infection control is crucial for orthodontists and for patient health. The concept of sterilization and disinfection was introduced into the dental practice with the recognition of hepatitis B as an occupational disease in 1975, and considerable steps have been taken in infection control procedures with increasing prevalence of human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) in the mid-1980s. Dental practitioners are exposed to various types of microorganisms. This exposure poses dental practitioners to the risk of developing infections from mild flu to more severe conditions such as HIV (AIDS), hepatitis B, and hepatitis C. Finally, all precautions must be taken, and sterilization and disinfection methods must be rigorously practiced assuming all patients in dental practice are potential carriers of an infectious disease (1-3).

Infection control procedures in dental practice have been published for the first time in 1978 by the American Dental Association. The Center for Disease Control and Prevention (CDC) later established and implemented the principles for the first time in 1986 and published the guidelines for infection control in 1988, 1989, 1993, and 2003, particularly dedicated to the dental practice (4-8).

Address for Correspondence: Asuman Deniz Gümrü Çelikel, Department of Orthodontics, İstanbul University School of Dentistry, İstanbul, Turkey
E-mail: denizgumru@hotmail.com

Received: 3 August 2017
Accepted: 13 October 2017
Available Online Date: 11 April 2018

All dental procedures carry the risk of direct or indirect cross-infection between the patients and dental care professionals. Current dental services have adopted "standard infection control" measures originally described in the Guidelines for Infection Control in Dental Health-Care Settings published in 2003 by the CDC, the steering organization setting the standards in healthcare services worldwide; the guidelines recognize saliva, in addition to blood, as a potential source of infection. According to the guidelines of the CDC published in 2003, all private practice and clinics must have a written infection control program and have designated an infection control coordinator; the employees must be informed and monitored, and the program must be updated on a regular basis (8-10).

In Turkey, the Turkish Dental Association (TDB) published a special edition for Infection Control in Dental Practice in 2000 (11). In 2007, the Istanbul Chamber of Dental Practitioners distributed an educational CD of Infection Control Directory in Dental Practice in March/April edition (9). Dental practice is a team work involving dental assistants, and the assistants are important components of this team and they play an important part in sterilization (12). Regarding the infection control, the Ministry of Labor and Social Security enacted the Occupational Health and Safety law, and further legal regulations on the patient and employee safety are underway (13, 14). However, training strategy for infection control in dental practice in Turkey does not put dental practitioners at the center of education starting from their education period in the faculty, but, indeed, dental practitioners are primarily responsible for the provision of dental health services (9).

Orthodontists usually do not perform comprehensive surgical procedures, but they are obliged to use appropriate sterilization techniques to prevent cross-infection in daily practice. This is also important from an ethical and legal point of view (15-18). However, the studies have found that orthodontists have lower compliance to the infection control procedures than dentists. The main reason for this is that they work on pediatric cases, they do not perform procedures in deep tissues, sterilization procedures result in the loss of time and money, and sterilization procedures cause corrosion in orthodontic pliers (19-21). There are many studies in the literature that studied the effects of sterilization on orthodontic archwires, pliers, brackets, bands, and elastic ligatures and evaluated infection control procedures to be followed in the practice of orthodontics and the compliance of orthodontists to these procedures (22-28). However, no comprehensive research evaluating the compliance of the Turkish orthodontists to the infection control procedures is available.

In the present study, we aimed to evaluate sterilization and disinfection methods employed in the practice of orthodontics in Turkey and the compliance of orthodontists to these methods.

METHODS

In the present study, a 36 items questionnaire (Appendix 1) was delivered to a total of 1152 orthodontists/residents affiliated to the Turkish Orthodontic Society (TOD) between October 3, 2014 and March 23, 2015 (29). Two deliveries were made using the resources of TOD and two deliveries personally by the authors. A total of 130 (11.28%) respondents completed the questionnaire.

The questionnaire inquired the following variables:

- Experience in practice,
- Place of work,
- Daily patient capacity,
- Number of dental assistant,
- Sterilization devices used,
- Whether or not regular control and maintenance of the sterilization devices are performed,
- The methods used in sterilization control,
- Sterilization status of the instruments and method of sterilization,
- Disposal of bands, brackets, and archwires removed from the patients,
- Whether they use recycled brackets/orthodontic materials,
- Disinfection status of the impressions and appliances delivered to the dental laboratory,
- Presence of written communication line with the dental laboratory,
- Place of sharp objects disposal container,
- Methods used for the cleaning of environmental surfaces at the clinic and type of gloves used,
- Use of protective masks and goggles during environmental cleaning,
- Hand washing practices before wearing and after removing gloves,
- Use of a separate protective mask in each patient,
- Use of protective goggles/face shield during treatment,
- Presence of written infection control program,
- Hepatitis B, influenza, and tetanus vaccination status.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences version 22.0 software (IBM Corp.; Armonk, NY, USA). Descriptive data were expressed in frequency. The chi-square, Fisher's exact, and Yates continuity correction tests were used to compare the qualitative data. A p value of <0.05 was considered statistically significant.

RESULTS

The responses of a total of 130 orthodontists and residents included in the present study were compared according to the experience in orthodontics, place of work, and daily number of examined patients (Table 1-5).

Table 1. Descriptive characteristics of the orthodontists/residents included in the study

		n	%
Experience in orthodontics	≤20 years	105	80.8
	>20 years	25	19.2
Place of work	Private office	32	24.6
	Private oral and dental health clinic	28	21.5
	University clinic	70	53.8
Daily patient volume	0-10	53	40.8
	10-20	50	38.5
	>20	27	20.8

Table 2. Percentage of orthodontists/residents who responded to questions regarding infection control procedure

		n	%
Written infection control program at your clinic	Yes	65	50
	No	65	50
A separated sterilization room	Yes	113	86.9
	No	17	13.1
Cleaning of the instruments to be sterilized	Manually with water	61	46.9
	Ultrasonic cleaner	31	23.8
	Washer disinfector	38	29.2
A separated instrument washing sink separate from the hand washing sink	Yes	107	82.3
	No	23	17.7
Sterilization devices used	Type B autoclave	52	40.0
	Non-type B autoclave	23	17.7
	Cassette autoclave	19	14.6
	Dry-heat sterilizer	22	16.9
	No response	14	10.8
Annual maintenance of sterilization devices	Yes	109	83.8
	No	21	16.2
Cleaning of water tank of the autoclave	Yes	102	78.5
	No	28	21.5
Packing of instruments to be sterilized in the autoclave	I do pack	115	88.5
	I do not pack	15	11.5
Autoclave sterilization control	I perform	77	59.2
	I do not perform	53	40.8
Supply of biological indicator spore test for the control of autoclave sterilization	I perform	58	44.6
	I do not perform	72	55.4
Regularly keeping and storing of sterilization records	Yes	67	51.5
	No	63	48.5
Methods used for the sterilization of dental handpieces	Wiping the outer surface with disinfectant solution	74	56.9
	In the autoclave	37	28.5
	Handpiece autoclave	19	14.6
Methods used for the sterilization of hand instruments/orthodontic pliers	Wiping with a disinfectant solution	32	24.6
	Autoclave	74	56.9
	Cassette autoclave	16	12.3
	Dry-heat sterilizer	8	6.2
Sterilization of molar bands after purchase	Yes	36	27.7
	No	94	72.3
Sterilization of molar bands after trial in the patient	Sitting in disinfectant	45	34.6
	Autoclave	69	53.1
	Cassette autoclave	9	6.9
	Dry-heat sterilizer	7	5.4
Disposal of the bands, brackets, and archwires removed from the patients during or after treatment	Waste basket	53	40.8
	Sharps bin	66	50.8
	Metal waste bin	11	8.5
Use of recycled brackets/orthodontic materials	Yes	25	19.2
	No	105	80.8
Disinfection status of impressions or appliances to be delivered to an outer laboratory	Yes	79	60.8
	No	51	39.2

