

CONTINUING EDUCATION ARTICLE

Prospective survey of percutaneous injuries in orthodontic assistants

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This prospective diary survey provides documentation concerning the occurrence of percutaneous injury among orthodontic chairside assistants in the United States and Canada. A 20-day period was used to collect data regarding exposure to injuries; 693 valid responses were received from orthodontic assistants. Most chairside assistants in this sample work in a solo practice and average 33 hours per week treating patients for 49 weeks per year. The study identified a percutaneous injury rate of 0.11 for chairside assistants during this period, a rate that can be extrapolated to 1.4 episodes of percutaneous injury per year per chairside assistant. The majority of these injuries occurred outside the mouth. Those assistants with longer orthodontic experience had a lower injury rate than those with less experience. The rate of percutaneous injury to dental assistants was slightly higher than the annual rate (0.99) for orthodontists monitored by means of a companion survey and slightly lower than the rate (1.9) for a smaller sample of orthodontists from the American Dental Association survey of 1995. The annual rate of percutaneous injury for orthodontic chairside assistants is less than half of that observed for dentists in general practice. (*Am J Orthod Dentofacial Orthop* 1999;115:72-6)

There have been several studies of the rate of occurrence of percutaneous injuries among health care workers conducted by the Centers for Disease Control (CDC).¹⁻⁷ These retrospective and prospective studies have focused on the risk of transmission from infected patient to clinician,¹⁻³ from infected clinician to patient,⁴ as well as from needlestick injury.⁵⁻⁷ These investigations have shown that percutaneous injuries associated with the delivery of patient care are the most likely pathways for the transmission of bloodborne pathogens such as hepatitis B and HIV to the health care worker.

The American Dental Association (ADA) has conducted both retrospective and prospective studies on the risk of percutaneous injury in the dental office.⁸⁻¹¹ These studies have focused primarily on the risk to dentists in private practice. In general these investigations have indicated that dentists experience about

three percutaneous injuries each year; these injuries are associated most commonly with the use of syringes and other sharp instruments.¹¹ These studies also noted that pediatric dentists and oral and maxillofacial surgeons generally have higher rates of injury, whereas endodontists and orthodontists have lower.

No previous studies have considered the rate of percutaneous injury experienced by dental auxiliaries. Perhaps this lack of data is due in part to the perception that dental assistants have less of a risk of injury than do dentists because an assistant in the typical dental practice often works in tandem with the dentist rather than alone, with the dentist performing the majority of a given procedure. Dental assistants, however, also have exposure to injury during the treatment as well as during preparation, clean-up, and laboratory phases.

Four-handed dentistry is less common in an orthodontic practice, as most assistants work alone in performing routine orthodontic tasks such as fitting bands, changing and ligating arch wires, and taking impressions, as well as during clean-up and laboratory procedures. Needlestick injuries, however, presumably are less of a risk for the orthodontic assistant as injections are used very infrequently in routine orthodontic patient care.

Because of the nature of orthodontic practice, an analysis of the rate of percutaneous injury was deemed in order, with the assumption that orthodontists and orthodontic assistants would experience lower rates of percutaneous injury than clinicians in most other areas

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Table I. Procedure being performed when injury occurred

Procedure	N	Percent
Diagnostic	1	1.3
Bracket placement	5	6.4
Retention	4	5.1
Laboratory procedure	9	11.5
Arch wire change	24	30.8
Emergency	1	1.3
Other	29	37.2
No response	5	6.4
Total	78	100.0

of dentistry. Thus the American Association of Orthodontists (AAO) commissioned a prospective survey of percutaneous injuries in the orthodontic office. In addition to surveying the practicing orthodontist, chairside assistants also were monitored because of the nature of their clinical contacts. The results from the chairside assistant survey are presented in this report. Results from the survey of orthodontists are presented elsewhere.¹¹

MATERIAL AND METHODS

A stratified random sample of practicing orthodontists from the eight regions of the United States and Canada represented by the eight components of the AAO was used for this study. The sample was selected using every third orthodontist who was an active, affiliate, or associate member of the AAO at the time the survey was conducted. The target sample included 2800 orthodontists. In addition, two other surveys modified to orthodontic assistants were sent to each office, with instructions that these surveys were to be completed by two of the chairside assistants in each practice.

