Orthodontic Training in Pediatric Dental Residencies

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Abstract: The purpose of this study was to determine the amount and types of orthodontic training in pediatric dental residencies. A twenty-one-item survey was mailed to sixty directors of pediatric dental residencies. Follow-up surveys were sent to those who had not responded. Fifty-two surveys were returned for a response rate of 87 percent. Most programs provided forty-eight formal orthodontic course hours, one-half to one day of clinical orthodontic experience per week, and six to ten case starts for each resident. Most program directors anticipated this amount of experience would increase or stay the same in the future. Though most programs had an affiliated graduate orthodontic program, fewer than half of the programs had an orthodontist on faculty from the affiliated program (43 percent). As expected, orthodontic training varies with different program characteristics. The faculty members teaching orthodontics in pediatric dental residencies are often not from affiliated graduate orthodontic programs. Most program directors do not anticipate a decrease in the didactic or clinical components in the next five years.

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Relatively little is known about the current amount of orthodontic education pediatric dentists receive during their residency programs. In 1977, Rawlings et al.[1] surveyed pediatric dental residency programs in the United States regarding the amount of orthodontic training. He found that residents received an average of 2.4 hours of orthodontic theory and diagnosis and 3.7 hours of clinical orthodontic experience weekly. Universally, residents were exposed to a variety of orthodontic topics, including growth and development and cephalometrics. However, Rawlings found that only 50 percent of programs taught full-banded techniques, while 95 percent taught the use of appliances for extra-oral force application. Sixty-nine percent of all programs had university-trained orthodontic faculty on staff, of which 85 percent were from an affiliated orthodontic program. The majority of chairpersons who responded to Rawlings' survey felt that pediatric dentists should be capable of treating the following orthodontic conditions: 1. Primary and mixed dentition: Class I skeletal problems, habit therapy, and ectopic eruption; 2. Mixed dentition: dental open bite malocclusions; 3. All dentition assignments (primary, mixed, and permanent): anterior and posterior crossbites, space maintenance, and space regaining. When asked about the possibility of combining orthodontic and pediatric dental residencies in order to expand the orthodontic training provided to pediatric dental residents, the majority of respondents were not in favor of this recommendation.

Today, however, with the current shortage of pediatric dentists and the increasing demand for restorative care, as reported by Davis[2] in 1999, there may be less emphasis on orthodontic education in pediatric dental residency programs. Accreditation standards issued by the Commission on Dental Accreditation regarding this topic in pediatric dental residencies are not specific in the amount or types of orthodontic treatment provided by residents.[3] The standards state that residents receive training in "craniofacial growth and development to enable the student to diagnose, consult and/or refer to other specialists, problems affecting orofacial esthetics, form, or function. This includes but is not limited to the following: a) theories of growth mechanisms; b) prin-

ciples of comprehensive diagnosis and treatment planning to identify normal and abnormal dentofacial growth and development; and c) indications and contraindications for extraction and non-extraction therapy, growth modification, dental compensation for skeletal problems, growth prediction, and treatment modalities." Due to the ambiguity of this standard, programs could cover only theoretical concepts of orthodontic treatment and teach residents to refer patients for all treatment. Hence, the amount of actual clinical experience in treating orthodontic cases may vary greatly between programs.

With the lack of current knowledge regarding orthodontic training in pediatric dental residencies, the purposes of this study were to gather information on the didactic and clinical orthodontic material being taught to pediatric dental residents and to provide a basis for comparison with past and future studies. It is hypothesized that the emphasis on such orthodontic education has decreased due to the increased restorative needs of pediatric patients and the shortage of practicing pediatric dentists.

Materials and Methods

A twenty-one-item survey with two open-ended questions was sent to sixty pediatric dental residency program directors in the United States and Canada in June 2002. Two pediatric dental residency programs were relatively new and were, therefore, excluded from the study. Appropriate Institutional Review Board (IRB) approval was obtained at the University of Connecticut. Envelopes were numerically coded to allow follow-up surveys to be sent to programs that had not responded within eight weeks of the original mailing date. As seen in Figure 1, the survey primarily included closed-ended questions to minimize interpretation ambiguity and to facilitate analysis.