Table 2. Percentage of orthodontists/residents who responded to questions regarding infection control procedure (Continued)

Written communication line with outer laboratory	Yes	93	71.5
	No	37	28.5
Knowledge of biofilm development in the dental unit water lines requiring cleaning	Yes	97	74.6
	No	33	25.4
Place of sharps bin	At the clinic	73	56.2
	At the sterilization room	57	43.8
Environmental surface cleaning	I disinfect	100	76.9
	I cover with dedicated cloths	30	23.1
Type of gloves used in instrument and environmental cleaning	I do not wear	6	4.6
	Kitchen-type gloves	24	18.5
	Examination gloves	100	76.9
Wearing protective mask and goggles during environmental cleaning/manual cleaning of instruments	Yes	64	49.2
	No	66	50.8
Hand washing before wearing gloves	Yes	74	56.9
	No	56	43.1
Hand washing after removing gloves	Yes	124	95.4
	No	3	4.6
Using a separate protective mask for each patient	Yes	41	31.5
	No	89	68.5
Wearing protective goggles/shields during treatment	Yes	63	48.5
	No	67	51.5
Hepatitis B vaccination status	Yes	124	95.4
	No	6	4.6
Influenza vaccination status	Yes	21	16.2
	No	109	83.8
Last tetanus vaccination	6-10 years	78	60.0
	10-20 years	20	15.4
	>20 years	32	24.6

Of the total respondents, 80.8% have an experience less than 20 years, and 19.2% have an experience more than 20 years in the field of orthodontics; 24.6% work in private offices, 21.5% work in private oral and dental health clinics, and 53.8% work in university clinics. In terms of daily patient capacity, 40.8% of the respondents have 0-10, 38.5% of them have 10-20, and 20.8% have over 20 patients (Table 1).

Percentage of orthodontists/residents who responded to questions regarding infection control procedure are shown in Table 2. The rates of using type B autoclave, non-type B autoclave, cassette autoclave, and dry-heat sterilizer were 40%, 17.7%, 14.6%, and 16.9%, respectively. The rate of packing instruments to be sterilized in the autoclave was 88.5%, autoclave sterilization control was 59.2%, and supplying biological indicator spore test for controlling of autoclave sterilization was 44.6%. The rate of wiping the outer surface of dental handpieces with disinfectant solution was 56.9%, and using autoclave for the sterilization of hand instruments/orthodontic pliers was 56.9%. Whereas the rate of sitting molar bands in disinfectant solution after trial in the patient was 34.6%, the rate of autoclave sterilization was 53.1%. The rates of using waste basket and sharps bin for the disposal of the bands, brackets, and archwires removed from the patients during or after treatment were 40.8% and 50.8%, respectively. Hepatitis B immunization rate was 95.4% (Table 2).

Percentage of orthodontists/residents who responded to questions regarding infection control procedure according to experience are shown in Table 3. The rate of biological indicator spore test supply for controlling autoclave sterilization of junior orthodontists with an experience of less than 20 years (50.5%) was significantly higher than senior orthodontists with an experience of more than 20 years (20%). The rate of using waste basket for the disposal of bands, brackets, and archwires removed from the patients during or at the end of the treatment of junior orthodontists (45.7%) was significantly higher than senior orthodontists (20%). The rate of using sharps bin of junior orthodontists (47.6%) was lower than senior orthodontists (64%); however, this difference was not statistically significant. The rate of washing hands before wearing gloves of junior orthodontists (51.4%) was significantly lower than senior orthodontists (80%). The rate of autoclave usage for the sterilization of dental handpieces was lower among junior orthodontists (26.7%) and senior orthodontists (36%). On the other hand, the rate of wiping the outer surface of dental handpieces with disinfectant solution was higher

Table 3. Percentage of orthodontists/residents who responded to questions regarding infection control procedures according to experience

		Experience		
		≤20 years	>20 years	
		n (%)	n (%)	p
Presence of dental assistant		93 (88.6%)	25 (100%)	0.121
Presence of a written infection control program at the clinic		52 (49.5%)	13 (52%)	1.000
Presence of a separated sterilization room		94 (89.5%)	19 (76%)	0.096
Cleaning of the instruments to be sterilized	Manually with water	48 (45.7%)	13 (52.0%)	0.856
	Ultrasonic cleaner	25 (23.8%)	6 (24.0%)	
	Washer disinfector	32 (30.5%)	6 (24%)	
Presence of a separated instrument washing sink separate from the hand washing sink		87 (82.9%)	20 (80%)	0.772
Sterilization devices used	Type B autoclave	45 (47.4%)	7 (33.3%)	0.305
	Non-type B autoclave	19 (20.0%)	4 (19.0%)	
	Cassette autoclave	16 (16.8%)	3 (14.3%)	
	Dry-heat sterilizer	15 (15.8%)	7 (33.3%)	
Annual maintenance of sterilization devices		87 (82.9%)	22 (88%)	0.763
Cleaning of water tank of the autoclave		82 (78.1%)	20 (80%)	1.000
Packing of instruments to be sterilized in the autoclave		93 (88.6%)	22 (88%)	1.000
Autoclave sterilization control		62 (59%)	15 (60%)	1.000
Supply of biological indicator spore test for the control of autoclave sterilization		53 (50.5%)	5 (20%)	0.011*
Regularly keeping and storing of sterilization records		58 (55.2%)	9 (36%)	0.132
Methods used for the sterilization of dental handpieces	Wiping the outer surface with disinfectant solution	60 (57.1%)	14 (56.0%)	0.461
	In the autoclave	28 (26.7%)	9 (36.0%)	
	Dedicated device (handpiece autoclave)	17 (16.2%)	2 (8.0%)	
Methods used for the sterilization of hand instruments/orthodontic pliers	Wiping with a disinfectant solution	23 (21.9%)	9 (36.0%)	0.138
	Autoclave	62 (59.0%)	12 (48.0%)	
	Cassette autoclave	15 (14.2%)	1 (4.0%)	
	Dry-heat sterilizer	5 (4.8%)	3 (12.0%)	
Sterilization of molar bands after purchase		26 (24.8%)	10 (40%)	0.200
Sterilization of molar bands after trial in the patient	Sitting in disinfectant solution	37 (35.2%)	8 (32.0%)	0.624
	Autoclave	57 (54.3%)	12 (48.0%)	
	Cassette autoclave	6 (5.7%)	3 (12.0%)	
	Dry-heat sterilizer	5 (4.8%)	2 (8.0%)	
Disposal of the bands, brackets, and archwires removed from the patients during or after treatment	Waste basket	48 (45.7%)	5 (20.0%)	0.040*
	Sharps bin	50 (47.6%)	16 (64.0%)	
	Metal waste bin	7 (6.7%)	4 (16.0%)	
Use of recycled brackets/orthodontic materials		19 (18.1%)	6 (24%)	0.573
Disinfection status of impressions or appliances to be delivered to an outer laboratory		67 (63.8%)	12 (48%)	0.220
Written communication line with outer laboratory		75 (71.4%)	18 (72%)	1.000
Knowledge of biofilm development in the dental unit water lines requiring cleaning		80 (76.2%)	17 (68%)	0.555
Place of sharps bin	At the clinic	59 (56.2%)	14 (56%)	1.000
	At the sterilization room	46 (43.8%)	11 (44%)	
Environmental surface cleaning	I disinfect	83 (79%)	17 (68%)	0.361
	I cover with dedicated cloths	22 (21%)	8 (32%)	