Each subject was mailed a letter explaining the study along with a precoded questionnaire that requested information on demographics, area of practice, nature of practice (group or solo), level of education or training, handedness, hours and days worked, type of procedures, and time and location of injuries. Questionnaires were mailed with preaddressed and stamped return envelopes. Only one follow-up mailing was conducted for nonresponders. Two-hundred and twenty-five offices were eliminated due to death, retirement, and other reasons. Returns included 449 valid orthodontist and 693 assistant questionnaires used in the analysis.

The survey mailings were handled through the central offices of the AAO. A private statistical consulting group was used for the receipt of completed surveys, coding, verifying accuracy, data entry, and preliminary statistical analyses.

Data then were analyzed further with the SPSS statistical package to verify frequencies, means, standard errors, and statistical significance. Chi square was used to test for significance related to proportions and percentages of responses, whereas *t* tests were used for examining significance among

Table II. Object associated with assistant injury

Object	N	%
Bur	6	7.7
Explorer	15	19.2
Orthodontic wire	23	29.5
Scaler	13	16.7
Other sharp instrument	5	6.4
Other	15	19.2
No response	1	1.3
Total	78	100.0

mean responses. Statistical significance was determined for those results having a *P* value less than .05.

RESULTS

Injury Exposure Risk

A 20-day prospective period was used to examine the prevalence and risk of percutaneous injury. For chairside assistants, the mean number of reported injuries per 20-day period was 0.11. Seventy (10%) chairside assistants reported they received a total of 78 percutaneous injuries. Sixty-two (9%) assistants reported receiving one injury; 8 (1%) reported receiving two injuries during the 20-day reporting period.

Only 12% of injuries occurred inside the mouth; the remainder were outside the mouth at chairside (56%) or in another setting (32%). The largest number of injuries related to intraoral procedures occurred with changing arch wires (n = 24, 30.8%); however, 38.5% of injuries were reported to have occurred in other situations not directly related to patient procedures (Table I).

There were reports of injuries from a variety of objects present in the office such as burs (7.7%), explorers (19.2%), and scalers (16.7%). Scalers, explorers, and other sharp instruments accounted for 42.3% of injuries (Table II).

Only three injuries were reported on the arm, with the vast majority (n = 73; 94%) occurring on the finger or hand. Ninety-two percent of the assistants were right handed, and injuries reflected a similar incidence between right and left handedness with no statistical significance. Sixty-two percent of the finger/hand injuries occurred on the left hand. The most frequent site of 45 injuries of the left hand was the index finger (44%) followed by the middle finger (22%). Of the 28 injuries (38%) to the right hand, the most frequent site was the ring finger (36%) followed by the palm or back of the hand (25%). Although there was no statistical significance between assistants' right or left handedness and which hand was injured, the sites of injury differed between hands ($\chi^2 = 22.7, P < .001$).

Table III. Assistants and injuries by years of experience

Years of experience	<i>Not injured (N = 623)</i>		<i>Injured assistants (N = 70)</i>		Injury rate
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
5 Years or less	251	40.3	37	52.9	12.8%
6 Years or more	372	59.7	33	47.1	8.1%

Table IV. Number of procedures performed in a typical day

Number of procedures	<i>Not injured (N = 623)</i>		<i>Injured assistants (N = 70)</i>		Injury rate
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
16 or fewer	195	31.3	18	25.7	8.5%
17-24	222	35.6	25	35.7	10.1%
25-32	100	16.1	14	20.0	12.3%
33 or more	106	17.0	33	47.1	10.9%