Data collected from the surveys were entered into an Excel database and verified for accuracy. The data files were then converted for use with the Statistical Package for the Social Sciences software, which was used to conduct the analyses. The major approach to the analyses was descriptive as the information gathered was primarily categorical in nature and thus focused on frequency distributions and tabular analysis. Frequency distributions and, where appropriate, measure of central tendency, including means, standard deviations, medians, and modes were determined. Cross tabulations and chi-square analyses were performed to assess bivariate associations between the structural characteristics of the residency programs and the orthodontic education provided. Because multiple comparisons were made for each variable, the level of significance was determined to be $p<.01$.

Results

The response rate from the two mailings was 87 percent (fifty-two out of sixty programs). The characteristics of the pediatric dental residency programs are summarized in Table 1. The majority (44 percent) of programs were combined (university and hospital) programs. Many treated a large population of patients on public assistance. In fact, in 48 percent of the programs, 61 to 80 percent of patients received public assistance. Most programs were located in an urban area (89 percent), and 50 percent had program directors who had held that position for five years or less.

With regard to the orthodontic component in programs, 10 percent stated they had no orthodontist on faculty. In the programs that had orthodontist/s on faculty, the majority taught only part-time (77 percent), while fewer held full-time positions (28 percent). Most programs had an "affiliated graduate orthodontic program" (83 percent), but only 43 percent actually had an orthodontist on faculty from the affiliated program. Overall, the majority of programs provided residents with six to ten orthodontic case starts (35 percent), but many provided eleven to fifteen (25 percent). The number of orthodontic cases had increased in 40 percent of programs over the past five years and was anticipated to stay the same in 71 percent of programs in the next five years. The respondents described several reasons for previous changes including: "new program director wanted comprehensive orthodontic treatment taught," "new source of patient-assisted funding," and "identifying more orthodontic needs in the population."

The content and learning experiences of orthodontic education during pediatric dental residencies are listed in Table 2. The number of formal orthodontic course hours varied widely, but over half of programs provided residents with four to six clinical orthodontic hours per week in the first year (55 percent) as well as in the second year (61 percent).

Most programs treated patients with orthodontics in the primary dentition (96 percent), early mixed dentition (100 percent), and late mixed dentition (96

1. Which of the following best describes your program?
□ University-based □ Hospital-based □ Combined university- and hospital-based

2. If your program is affiliated with a dental school, does the school also have a graduate orthodontic program?
□ Y □ N

3. How long is your pediatric dental program?
□ 2 years □ 2 ½ years □ 3 years

4. In the past 3 years, what degrees or certificates have graduating residents achieved?
(Check all that apply)
□ Certificate □ Masters degree □ PhD

5. How long have you served as the director of this program?
□ 0-1 years □ 2-4 years □ 5-10 years □ >10 years

6. How many residents on average are in each class?
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ >6

7. In which type of area is your program located? (Check all that apply.)
□ Urban □ Suburban □ Rural

8. Of all patients treated by your residents, approximately what *percent* are on public assistance?
□ 0% □ 1-20% □ 21-40% □ 41-60% □ 61-80% □ 81-99% □ 100%

9. How many orthodontists work full-time as pediatric dental faculty members?
□ 0 □ 1-2 □ 3-4 □ 5+

10. How many orthodontists work part-time as pediatric dental faculty members/courtesy staff?
□ 0 □ 1-2 □ 3-4 □ 5+

11. If there are orthodontists who are pediatric dental faculty, are any from an affiliated orthodontic graduate program?
□ Yes □ No □ There is no affiliated orthodontic graduate program.

12. Do you have a formal course devoted to orthodontic theory and diagnosis?
□ Yes □ No

If yes, how many hours is it in total? _____

13. How many hours per week are devoted to clinical orthodontic experience?

1st Year:	□ 0	□ 1-3	□ 4-6	□ 6-8	□ >8	
2nd Year:	□ 0	□ 1-3	□ 4-6	□ 6-8	□ >8	
3rd Year:	□ 0	□ 1-3	□ 4-6	□ 6-8	□ >8	□ N/A

14. Which of the following stages of dental development do residents treat orthodontically?
(Check all that apply.)
□ Primary dentition □ Early mixed dentition □ Late mixed dentition □ Permanent dentition