Table 3. Percentage of orthodontists/residents who responded to questions regarding infection control procedures according to experience (Continued)

Type of gloves used in instrument and environmental cleaning	Do not wear	5 (4.8%)	1 (4.0%)	0.966
	Kitchen-type gloves	19 (18.1%)	5 (20%)	
	Examination gloves	81 (77.1%)	19 (76%)	
Wearing protective mask and goggles during environmental cleaning/manual cleaning of instruments		49 (46.7%)	15 (60%)	0.329
Hand washing before wearing gloves		54 (51.4%)	20 (80%)	0.018*
Hand washing after removing gloves		100 (95.2%)	24 (96%)	1.000
Use of a separate protective mask for each patient		36 (34.3%)	5 (20%)	0.253
Wearing protective goggles/shields during treatment		50 (47.6%)	13 (52%)	0.864
Hepatitis B vaccination status		100 (95.2%)	24 (96%)	1.000
Influenza vaccination status		14 (13.3%)	7 (28%)	0.125
Last tetanus vaccination	6-10 years	67 (63.8%)	11 (44.0%)	0.116
	10-20 years	16 (15.2%)	4 (16.0%)	
	>20 years	22 (21.0%)	10 (40.0%)	

Chi-square, continuity (Yates) correction, and Fisher's exact tests were used, *p<0.05

Table 4. Percentage of orthodontists/residents who responded to questions regarding infection control procedures according to the place of work

		Place of work			
		Private office n (%)	**Private oral and dental health clinic n (%)**	**University clinic n (%)**	**p**
Presence of dental assistant		32 (100%)	27 (96.4%)	59 (84.3%)	0.020*
Presence of a written infection control program at the clinic		16 (50%)	13 (46.4%)	36 (51.4%)	0.905
Presence of a separated sterilization room		21 (65.6%)	24 (85.7%)	68 (97.1%)	0.001**
Cleaning of the instruments to be sterilized	Manually with water	19 (59.4%)	13 (46.4%)	29 (41.4%)	0.419
	Ultrasonic cleaner	6 (18.8%)	7 (25.0%)	18 (25.7%)	
	Washer disinfector	7 (21.8%)	8 (28.6%)	23 (32.9%)	
Presence of a separated instrument washing sink separate from the hand washing sink?		26 (81.3%)	24 (85.7%)	57 (81.4%)	0.867
Sterilization devices used	Type B autoclave	16 (53.3%)	16 (61.5%)	20 (33.3%)	0.007**
	Non-type B autoclave	4 (13.3%)	0 (0%)	19 (31.7%)	
	Cassette autoclave	2 (6.7%)	6 (23.1%)	11 (18.3%)	
	Dry-heat sterilizer	8 (26.7%)	4 (15.4%)	10 (16.7%)	
Annual maintenance of sterilization devices		20 (62.5%)	25 (89.3%)	64 (91.4%)	0.001**
Cleaning of water tank of the autoclave		25 (78.1%)	24 (85.7%)	53 (75.7%)	0.553
Packing of instruments to be sterilized in the autoclave		26 (81.3%)	28 (100%)	61 (87.1%)	0.067
Autoclave sterilization control		13 (40.6%)	16 (57.1%)	48 (68.6%)	0.028*
Supply of biological indicator spore test for the control of autoclave sterilization		4 (12.5%)	15 (53.6%)	39 (55.7%)	0.001**
Regularly keeping and storing of sterilization records		9 (28.1%)	13 (46.4%)	45 (64.3%)	0.003**
Methods used for the sterilization of dental handpieces	Wiping the outer surface with disinfectant solution	21 (65.6%)	12 (42.9%)	41 (58.6%)	0.050
	In the autoclave	11 (34.4%)	10 (35.7%)	16 (22.9%)	
	Dedicated device (handpiece autoclave)	0 (0%)	6 (21.4%)	13 (18.6%)	
Methods used for the sterilization of hand instruments/orthodontic pliers	Wiping with a disinfectant solution	11 (34.4%)	11 (39.3%)	10 (14.3%)	0.050
	Autoclave	17 (53.1%)	12 (42.9%)	45 (64.3%)	
	Cassette autoclave	2 (6.3%)	5 (17.9%)	9 (12.9%)	
	Dry-heat sterilizer	2 (6.3%)	0 (0%)	6 (8.6%)	

Table 4. Percentage of orthodontists/residents who responded to questions regarding infection control procedures according to the place of work (Continued)

Sterilization of molar bands after purchase		13 (40.6%)	5 (17.9%)	18 (25.7%)	0.125
Sterilization of molar bands after trial in the patient	Sitting in disinfectant solution	13 (40.6%)	8 (28.6%)	24 (34.3%)	0.254
	Autoclave	17 (53.1%)	14 (50.0%)	38 (54.3%)	
	Cassette autoclave	1 (3.1%)	5 (17.9%)	3 (4.3%)	
	Dry-heat sterilizer	1 (3.1%)	1 (3.6%)	5 (7.1%)	
Disposal of the bands, brackets, and archwires removed from the patients during or after treatment	Waste basket	9 (28.1%)	11 (39.3%)	33 (47.1%)	0.456
	Sharps bin	19 (59.4%)	15 (53.6%)	32 (45.7%)	
	Metal waste bin	4 (12.5%)	2 (7.1%)	5 (7.1%)	
Use of recycled brackets/orthodontic materials		6 (18.8%)	3 (10.7%)	16 (22.9%)	0.386
Disinfection status of casts or equipment to be delivered to an outer laboratory		16 (50%)	16 (57.1%)	47 (67.1%)	0.234
Written communication line with outer laboratory		25 (78.1%)	21 (75%)	47 (67.1%)	0.470
Knowledge of biofilm development in the dental unit water lines requiring cleaning		22 (68.8%)	20 (71.4%)	55 (78.6%)	0.520
Place of sharps bin	At the clinic	18 (56.3%)	17 (60.7%)	38 (54.3%)	0.845
	At the sterilization room	14 (43.8%)	11 (39.3%)	32 (45.7%)	
Environmental surface cleaning	I disinfect	26 (81.3%)	21 (75%)	53 (75.7%)	0.797
	I cover with dedicated cloths	6 (18.8%)	7 (25%)	17 (24.3%)	
Type of gloves used in instrument and environmental cleaning	Do not wear	1 (3.1%)	1 (3.6%)	4 (5.7%)	0.836
	Kitchen-type gloves	5 (15.6%)	7 (25%)	12 (17.1%)	
	Examination gloves	26 (81.3%)	20 (71.4%)	54 (77.1%)	
Wearing protective mask and goggles during environmental cleaning/manual cleaning of instruments		17 (53.1%)	16 (57.1%)	31 (44.3%)	0.454
Hand washing before wearing gloves		22 (68.8%)	14 (50%)	38 (54.3%)	0.276
Hand washing after removing gloves		32 (100%)	24 (85.7%)	68 (97.1%)	0.018*
Use of a separate protective mask for each patient		6 (18.8%)	9 (32.1%)	26 (37.1%)	0.178
Wearing protective goggles/shields during treatment		14 (43.8%)	15 (53.6%)	34 (48.6%)	0.749
Hepatitis B vaccination status		31 (96.9%)	28 (100%)	65 (92.9%)	0.282
Influenza vaccination status		6 (18.8%)	3 (10.7%)	12 (17.1%)	0.663
Last tetanus vaccination	6-10 years	15 (46.9%)	15 (53.6%)	48 (68.6%)	0.091
	10-20 years	4 (12.3%)	5 (17.9%)	11 (15.7%)	
	>20 years	13 (40.6%)	8 (28.6%)	11 (15.7%)	