Table V. Mean percentage of time per task

Procedure	<i>Not injured (N = 623)</i>	<i>Injured assistants (N = 70)</i>
Examination/consultation	2.6%	2.7%
Diagnostics	10.0%	9.8%
Appliance placement/removal	17.9%	15.6%
Arch wire change	34.6%	35.7%
Appliance adjustment	13.6%	10.9%
Retainer check	4.7%	4.1%
Lab procedures	8.8%	10.2%
Administrative/clerical	7.0%	5.6%
Other	0.8%	5.4%
Total	100.0%	100.0%

Practice Characteristics and Injuries

All parts of the United States and Canada having members of the AAO were represented in the response. The largest response was in the Pacific Coast at 20%, with the lowest at 5% for the Rocky Mountain area. Injuries appeared to occur equally across most areas of the country. Seventy-nine percent of the dental assistants in this survey worked with orthodontists in solo practice. The pattern of injuries for group or solo practices were similar.

In this sample, the majority of assistants (52%) were trained on the job; 24% were certified dental assistants and 21% registered dental assistants. About 3% were registered dental hygienists. Similar patterns of injuries occurred with assistants in each category. There was no statistical significance between type of training and injuries.

Forty-five percent of the assistants had worked in dentistry for over 10 years; 35% had worked as assistants in orthodontics for over 10 years. There was a statistically significant pattern of more injuries for those

assistants with less experience and fewer injuries for those assistants with greater experience. Assistants with 5 years or less of experience in orthodontics were more likely to be injured (12.8%) than those with more than 5 years of experience (8.1%) ($\chi^2 = 4.09$, $P < .05$; Table III).

Injuries did not show a relationship to days of the week with fewer injuries reported on Friday (7%), Saturday (1%), and Monday (15%) and more injuries on Tuesday (27%) and Thursday (26%). Injuries were reported during all times of the day, with 60% occurring during the morning hours from 7:30 until noon.

The average number of patients seen during the 20-day period was 297 or 14.8 patients per day. There was no statistical significance between number of patients seen and injury. The average number of procedures performed by an individual dental assistant on a typical day was > 23. Injury rates were not statistically significant in relation to average number of patients seen or to the number of procedures completed on a typical day (Table IV).

Two-handed procedures were performed by assistants 61% of the time; 20% of their time was spent on four-handed procedures. The remaining time (19%) was spent on lab procedures and clerical duties.

Dental assistants spent 35% of their time changing arch wires, 18% placing or removing appliances, and 13% on appliance adjustments. The most frequent procedure leading to injury was changing arch wires (35%). There were no significant differences between injured and noninjured assistants in estimated percentages of time spent on various procedures (Table V). Injured assistants, however, did see statistically significantly fewer patients (2.3) on a daily basis for appliance placement or removal than did noninjured assistants (3.3; $P < .05$).

Table VI. Average hours worked per day in a 20-day period

Hours worked	Not injured		Injured assistants		Injury rate
	N	%	N	%	
2-6 hours	25	4.0	1	3.8	3.9%
6-7 hours	111	17.8	12	17.1	9.0%
7-8 hours	343	55.1	41	58.6	11.6%
>8 hours	144	23.1	16	22.9	10.0%
Mean	7.65 hours (N = 623)		7.60 hours (N = 70)		

The average hours worked by the respondents during this period was 153 or 7.65 hours per day. The majority of the sample (55%) reported they worked between 6 and 7 hours per day, 23% worked more than 8 hours, and 22% worked fewer than 7 hours. Injury rate was not significantly associated with the number of hours worked during the 20-day period (Table VI).

On average, this sample of assistants worked 33 hours per week for 49 weeks. Seventy-five percent stated they worked from 31 to 40 hours per week. No statistically significant differences appeared between those assistants injured or not in relation to number of hours or weeks worked.

DISCUSSION

The present survey monitored the activities of orthodontic chairside assistants, a group of health care providers that has not been considered previously. The orthodontic assistant study being reported here was designed to parallel the 1995 ADA survey¹⁰ so that results could be compared. This orthodontic survey also used a prospective method to gather data during a 20-day practice period, rather than asking respondents to recall information from the past.^{8,9} The use of selective memory in retrospective self-reporting studies is not as accurate as specific data gathered prospectively by the diary method, as occurred in the current study.