15. Which of the following conditions are residents trained to treat? (Check all that apply.)
□ Space maintenance □ Space regaining
□ Anterior cross-bite □ Posterior cross-bite □ Habits
□ Dental Class I malocclusion □ Dental Class II malocclusion □ Dental Class III malocclusion
□ Deep bite □ Skeletal Class II malocclusion □ Skeletal Class III malocclusion
□ Open bite □ Rotation/minor malposition □ Alignment of impacted teeth
□ Molar uprighting □ Ectopic/eruption guidance □ Serial extraction

16. Which types of orthodontic therapy are residents trained to use? (Check all that apply.)
□ Fixed rapid palatal expander/RPE □ Removable Hawley with auxiliary springs
□ Removable RPE □ Functional appliances
□ Straight wire technique □ Edgewise technique □ Utility archwires (2x4, etc.)
□ Intra-arch molar distalization appliances □ Headgear □ Invisalign

17. How many orthodontic cases does the average resident start during his or her training?
□ 0-5 □ 6-10 □ 11-15 □ 16-20 □ >20

18. How has this changed since you became the director of this program?
□ It has increased. □ It has decreased. □ It has stayed the same.

19. Do you anticipate a change in the next 5 years?
□ It will increase. □ It will decrease. □ It will stay the same.

20. If the amount of cases a resident starts during the program has changed (will change), what was (will be) the reason be for the change?

Figure 1. Orthodontic training in pediatric dental residencies: an example of the survey sent to pediatric dental residencies

Table 1. Program characteristics of the pediatric dental residency programs (n=52) surveyed

Type	
University	21.2%
Hospital	34.6
Combined	44.2
Location	
Urban	88.5%
Suburban	9.6
Rural	1.9
Years as Program Director	
Less than 5 years	50.0%
5 or more years	50.0
% of Patients on Public Assistance	
0-60%	38.5%
61-80%	48.0
81-100%	13.5
Affiliated Graduate Ortho Program	
Yes	83.0%
No	17.0
Orthodontic Faculty from Affil. Program	
Yes	42.6%
No	38.3
No program	19.1
Full-Time Orthodontist on Faculty	
0	72.5%
1-2	27.5
Part-Time Orthodontist on Faculty	
0	23.5%
1+	76.5
Orthodontic Cases Started	
0-5 Cases	19.2%
6-10 Cases	34.6
11-15 Cases	25.0
>15 Cases	21.1
Changes in Cases Started Over Past 5 Years	
Increase	40.4%
Decrease	7.7
Same	51.9
Changes in Cases Over Next 5 Years	
Increase	26.9%
Decrease	1.9
Same	71.2

Table 2. Orthodontic education: the percentage of programs providing the different types of orthodontic education including the stages of dental development treated, malocclusions treated, and therapies used

Formal Ortho Course Hours	
0-20 hours	25.0%
21-40 hours	20.5
41-90 hours	27.3
>90 hours	27.3
Clinical Ortho Hours	
1st Year: 0-3	23.6%
4-6	54.9
6-8	21.6
2nd Year: 0-3	11.8
4-6	60.8
6-8	27.5
Stages of Development Ortho Treated	
Primary Dentition	96.2%
Early Mixed Dentition	100.0
Late Mixed Dentition	96.2
Permanent Dentition	59.6
Orthodontic Conditions Treated	
Space Maintenance	100.0%
Anterior Crossbite	98.1
Dental Class I	84.6
Dental Class II	63.5
Dental Class III	46.2
Skeletal Class II	25.0
Skeletal Class III	9.6
Deep Bite	57.7
Open Bite	59.6
Molar Uprighting	67.3
Space Regaining	90.4
Posterior Crossbite	98.1
Minor Rotation/Malposition	84.6
Ectopic Eruption/Eruption Guidance	98.1
Habits	98.1
Impaction Alignment	38.5
Serial Extraction	73.1
Orthodontic Therapies Used	
Fixed Rapid Palatal Expander	96.2%
Removable Palatal Expander	57.7
Straight Wire	80.8
Intra-arch Molar Distalization	51.9
Removable Hawley with Finger Springs	92.3
Functional Appliances	50.0
Edgewise	46.2
Headgear	55.8
Utility Archwires	71.2
Invisalign	5.8

percent), though only 60 percent treated patients in the permanent dentition. The majority of programs also treated orthodontic conditions such as space maintenance, anterior cross bite, posterior cross bite, ectopic eruption, habits, space regaining, dental Class I, and minor rotation/malpositions. Less commonly, the treatment of serial extraction, molar uprighting, dental Class II, open bite, and deep bite was also undertaken. The treatment of more complex cases, such as dental Class III, dental impactions, skeletal Class II, and skeletal Class III was substantially lower. The most common orthodontic therapies used were the fixed rapid palatal expander (96 percent), removable Hawley with finger springs (92 percent), and straight wire technique (81 percent). Other therapies varied widely.