Chi-square test was used, *p<0.05, **p<0.01

than autoclave usage in both junior orthodontists (57.1%) and senior orthodontists (56%). However, these differences were not statistically significant (Table 3).

Percentage of orthodontists/residents who responded to questions regarding infection control procedure according to place of work are shown in Table 4. The presence of dental assistant in private clinics (100%) was significantly higher than in university clinics (84.3%). The presence of a separated sterilization room at university clinics (97.1%) was significantly higher than other private centers. The rate of type B autoclave usage in private oral and dental health clinics (61.5%) was significantly higher than in university clinics (33.3%), and non-type B autoclave usage in university clinics (31.7%) was significantly higher than in private oral and dental health clinics (0%). The rate of annual maintenance of sterilization devices in private offices (62.5%) was significantly lower than in private oral and dental health clinics (89.3%) and university clinics (91.4%), and autoclave sterilization control in private offices (40.6%) was significantly lower than in university clinics (68.6%). The rate of supplying biological indicator spore test for controlling of autoclave sterilization in private offices (12.5%) was significantly lower than in private oral and dental health clinics (53.6%) and university clinics (55.7%). The rate of regularly keeping and storing sterilization records (28.1%) in private offices was significantly lower than in university clinics (64.3%). The rate of washing hands after removing gloves was significantly lower in private oral and dental health clinics (85.7%) than in private offices (100%) and university clinics (97.1%) (Table 4).

Percentage of orthodontists/residents who responded to questions regarding infection control procedure according to daily patient capacity are shown in Table 5. The rate of wearing protective mask and goggles during environmental cleaning/manual

Table 5. Percentage of orthodontists/residents who responded to questions regarding infection control procedures according to the daily volume of patient

		Daily patient volume			
		0-10	10-20	>20	
		n (%)	n (%)	n (%)	p
Presence of dental assistant		45 (84.9%)	47 (94%)	26 (96.3%)	0.151
Presence of a written infection control program at the clinic		31 (58.5%)	23 (46%)	11 (40.7%)	0.250
Presence of a separated sterilization room		44 (83%)	44 (88%)	25 (92.6%)	0.466
Cleaning of the instruments to be sterilized	Manually with water	28 (52.8%)	23 (46.0%)	10 (37.0%)	0.299
	Ultrasonic cleaner	15 (28.3%)	11 (22.0%)	5 (18.5%)	
	Washer disinfector	10 (18.9%)	16 (32.0%)	12 (44.5%)	
Presence of a separated instrument washing sink separate from the hand washing sink?		44 (83%)	40 (80%)	23 (85.2%)	0.837
Sterilization devices used	Type B autoclave	18 (39.1%)	20 (44.4%)	14 (56.0%)	0.636
	Non-type B autoclave	12 (26.1%)	7 (15.6%)	4 (16.0%)	
	Cassette autoclave	9 (19.6%)	7 (15.6%)	3 (12.0%)	
	Dry-heat sterilizer	7 (15.2%)	11 (24.4%)	4 (16.0%)	
Annual maintenance of sterilization devices		45 (84.9%)	39 (78%)	25 (92.6%)	0.243
Cleaning of water tank of the autoclave		38 (71.7%)	42 (84%)	22 (81.5%)	0.288
Packing of instruments to be sterilized in the autoclave		45 (84.9%)	43 (86%)	27 (100%)	0.107
Autoclave sterilization control		30 (56.6%)	31 (62%)	16 (59.3%)	0.856
Supply of biological indicator spore test for the control of autoclave sterilization		22 (41.5%)	26 (52%)	10 (37%)	0.379
Regularly keeping and storing of sterilization records		25 (47.2%)	27 (54%)	15 (55.6)	0.704
Methods used for the sterilization of dental handpieces	Wiping the outer surface with disinfectant solution	33 (62.3%)	26 (52.0%)	15 (55.6)	0.166
	In the autoclave	13 (24.5%)	19 (38.0%)	5 (18.5%)	
	Dedicated device (handpiece autoclave)	7 (13.2%)	5 (10%)	7 (25.9%)	
Methods used for the sterilization of hand instruments/ orthodontic pliers	Wiping with a disinfectant solution	13 (14.5%)	16 (32.0%)	3 (11.1%)	0.556
	Autoclave	29 (54.7%)	26 (52.0%)	19 (70.4%)	
	Cassette autoclave	7 (13.2%)	6 (12.0%)	3 (11.1%)	
	Dry-heat sterilizer	4 (7.5%)	2 (4.0%)	2 (7.4%)	
Sterilization of molar bands after purchase		10 (18.9%)	18 (36%)	8 (29.6%)	0.147
Sterilization of molar bands after trial in the patient	Sitting in disinfectant solution	21 (39.6%)	18 (36.0%)	6 (22.2%)	0.540
	Autoclave	26 (49.1%)	25 (50%)	18 (66.7%)	
	Cassette autoclave	2 (3.8%)	5 (10%)	2 (7.4%)	
	Dry-heat sterilizer	4 (7.5%)	2 (4.0%)	1 (3.7%)	
Disposal of the bands, brackets, and archwires removed from the patients during or after treatment	Waste basket	22 (41.5%)	22 (44.0%)	9 (33.3%)	0.782
	Sharps bin	28 (52.8%)	23 (46.0%)	15 (55.6)	
	Metal waste bin	3 (5.7%)	5 (10%)	3 (11.1%)	
Use of recycled brackets/orthodontic materials		11 (20.8%)	11 (22%)	3 (11.1%)	0.479
Disinfection status of impressions or appliances to be delivered to an outer laboratory		28 (52.8%)	32 (64%)	19 (70.4%)	0.264
Written communication line with outer laboratory		39 (73.6%)	35 (70%)	19 (70.4%)	0.912
Knowledge of biofilm development in the dental unit water lines requiring cleaning		38 (71.7%)	37 (74%)	22 (81.5%)	0.631
Place of sharps bin	At the clinic	32 (60.4%)	25 (50%)	16 (59.3%)	0.533
	At the sterilization room	21 (39.6%)	25 (50%)	11 (40.7%)	

Table 5. Percentage of orthodontists/residents who responded to questions regarding infection control procedures according to the daily volume of patien (Continued)