Because of their often independent chairside duties, it was hypothesized that the responding assistants would be similarly exposed to the possibility of percutaneous injury as orthodontists. The results of this prospective diary survey indicate that the risk for percutaneous injury among orthodontic chairside assistants is low. During a 20-day period, the average number of percutaneous injuries was 0.11. Using the same guidelines of the 1995 ADA study of percutaneous injuries¹⁰ to determine the annual injury rate, the average orthodontic assistant experiences 1.4 injuries per year. This rate is similar to the rate of injury (0.99) of the orthodontists responding to a companion survey¹¹ and also is slightly lower than the rate (1.9) for the limited number of orthodontists monitored during the 1995 ADA study.¹⁰ The injury rate for orthodontic

chairside assistants is substantially lower than the 3.3 injuries per year of general dentists, and the 2.8 injuries per year of specialists in general.¹⁰ The injury rate for orthodontic assistants also is less than the rate of 3.6 injuries per dentist per year reported in the observational study of Cleveland et al.¹²

The 1995 ADA study¹⁰ reported that the primary causes for injury were burs, syringe needles, and sharp instruments. As needles and burs are used infrequently during the delivery of routine orthodontic patient care in comparison to treatments in other areas of dentistry, this difference may account in part for the reduced injury rate for orthodontists and their staff members.

Some interesting observations can be made from considering the demographic data obtained in the survey. For example, over half of the chairside assistants responding had no formal education in dental assisting, but rather were trained "on-the-job." Only 3% of the sample were dental hygienists. It could be hypothesized that there would be a higher rate of percutaneous injury among those assistants with no formal training in dentistry in comparison to registered and certified dental assistants and registered dental hygienists. This was not the case; there was no difference in injury rate according to the type of education or training. It should be noted, however, that the most common procedure causing injury was the manipulation of arch wires, a task that typically is not part of the formal educational experience of dental assistants and hygienists. In fact, perhaps the majority of the functions of the average orthodontic assistant are learned on-the-job regardless of the level of education, as these tasks are covered superficially or not at all in the typical educational program of assistants and hygienists.

It also should be noted that those chairside assistants with more experience had fewer injuries than those with less experience. In contrast, no significant differences appeared between those assistants injured or not in relation to number of hours or weeks worked or the number of patients treated.

The results of this study indicate that although the rate is low relative to practitioners in other areas of dentistry, percutaneous injuries do occur to orthodontic

chairside assistants. As this type of injury has been shown to be a primary path of infection of such blood-borne pathogens as hepatitis B and HIV, chairside assistants as well as orthodontists should be made aware of the inherent danger associated with such common procedures as changing arch wires, replacing burs in a high-speed handpiece, and handling a laboratory knife.

SUMMARY AND CONCLUSIONS

This national survey provides documentation regarding typical orthodontic assistant practice patterns in the United States and Canada, including the incidence of percutaneous injuries. The sample reflected a similar geographic distribution as the population as a whole with more practices in areas with higher populations. Most chairside assistants in this sample were employed by solo practitioners, and the assistants treated patients an average of 33 hours per week for 49 weeks per year.

A 20-day prospective period was used to collect data regarding exposure to injuries. Those assistants with longer orthodontic experience had a lower injury rate than those with less experience. No difference was noted relative to the level and type of education or training. The study identified a percutaneous injury rate of 0.11 for chairside assistants during this period or 1.4 injuries per year per assistant. The majority of these injuries occurred outside the mouth. This rate was comparable to the figure determined by a companion survey of orthodontists as well as the rate for a small sample of orthodontists from a similar survey conducted in 1995

by the ADA. The risk of percutaneous injury is relatively low in comparison to clinicians in other areas of dentistry, with only about one injury per orthodontic assistant per year being reported.

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