As noted in Table 3, the number of cases started was significantly affected by the number of clinical

Table 3. Comparison of the individual program characteristics to the number of orthodontic cases started

	Cases Started			
Program Characteristic	0-5 Cases	6-10 Cases	11-15 Cases	>15 Cases
Type				
University (n=11)	18.2%	18.2%	18.2%	45.5%
Hospital (n=18)	27.8	33.3	22.2	16.7
Combined (n=23)	13.0	43.5	30.4	13.0
% Pub Asst				
0-60% (n=12)	16.7%	50.0%	33.3%	0.0%
61-80% (n=17)	5.9	35.3	23.5	35.3
81-100% (n=23)	30.4	26.1	21.7	21.7
Grad Ortho Pgm				
Yes (n=39)	15.4%	30.8%	30.8%	23.1%
No (n=8)	25.0	62.5	0.0	12.5
Orthodontist from Afil Ortho Pgm				
Yes (n=20)	15.0%	45.0%	20.0%	20.0%
No (n=18)	22.2	22.2	33.3	22.2
No Program (n=9)	22.2	44.4	11.1	22.2
P/T Ortho Faculty				
0 (n=12)	25.0%	33.3%	25.0%	16.7%
1+ (n=39)	15.4	35.9	25.6	23.1
F/T Ortho Faculty				
0 (n=37)	21.6%	24.3%	32.4%	21.6%
1-2 (n=14)	7.1	64.3	7.1	21.4
1st Yr Clinic Hrs/Wk				
0-3 (n=12)	*50.0%	*25.0%	*8.3%	*16.7%
4-6 (n=28)	*10.7	*46.4	*28.6	*14.3
6-8 9 (n=11)	*9.1	*9.1	*36.4	*45.5
2nd Yr Clinic Hrs/Wk				
0-6 (n=37)	*21.6%	*43.2%	*24.3%	*10.8%
>6 (n=14)	*14.3	*7.1	*28.6%	*50.0

*p<.01

orthodontic hours in the first year and second year of residency (increased hours with increased starts, p<.01). Variables that did not significantly affect the number of case starts included the type of program (university/hospital/combined), the amount of public assistance patients treated in the program, the presence of an affiliated graduate orthodontic program, the presence of orthodontic faculty from an affiliated graduate orthodontic program, and the presence of part-time or full-time orthodontic faculty.

Table 4 indicates factors significantly affecting whether orthodontic conditions were treated. These factors included whether the program was a combined program, if there was a full-time orthodontist on faculty, and the hours of clinical orthodontic training in the first and second years of residency. Combined programs (university and hospital) and programs that provided second-year residents with greater than six clinical orthodontic hours per week treated more dental Class III cases (p<.01). More hours in the second year also increased the orthodontic treatment of dental impactions (p<.01), while more clinical hours in the first year increased the treatment of both dental Class II and deep bite (p<.01). Interestingly, having a full-time orthodontist on faculty only increased the treatment of skeletal Class II (p<.01), while having a part-time orthodontist or an orthodontist from an affiliated graduate orthodontic program did not alter the conditions treated.

Although a comparison was made between the types of orthodontic therapies rendered and the program variables, no significant associations were found.