Environmental surface cleaning	I disinfect	43 (81.1%)	36 (72%)	21 (77.8%)	0.543
	I cover with dedicated cloths	10 (18.9%)	14 (28%)	6 (22.2%)	
Type of gloves used in instrument and environmental cleaning	Do not wear	2 (3.8%)	4 (8.0%)	0 (0%)	0.411
	Kitchen-type gloves	10 (18.9%)	7 (14%)	7 (25.9%)	
	Examination gloves	41 (77.4%)	39 (78%)	20 (74.1%)	
Wearing protective mask and goggles during environmental cleaning/manual cleaning of instruments		18 (34%)	28 (56%)	18 (66.7%)	0.011*
Hand washing before wearing gloves		29 (54.7%)	27 (54%)	18 (66.7%)	0.516
Hand washing after removing gloves		51 (96.2%)	49 (98%)	24 (88.9%)	0.178
Use of a separate protective mask for each patient		16 (30.2%)	18 (36%)	7 (25.9%)	0.638
Wearing protective goggles/shields during treatment		18 (34%)	26 (52%)	19 (70.4%)	0.007**
Hepatitis B vaccination status		50 (94.3%)	48 (96%)	26 (96.3%)	0.893
Influenza vaccination status		4 (7.5%)	9 (18%)	8 (29.6%)	0.036*
Last tetanus vaccination	6-10 years	30 (56.6%)	31 (62.0%)	17 (63.0%)	0.607
	10-20 years	11 (20.8%)	7 (14.0%)	2 (7.4%)	
	>20 years	12 (22.6%)	12 (24.0%)	8 (29.6%)	

Chi-square test was used, *p<0.05, **p<0.01

cleaning of instruments in facilities with a daily patient volume of 0-10 patients (34%) was significantly lower than in facilities with a daily patient volume of 10-20 patients (56%) and 20 patients and above (66.7%). The rate of wearing protective goggles/shields during treatment in facilities with a daily patient volume of 0-10 patients (34%) was significantly lower than in facilities with a daily patient volume of 20 patients and above (70.4%). The rate of influenza vaccination in facilities with a daily patient volume of 0-10 patients (7.5%) was significantly lower than in facilities with a daily patient volume of 20 patients and above (29.6%) (Table 5).

DISCUSSION

In the literature, many studies outside of Turkey relevant to the infection control procedures in dental practice were found. There are survey studies reported from Canada and the US that evaluated the compliance of orthodontists to the infection control procedures (22, 23, 30). There are, however, a few studies evaluating the compliance of orthodontists to the infection control procedures in Turkey. Various articles have been published regarding sterilization and disinfection practices in orthodontics, such as the study published in the special edition of TDB in 2000 and the reports published by Akçam (21) in 1999, Ozer (1) in 2005, and Aksoy et al. (31) in 2011 (11). The only study that evaluated the attitudes of orthodontists towards infection control and the procedures practiced by these orthodontists was performed by Saraç and Yalçın (32) in 1995.

The results of the present study were evaluated taking into account the experience, place of work, and daily patient capacity of the orthodontists/residents. The rate of dental assistant was higher in private offices (100%) and private oral and dental health clinics (96.4%), whereas this rate was lower in university clinics (84.3%), and the difference between these facilities that was caused by understaffing in university clinics was found to be statistically significant (Table 4). When the rate of dental assistant was evaluated according to the patient volume, the rate of dental assistant was 84.9% in facilities with a daily patient volume of 0-10, 94% in facilities with a daily patient volume of 10-20, and 96.3% in facilities with a daily patient volume more than 20 (Table 5). Although the difference was not statistically significant, work load increases with daily patient volume, and accordingly, number of dental assistant increases. In the practice of experienced orthodontists, number of dental assistant was found to be higher with increasing daily patient volume.

In a study published by Topcuoglu and Kulekci (33) in 2009, progress of the dental practitioners on infection control practices within a 2-year period was evaluated in Turkey. The autoclave usage rate increased from 39% to 62%, and dry-heat sterilizer usage rate decreased from 71% to 55% in a 2-year period. In the present study, some type of autoclave usage rate between 2014 and 2015 was 72.3%, and the dry-heat sterilizer usage rate was 16.9% (Table 2). There seems to be an improvement in autoclave usage over the years among dental practitioners and orthodontists. However, autoclave usage rate could not be compared between the two groups of orthodontists as there were no studies conducted in the same period on dental practitioners and orthodontists.

In a survey study on 110 orthodontists published by Saraç and Yalçın (32) in 1995, 32.3% of orthodontists were immunized against hepatitis B, autoclave usage rate was 9%, and dry-heat sterilizer usage rate was 14.5%. In the present study, 95.4% of orthodontists were immunized against hepatitis B, type B autoclave usage rate was 40%, non-type B autoclave usage rate was 17.7%, cassette autoclave usage rate was 14.6%, and dry-heat sterilizer usage rate was 16.9% (Table 2). In recent years, type B autoclave has been established as the most appropriate device

in dental practice as it possesses the highest vacuum system that is able to sterilize all types of loads; the instruments used in dental practice are mostly in type B hollow load class (30, 33, 34). In the present study, the rate of type B autoclave usage was 53.3% in private offices, 61.5% in private oral and dental health clinics, and 33.3% in university clinics. The usage rates for autoclaves other than type B and cassette autoclave were found to be lower (Table 4). The usage rate for type B autoclave was higher in private offices and private oral and dental health clinics, whereas previously purchased autoclaves other than type B were found to be used in university clinics. The usage rate for cassette autoclaves was lower than type B and non-type B autoclaves. The manufacturers recommend cassette autoclaves owing to rapid sterilization feature; however, cassette autoclaves are not suitable for orthodontic purposes (9, 34, 35). Dry-heat sterilizer performs sterilization at high temperature in prolonged duration. In addition, instruments removed from dry-heat sterilizer must be stored in ultraviolet cabinets. Otherwise, the instruments become contaminated (35). The usage rate for dry-heat sterilizer was found to be low (16.9%) in the present study (Table 2). Compared with the results of Saraç and Yalçın (32), positive but insufficient progress in the compliance to the infection control procedures observed in recent years can be attributed to the courses and training programs on the infection control. Training on infection control procedures in dental practice must be included in education program to be conducted on a regular basis, and these programs must be audited.

According to the study by McCarthy et al. (22) that evaluated 265 orthodontists and 5176 dental practitioners in 1997, 94% of the orthodontists and 92.3% of the dental practitioners were immunized against hepatitis B virus. In their study, 62.4% of the orthodontists and 81.5% of the dental practitioners reported that they changed their protective mask for each patient; the rate of using protective goggles was 88.7% in orthodontists and 96.4% in dental practitioners. The rate of hepatitis B vaccination was 95.4% among orthodontists/residents (Table 2), and this rate was consistent with the rates reported in the study by McCarthy et al. (22). In the present study, the rate of changing protective mask in each patient was 31.5%, and the rate of using protective goggles was 48.5% among orthodontists/residents (Table 2). These figures are considerably lower than those reported by McCarthy et al. (22).