Table 4. A comparison of the individual program characteristics with the types of malocclusions treated with orthodontics

Program Characteristics	Deep Bite	Open Bite	Molar Uprighting	Dental Class II	Skeletal Class II	Dental Class III	Skeletal Class III	Impacted Teeth	Serial Extraction
Type Program									
Univ (n=11)	54.5%	72.7%	72.7%	63.6%	18.2%	*27.3%	9.1%	27.3%	90.9%
Hosp (n=18)	44.4	55.6	66.7	44.4	16.7	*27.8	0.0	27.8	77.8
Combo (n=23)	69.6	56.5	65.2	78.3	34.8	*69.6	17.4	52.2	60.9
Affil Ortho Pgm									
Yes (n=39)	64.1%	61.5%	66.7%	69.2%	30.8%	53.8%	12.8%	43.5%	74.4%
No (n=8)	37.5	50.0	65.2	50.0	12.5	25.0	0.0	37.5	62.5
F/T Orthodontist									
Yes (n=14)	78.6%	64.3%	71.4%	78.6%	*50.0%	57.1%	14.3%	57.1%	78.6%
No (n=37)	51.4	59.5	64.9	59.5	*16.2	43.2	8.1	32.4	73.0
P/T Orthodontist									
Yes (n=39)	59.0%	61.5%	66.7%	66.7%	33.3%	48.7%	7.7%	41.0%	76.9%
No (n=12)	58.3	58.3	66.7	57.3	23.1	41.7%	16.7	33.3	66.7
% Public Assistance									
0-60% (n=12)	58.3%	50.0%	66.7%	50.0%	16.7%	33.3%	0.0%	8.3%	75.0%
61-80% (n=17)	70.6	70.6	64.7	76.5	47.1	58.8	17.6	52.9	82.4
81-100% (n=23)	47.8	56.5	69.6	60.9	13.0	43.5	8.7	43.5	65.2
1st Yr Clinic Hrs/Wk									
0-3 (n=12)	*25.0%	33.3%	66.7%	*33.3%	0.0%	25.0%	0.0%	25.0%	75.0%
4-6 (n=28)	*64.3	71.4	64.3	*67.9	32.1	50.0	10.7	39.3	82.4
6-8 (n=11)	*81.8	63.6	81.8	*90.9	36.4	63.6	18.2	54.5	65.2
2nd Yr Clinic Hrs/Wk									
0-6 (n=37)	51.4%	56.8%	62.2%	52.1%	21.7%	*35.1%	8.1%	*22.7%	73.0%
6-8 (n=14)	71.4	71.4	78.6	85.7	35.7	*71.4	14.3	*64.3	71.4
Orthodontist from Affiliated Ortho Program									
Yes (n=20)	65.0%	70.0%	79.0%	80.0%	35.0%	60.0%	20.0%	45.0%	70.0%
No (n=18)	61.1	61.1	72.2	55.6	24.8	33.3	5.6	33.3	83.3
No Pgm (n=9)	55.6	55.6	77.8	66.7	27.7	55.6	0.0	44.4	77.8

*p<.01

Discussion

The 87 percent response rate of this survey was exceptional in comparison to the expected response rate of mailed surveys.[5,6] Because nearly all programs responded, the results do not simply reflect a sample of the population but, for practical purposes, describes the population as a whole. Since multiple chi-square tests were used for the described variables, the significance level was set at p<.01 to control for random associations.

Closed-ended questions were used to allow statistical comparisons to be made between program characteristics and the orthodontic education provided to pediatric dental residents. Unfortunately, since no definitions of conditions or therapies were included in the survey, those responding may have inaccurately categorized different concepts.

Similar to Rawlings'[1] findings in 1977, the results of this survey indicated that residents in pediatric dental residency programs provided treatment of the following conditions: space maintenance, anterior cross bite, posterior cross bite, ectopic eruption, habits, space regaining, dental Class I, and minor rotation/malposition. Treatment varied for more advanced conditions such as serial extraction, molar uprighting, dental Class II, open bite, deep bite, dental Class III, dental impactions, skeletal Class II, and skeletal Class III. However, the number of programs providing serial extraction therapy in the present study was only 73 percent in comparison to the 91 percent reported in Rawlings' 1977 study. This may simply reflect the current trend in nonextraction therapy seen in cases treated by orthodontists, though this relationship was not evaluated.[7-9]

In our study, most programs utilized fixed rapid palatal expanders (96 percent) and removable Hawley appliances with finger springs (92 percent). The use of removable appliances was similar to Rawlings' reported finding of 98 percent, but the use of rapid palatal expanders in our study was higher than the previous report of 82 percent. Only 50 percent of programs in the previous study used full-banded techniques, but 81 percent of programs today used straight wire therapy and 71 percent today used utility archwires. Extra-oral force, such as headgear, however, had decreased from Rawlings' reported 95 percent to a surprising 56 percent in our study. This may indicate that patient compliance is lower today, requiring the use of options such as intra-arch distalization appliances (52 percent of programs use these today), that more options have become available for use, or that more residencies send these cases to orthodontists for treatment.

Our survey demonstrated a similar number of clinical hours devoted to orthodontics per week in the first and second years of residency (four to six hours) compared to Rawlings (3.7 hours).[1] Most programs in the present study also provided residents with six to ten case starts. In comparison to recently surveyed graduate orthodontic residencies,[4] pediatric dental residents began approximately one-fifth of the number of orthodontic cases reported as being started by orthodontic residents. The amount of time spent by pediatric dental residents in providing such clinical orthodontic treatment was also approximately one-fifth of the reported clinical time spent by orthodontic residents.

Interestingly, though public assistance funding seldom covers orthodontic treatment, the number of public assistance patients treated in residencies did not affect the amount of orthodontic treatment provided. The reason for this was not determined in this study, but may be due to an attempt by many programs to provide a broad education base in order to attract well-qualified candidates.

Rawlings[1] found that 69 percent of programs had university-trained orthodontists on faculty, of which 85 percent were from an affiliated graduate orthodontic program. In the present study, 10 percent of programs had no orthodontist on faculty, 28 percent had one or more full-time orthodontists, and 77 percent had one or more part-time orthodontists. However, only 43 percent of those who had an affiliated graduate orthodontic program had an orthodontist on faculty from the affiliated program. Though no reason for this finding was ascertained in our study, this may suggest a changed relationship between pediatric dental residency programs and orthodontic residency programs. This could also be a reflection of the growing shortage of faculty in graduate orthodontic programs.[4,10]

Having a full-time orthodontist on faculty increased the treatment of skeletal Class II malocclusions ($p<.01$). However, the presence of a full-time or part-time orthodontist did not impact the number of case starts or the stages of dental development treated.

It was expected that having an affiliated graduate orthodontic program would have decreased the number of case starts in pediatric dental residencies, but this was not found. In fact, having an affiliated graduate orthodontic program did not affect the number of orthodontic cases started, although the small number of programs without affiliated orthodontic programs may have complicated this finding.

As expected, the number of clinical orthodontic hours in the first and second years did affect the number of case starts ($p<.01$). With more clinical hours in each year, residents were beginning more cases. In addition, programs with more clinical hours devoted to orthodontics in the first and second years of residency treated more advanced conditions. The treatment of deep bite and dental Class II increased with more clinic hours in the first year, while the treatment of dental Class III and dental impactions increased with more clinic hours in the second year. In Tables 3 and 4, it should be noted that the number of clinic hours compared in the first year were broken into smaller increments than within the second year. This was done to form more equal groups for the analyses and to allow the findings to be more descriptive in nature.

Finally, although not significant statistically, program directors who had held that position for less than five years anticipated an increase (42 percent) in the amount of orthodontic case starts in the next five years over those who had held that position longer (12 percent). This may suggest a future trend toward increasing the amount of orthodontic education in pediatric dental residencies.

Conclusions

Contrary to our hypothesis, we found that the amount of orthodontic training in pediatric dental residencies has not decreased in the past five years and is not projected to decrease in the next five years.

The results of this survey indicate that U.S. pediatric dental residency programs have the following characteristics in regard to orthodontic training:

1. In most programs, residents:
   - provide orthodontic treatment in the primary, early mixed, and late mixed dentitions;
   - spend one-half to one full day per week providing orthodontic treatment to patients;
   - start six to ten orthodontic cases;
   - provide space maintenance, space regaining, and treat anterior crossbites, posterior crossbites, ectopic eruptions, habits, dental Class I malocclusions, and minor rotations/malpositions using orthodontic therapy; and
   - use fixed rapid palatal expanders, removable Hawley appliances with finger springs, and straight archwire therapy.
2. The malocclusions treated are generally not dependent on whether an orthodontist, who is part-time or from an affiliated orthodontic program, is on faculty, but did increase in complexity with more clinical orthodontic hours in the first and second years of the residency.
3. Full-banded orthodontic cases (including straight wire and utility arch wires) have increased since last surveyed in 1977, although extraoral appliance use has decreased.

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