According to the study by Davis et al. (23) that evaluated 140 orthodontists in 1998, the rate of using protective goggles was 95%, and the rate of washing hands after removing gloves was 99.2%. The rate of subjects washing hands after removing gloves was 95.4% (Table 2), and this rate was comparable with that reported in the study by Davis et al. (23). However, in our study, the rate of using protective goggles was considerably lower (48.5%) (Table 2).

The rates of subjects disinfecting pliers and hand instruments were 12%, 50%, and 21% in the studies by Davis (23), Cash (36), and Woo (37), respectively. In the studies by Davis (23) and Cash (36), the rates of using autoclave for the sterilization of hand instruments were 26% and 18%, respectively; the rates of using dry-heat sterilizer were 72% and 24%, whereas the rates of using autoclave for the sterilization of pliers were 14% and 11%, and the rates of using dry-heat sterilizer were 80% and 20%, respectively. In the present study, the rate of using disinfection for the sterilization of orthodontic pliers and hand instruments was 24.6%, the rate of using autoclave was 56.9%, and the rate of using dry-heat sterilizer was 6.2% (Table 2). According to the findings of the present study, autoclave was the most commonly preferred method, and dry-heat sterilizer was the least commonly preferred method for the sterilization of pliers and hand instruments. Lower autoclave usage rates in the studies by Davis (23) and Cash (36) are caused by temporal differences between the studies. In the US and other countries, infection control procedures in dental practice were established by the guidelines of the CDC published in 1993, which declared universal precautions against blood-borne pathogenic agents. This subject has attracted attention in Turkey for the first time in 2000s.

The rate of washing hands before wearing gloves was 56.9%, and the rate of washing hands after removing gloves was 95.4% in the present study (Table 2). The rate of washing hands before wearing gloves was significantly higher in senior orthodontists who had an experience of more than 20 years than in junior orthodontists who had an experience of lower than 20 years (Table 3). This difference highlights that the importance of hand washing practice in infection control was not sufficiently understood, and particularly, junior orthodontists do not pay strict attention to hand washing practice before wearing gloves.

When comparing protective goggles/shield usage rates, it was significantly lower in facilities with a daily patient volume of 0-10 patient than in facilities with a daily patient volume of more than 20 patients. Similarly, the rate of influenza vaccination was also significantly lower in facilities with a daily patient volume of 0-10 patients than in facilities with a daily patient volume of more than 20 patients. The rate of using protective mask and goggles during environmental cleaning was significantly lower in facilities with a daily patient volume of 0-10 patients than in facilities with a daily patient volume of 10-20 patients and 20 patients and above (Table 5). These findings suggest that the orthodontists attach more importance to infection control procedures with increasing daily patient volume, and in connection with this, they enhance protective measures.

In university clinics, while the rate of wiping hand instruments and orthodontic pliers with disinfectant solutions was lower, the rate of using autoclave sterilization was relatively higher than in private offices and private oral and dental health clinics. The rate of using dry-heat sterilizer was quite lower in private offices and university clinics (Table 4). Although wiping off orthodontic pliers and hand instruments without performing sterilization is not an appropriate method, this is used in all centers with lower rates observed in university clinics. As an ideal sterilization method, the rate of using autoclave does not exceed 64%. This finding suggests an inadequacy in sterilization of orthodontic pliers and hand instruments in Turkey.

The rate of wiping off the outer surface of dental handpieces was 56.9%, and the rate of using autoclave sterilization was 28.5%, whereas the rate of using dental handpiece autoclave was 14.6% (Table 2). Although wiping dental handpieces with disinfectant solutions without performing sterilization is an inappropriate and an inefficient means of sterilization, the rate of this method was considerably high. According to the study by Vendrell et al. (38) published in 2002, disinfection with ethanol, propanol (Incidur®) spray, and isopropanol (Iso-Septol) spray was not satisfactory in reducing the number of microorganisms. Dental handpieces must be therefore sterilized using the autoclave, and wiping the outer surface with a disinfectant solution must be abandoned (38).

According to the guidelines of the CDC published in 2003, dental handpieces with confirmed sterilization must be used in each patient (8). This requires keeping available dental handpieces in the number equals to the number of patients to be examined in that particular day or using rapid sequence sterilization methods.

The rate of sterilization for the purchased molar bands before trial in the patient was 27.7%, the rate of sitting in a disinfectant solution after trial was 34.6%, and the rate of autoclave sterilization was 53.1% (Table 2). Although the rate of sterilization for the purchased molar bands was low, the rate of sterilization after trial in the patient was found to be higher.

The study, published by Wichelhaus et al. (39) in 2006, reported that instruments that come into contact with blood in the mouth should be sterilized, and disinfection of instruments used outside of the mouth would be sufficient. Thermal disinfection and 5% Sekusept® Plus combined with ultrasonic bath were suggested for use in disinfection of heat-sensitive mouth retractor, photo mirror, and elastic chains (39). The rate of manual washing of hand instruments with water in the present study was 46.9%, whereas the rates of using ultrasonic cleaner and washer disinfector were 23.8% and 29.2%, respectively (Table 2).

The rate of using recycled brackets/orthodontic materials was found to be 19.2% (Table 2). In a study published by Oshagh et al. (40) in 2012, softening of archwires was reported after sterilization in the autoclave; however, this change was reported to be at low levels and does not pose a problem in clinical practice (40).

The rate for the presence of a separated sterilization room was 65.6% in private offices, 85.7% in private oral and dental health clinics, and 97.1% in university clinics (Table 4). The presence of a separated sterilization room is particularly important for the applicability of infection control procedures. The presence of a separated sterilization room carries a particular importance owing to risk of dispersion of infected particles while washing the instruments, evacuation of the vapor during autoclave cycle, inhalation of disinfectant agents, and protecting the sterility of the sterilized instruments. However, the rate of a separated sterilization room was particularly lower in private offices owing to inadequate physical conditions.

The rate of biological indicator spore test supply for controlling autoclave sterilization was significantly higher among junior orthodontists with an experience of less than 20 years than among senior orthodontists with an experience of more than 20 years. Whereas the rate of using waste basket for the disposal of bands, brackets, and archwires removed from the patients during or at the end of the treatment was higher in junior orthodontists, the rate of using sharps bin and metal waste bin was higher in senior orthodontists (Table 3). These results indicate an improvement in student education and increasing consciousness regarding infection control and sterilization in educational curriculums. However, the present study found that junior orthodontists do not show particular attention to the disposal of bands, brackets, and archwires removed from the patients into the infected waste bin.

The rate of annual maintenance for sterilization devices and using biological indicator spore test in autoclave sterilization control were significantly lower in private offices than in private oral and dental health clinics and university clinics. The rate of using autoclave sterilization control and regularly keeping and storing of sterilization records were significantly lower in private offices than in university clinics (Table 4). These results clearly indicate that maintenance and control procedures are more meticulously performed with institutionalization and increasing audit rates.

The most appropriate method for evaluating the compliance of orthodontists to infection control procedures is a survey study. However, in the present study, adequate feedback from orthodontists has not been achieved despite all our efforts. It would be better if the percentage of participation was higher so that the results could be more satisfying.

CONCLUSION

1. Although hepatitis B immunization rate was high among orthodontists/residents (95.4%), the rate of using protective goggles during treatment (48.5%) and the rate of using a separate protective mask for each patient (31.5%) were low.
2. During sterilization procedure, the usage rate for type B autoclave was higher than other devices. The usage rates for type B autoclave, non-type B autoclave, cassette autoclave, and dry-heat sterilizer were 40%, 17.7%, 14.6%, and 16.9%, respectively, and not at sufficient levels.
3. Although the usage rate for autoclave in sterilization of hand instruments and orthodontic pliers was higher in university clinics (64.3%) than in private offices (53.1%) and private oral and dental health clinics (42.9%), 24.6% of orthodontists used disinfectants in this procedure.
4. The rate of cleaning dental handpieces with wipes without performing sterilization was considerably high (56.9%).
5. In university clinics, the rate of using a specially produced device (handpiece autoclave) in sterilization of dental handpieces was considerably low (18.6%).
6. The rate of using biological indicator in autoclave sterilization control was lower in senior orthodontists (20%) who had an experience of more than 20 years than in junior orthodontists (50.5%).
7. The rate of using protective goggles during treatment was higher in facilities that had a higher daily volume of patient (70.4%); however, the rate of using a separate protective mask in each patient was lower (25.9%).

8. The rate of using examination gloves instead of thick kitchen-type gloves during cleaning of instruments and environmental cleaning was 76.9%.
9. The rate of disposing bands, brackets, and archwires into the waste basket instead of sharps bin was 40.8%.
10. Although the rate of sterilization of molar bands after purchase was low (27.7%), the rate of sitting molar bands in disinfection solution after trial was 34.6%, and the rate of sterilization of molar bands after trial was found to be 65.4%.
11. Orthodontists attach more importance to infection control procedures with increasing daily patient volume, and in connection with this, they enhance protective measures.

In conclusion, based on these study findings, it is obvious that there is a need for improving the compliance to the infection control procedures in the practice of orthodontics in Turkey. We, therefore, consider that training on the compliance to the infection control procedures must be taken into the scope of doctoral and residency training, knowledge of previous graduates must be updated, the training programs should be repeated on a regular basis through endeavors of dental association, and the practice of professionals should be audited.

You can reach the questionnaire of this article at https://doi.org/10.5152/TurkJOrthod.2018.17036

Ethics Committee Approval: N/A.

Informed Consent: N/A.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - S.F.; Design - S.F.; Supervision - S.F.; G.K.; Materials - G.S., S.F.; Data Collection and/or Processing - H.D.; Analysis and/or Interpretation - A.D.G.Ç.; Literature Search - A.D.G.Ç.; Writing Manuscript - A.D.G.Ç.; Critical Review - A.D.G.Ç.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Özer M, Devrim İ, Köprülü H, Dinçyürek Ç. Diş Hekimliği Kliniklerinde Uygulanan Sterilizasyon Yöntemleri. Ondokuz Mayıs Üniversitesi Diş Hekimliği Fakültesi Dergisi 2005; 6: 123-8.
2. Külekçi G. Ağız Mikrobiyolojisi, Diş Hekimliğinde İnfeksiyon Kontrolü. TDBD Özel Sayısı. 2000; 58: 10-2.
3. Külekçi G. Diş Hekimliği Açısından Adım Adım Enfeksiyon Kontrolü. TDBD Özel Sayı 2000; 58: 91-3.
4. CDC. Recommended infection-control practices for dentistry. MMWR Morb Mortal Wkly Rep 1986; 35: 237-42.
5. Centers for Disease Control (CDC). Update: Universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. MMWR Morb Mortal Wkly Rep 1988; 37: 377-82.
6. Centers for Disease Control (CDC). Guidelines for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health-care and public-safety workers. MMWR Suppl 1989; 38: 1-37.
7. Centers for Disease Control (CDC). Recommended Infection Control Practices in Dentistry. MMWR 1993; 41: 1-66.
8. Centers for Disease Control (CDC). Guidelines for Infection Control in Dental Health-Care Setting. MMWR 2003; 52: 1-66.
9. Külekçi G. Dişhekimliği İnfeksiyon Kontrol Rehberi CD'si. IDO Dergi 2007; 113: 55-7.
10. Külekçi G. Diş hekimliğinde infeksiyon kontrolü eğitimi-Türkiye'de diş hekimleri muaf mı? Hastane İnfeksiyonları Dergisi 2014; 18: 62-7.
11. Nohutçu N, Bulut ÖE, Külekçi G, Bebek T. Dişhekimliğinde İnfeksiyon Kontrolü. TDBD 2000; 58: 58.
12. Külekçi G. Bilimsel diş hekimliği 100. Yılında infeksiyon kontrolü ve yardımcılığı. TDB Dergisi 2009; 109: 84-6.
13. Hasta ve Çalışan Güvenliğinin Sağlanmasına Dair Yönetmelik http://www.resmigazete.gov.tr/eskiler/2011/04/20110406-3.htm
14. Çalışanların Sağlık ve Güvenliği ile İlgili Kimi Hak ve Yükümlülükler http://www.tdb.org.tr/tdb/v2/haber_goster.php?id=1537, http://tdb.org.tr/tdb/v2/ekler/Is_Guvenligi_Yasasi_ve_Risk_Analizi.doc
15. Shailer P. Clinical Dental Hygiene. The CV Mosby Company. 4th ed. St. Louis, 1972.
16. Mulick JF. Upgrading sterilization in the orthodontic Office. Am J Orthod 1986; 89: 346-51. [CrossRef]
17. Payne GS. Sterilization and disinfection in the orthodontic office: A practical approach. Am J Orthod 1986; 90; 250-2. [CrossRef]
18. Bhatnagar S, Bagga DK, Sharma P, Kumar P, Sharma R. Infection control strategy in orthodontic office. Eur J Gen Dentistry 2013; 2: 1-7. [CrossRef]
19. Starnbach H, Biddle P. A pragmathic approach to asepsis in the orthodontic office. Angle Orthod 1980; 50: 63-6.
20. Holht WF, Miller CH, Neeb JM, Sheldrake MA. Sterilization of orthodontic instruments and bands in cassettes. Am J Orthod 1998; 98: 411-6.
21. Akçam M, Özdiler E. Ortodontide Sterilizasyon ve Dezenfeksiyon. Cumhuriyet Üniversitesi Diş Hekimliği Fakültesi Dergisi 1999; 2: 129-33.
22. McCarthy GM, Mamandras AH, MacDonald JK. Infection control in the orthodontic office in Canada. Am J Orthod Dentofacial Orthop 1997; 112: 275-81. [CrossRef]
23. Davis D, DDS, BeGole E, PhDb. Compliance with infection-control procedures among Illinois orthodontists. Am J Orthod Dentofacial Orthop 1998; 113: 647-54. [CrossRef]
24. Jones M, Pizarro K, Blunden R. The effect of rutin steam autoclaving on orthodontic pliers. Eur J Orthod 1993; 15: 281-90. [CrossRef]
25. Pernier C, Grosgogeat B, Pansonnet L, Benay G, Lissac M. Influence of autoclave sterilization on the surface parameters and mechanical properties of six orthodontic wires. Eur J Orthod 2005; 27: 72-81. [CrossRef]
26. Speer C, Zimny D, Hopfenmueller W, Holtgrave EA. Bond Strength of Disinfected Metal and Ceramic Brackets: an in vitro study. Angle Orthod 2005; 75: 836-42.
27. Benson PE, Douglas CW. Decontamination of Orthodontic Bands following Size Determination and Cleaning. J Orthod 2007; 34: 18-24. [CrossRef]
28. Evangelista MB, Berzins DW, Monaghan P. Effect of Disinfecting Solutions on the Mechanical Properties of Orthodontic Elastomeric Ligatures. Angle Orthod 2007;77: 681-7. [CrossRef]
29. Ekmekçioğlu H. Türkiye'de Ortodonti Pratiğinde İnfeksiyon Kontrolünün Araştırılması. Bitirme Tezi, İstanbul Üniversitesi 2015.
30. Cleveland JL, Foster M, Barker L, Brown G, Lenfestey N, Lux L, Corley TL, Bonito AJ. Advancing infection control in dental care settings: factors associated with dentists' implementation of guidelines from the Centers for Disease Control and Prevention. J Am Dent Assoc 2012; 143: 1127-38. [CrossRef]
31. Aksoy A, Kılıç G, Hussein E, Aboukhalil D. Sterilization and Disinfection in Orthodontics. Principles in Contemporary Orthodontics. Dr. Silvano Naretto (Ed.), InTech. DOI: 10.5772/20901. Available from: http://www.intechopen.com/books/princi-

ples-in-contemporary orthodontics/sterilization-and-disinfection-in-orthodontics
32. Saraç M, Yalçın A. Ortodonti Uzmanlarının Hepatit B ve Çapraz İnfeksiyona Karşı Aldıkları Önlemler Yönünden Değerlendirilmesi. Türk Ortodonti Derg 1995; 8: 66-9. [CrossRef]
33. Topcuoğlu N, Külekçi G. Türkiye'deki Diş Hekimlerinin İnfeksiyon Kontrolü Uygulamaları: İki Yıllık Süredeki Gelişim. G.Ü. Diş Hekimliği Fakültesi Dergisi 2009; 26: 155-61.
34. Külekçi G: Diş Hekimliğinde ne tip otoklav alınmalı ve nasıl kullanılmalı. 5.Ulusal Sterilizasyon Dezenfeksiyon Kongresi Kongre Kitabı. 2007. p.617-25.
35. Külekçi G, Dülger O, Ergin U. Dişhekimliğinde otoklav. TDBD 2005; 91: 73-86.
36. Cash RG. Trends in sterilization and disinfection procedures in orthodontic offices. Am J Orthod Dentofacial Orthop 1990; 98: 292-9. [CrossRef]
37. Woo J, Anderson R, Maguire B, Gerbert B. Compliance with infection control procedures among California orthodontists. Am J Orthod Dentofacial Orthop 1992; 10: 268-75. [CrossRef]
38. Vendrell RJ, Hayden CL, Taloumis LJ. Effect of steam versus dry-heat sterilization on the wear of orthodontic ligature-cutting pliers. Am J Orthod Dentofacial Orthop 2002; 121; 467-71. [CrossRef]
39. Wichelhaus A, Bader F, Sander FG, Krieger D, Mertens T. Effective Disinfection of Orthodontic Pliers. J Orofac Orthop 2006; 67; 316-36. [CrossRef]
40. Oshagh M, Hematiyan MR, Mohandes Y, Oshagh MR, Pishbin L. Autoclaving and clinical recycling: Effects on mechanical properties of orthodontic wires. Indian J Dent Res 2012; 23: 638-42. [CrossRef]

Appendix 1. Survey Form
Infection Control in Orthodontics

1. How long have you been working as a dental practitioner/ orthodontist?
a) 0-5 years
b) 6-10 years
c) 11-15 years
d) 16-20 years
e) more than 20 years

2. Place of work?
a) Private office
b) Private oral and dental health clinic
c) Public oral and dental health clinic/state hospital
d) University clinics

3. Daily patient volume?
a) 0-5
b) 6-10
c) 11-15
d) 16-20
e) >20

4. Number of dental assistant?
a) 0
b) 1
c) 2
d) 3
e) 4
f) 5
g) >5

5. Is there a written infection control program at your clinic?
a) Yes
b) No

6. Is there a separated sterilization room?
a) Yes
b) No

7. How do you perform sterilization of the instruments?
a) Manually with water
b) Ultrasonic cleaner
c) Washer disinfector

8. Is there a separated instrument washing sink separate from the hand washing sink?
a) Yes
b) No

9. Sterilization devices used?
a) N type autoclave
b) B type autoclave
c) S type autoclave
d) Cassette autoclave
e) Dry-heat sterilizer

10. Is annual maintenance performed for sterilization devices?
a) Yes
b) No

11. Do you perform cleaning of water tank of the autoclave?
a) Yes
b) No

12. Packing of instruments to be sterilized in the autoclave?
a) Metal tray
b) Special tray
c) Autoclave bag
d) Wrap
e) I do not pack

13. Which methods do you use in the control of autoclave sterilization?
a) Chemical
b) Biological
c) Chemical+Biological
d) Bowie - Dick test
e) I do not use

14. How do you supply biological indicator spore test in the control of autoclave sterilization?
a) Spore test by mail
b) Branded tests
c) I do not perform biological control

15. Do you regularly keep and store sterilization records?
a) Yes
b) No

16. How do you sterilize dental handpieces?
a) In the autoclave
b) In a dedicated device (dental handpiece autoclave)
c) Wiping the outer surface with disinfectant solution

17. How do you sterilize hand instruments/orthodontic pliers?
a) Dry-heat sterilizer
b) Autoclave
c) Cassette autoclave
d) Wiping with a disinfectant solution

18. Do you sterilize molar bands after purchase?
a) Yes
b) No

19. How do you sterilize molar bands after trial in the patient?
a) Dry-heat sterilizer
b) Autoclave
c) Cassette autoclave
d) Sitting in disinfectant solution

20. Where do you dispose the bands, brackets, and archwires you remove from the patients during or after treatment?
a) Waste basket
b) Sharps bin
c) Metal waste bin
d) Infected waste bin

21. Do you use recycled brackets/orthodontic materials?
a) Yes
b) No

22. Do you disinfect impressions or appliances to be delivered to an outer laboratory?
a) Yes
b) No

23. Do you have a written communication line with the outer laboratory?
a) Yes
b) No

24. Do you know that biofilms develop in the dental unit water lines requiring cleaning?
a) Yes
b) No

25. Where do you place sharps bin?
a) At the clinic
b) In the sterilization room

26. How do you perform environmental surface cleaning?
a) I cover with dedicated cloths.
b) I disinfect.

27. Which type of gloves do you use during cleaning of instruments and environmental cleaning?
a) Examination gloves
b) Kitchen-type gloves
c) I do not wear

28. Do you wear protective mask and goggles during environmental cleaning/manual cleaning of instruments?
a) Yes
b) No

29. Do you wash your hands before wearing gloves?
a) Yes
b) No

30. Do you wash your hands after removing gloves?
a) Yes
b) No

31. Do you use a separate protective mask for each patient?
a) Yes
b) No

32. Do you wear protective goggles/shields during treatment?
a) Yes
b) No

33. Have you had hepatitis B vaccine?
a) Yes
b) No

34. Have you had influenza vaccine?
a) Yes
b) No

35. When did you have your last tetanus vaccine?
a) 0–5 years
b) 6–10 year
c) 11–15 years
d) 16–20 years
e) >20 years

36. What are your comments regarding infection control in dental practice/orthodontics?