

# Orthodontic treatment timing: A survey of orthodontists

Erica Y. Yang, BS,<sup>a</sup> and H. Asuman Kiyak, MA, PhD<sup>b</sup>

Seattle, Wash.

There has been much debate with respect to the ideal time to initiate orthodontic treatment. Recent clinical trials have tested the effects of early orthodontic treatment. The purpose of this study was to understand orthodontists' perspectives on the best time to initiate treatment, factors that preclude early treatment, and experiences with compliance or adherence problems among their younger patients. Questionnaires were distributed to 335 practicing orthodontists throughout the United States. Respondents were first asked to indicate the best stage to initiate orthodontic treatment for 41 different types of occlusal deviations. They were then asked what conditions might preclude early orthodontic treatment. After one reminder, 137 questionnaires (41%) were returned. The sample consisted of practitioners with 3 to 52 years of experience and represented 46 different orthodontic training programs; 19% were female. The majority (92%) were in private practice. Among the 41 conditions listed, orthodontists would most likely treat 21 in the early mixed dentition, especially anterior crossbites (> 76%); 13 in the late mixed dentition, especially deepbite (> 60%) and mandibular inadequacy (> 59%); and 4 in either stage. Only two conditions would be treated in later stages (maxillary midline diastema, 43%; and congenitally missing teeth, 39%). One third would postpone treating mandibular prognathism until adulthood. Patient variables that precluded treatment were behavior (98%) and compliance (96%) problems. Finances (76%) and family disruptions (57%) were less important deterrents to treatment. Orthodontists' experience with Phase I treatment influenced their decisions ( $p < 0.01$ ). Orthodontists who have been in practice longer were more likely to treat temporomandibular joint sounds ( $p < 0.003$ ) and deviations in opening ( $p < 0.002$ ) than less experienced orthodontists; the latter were more likely to refer such patients to temporomandibular disorder specialists. These findings suggest that early orthodontic intervention is the norm, but practice characteristics affect treatment timing. (*Am J Orthod Dentofacial Orthop* 1998;113:96-103.)

**T**here has been considerable discussion in the orthodontic literature regarding the biological and clinical advantages and disadvantages of early orthodontic treatment. Some orthodontists have argued that early treatment of early or mixed dentition with Phase I orthodontics reduces the time needed for Phase II treatment or can prevent it altogether. Others have argued that Phase I treatment has no long-term benefits. Moyers<sup>1</sup> suggests that early treatment can take advantage of normal growth to correct malocclusions before they become severe. He points out that some forms of treatment can only be done at an early age, and early treatment of deleterious habits is easier than treatment after

years of habit reinforcement. Compliance is also believed to be greater because younger patients are considered to be more cooperative and attentive than adolescents. However, Moyers warns that there is no assurance that the results of early treatment will be sustained. Improper early treatment can be harmful, and two-phase treatment may lengthen treatment time. Early treatment not only may do some damage or prolong therapy, it may exhaust the child's spirit of cooperation and compliance.

Dugoni and Lee<sup>2</sup> provide a case report discussing the advantages of initiating treatment in the mixed dentition. They suggest that the time required for treatment in the second phase of treatment can be reduced by initiating Phase I treatment between the ages of 7 and 9 years. They concur with Moyers that young patients are more adherent with orthodontic treatment and headgear therapy than most adolescent patients, in addition to their greater growth potential.

Moyers<sup>1</sup> discusses the advantages and disadvantages of orthodontic treatment during adolescence.

Supported by a Summer Research Fellowship, from the University of Washington Dental Alumni Association.

<sup>a</sup>Dental student, University of Washington.

<sup>b</sup>Professor, Department of Oral and Maxillofacial Surgery, University of Washington.

Reprint requests to: H. Asuman Kiyak, MA, PhD, Department of Oral and Maxillofacial Surgery, Box 357134, Seattle, WA 98195-7134

Copyright © 1998 by the American Association of Orthodontists.

0889-5406/98/\$5.00 + 0 8/1/86797

Because practitioners do not need to counter the unpredictable dynamics of growth, treatment goals can be more definitive in the older child. Motivation for treatment may also be higher than during earlier periods of development because the adolescent is often more concerned about facial esthetics. This may be counterbalanced by lower levels of adherence because of other interests and conflicts in parent-child relationships during adolescence.<sup>3</sup> Furthermore, because occlusion is fully established and root formation is complete, tooth positioning is often more difficult than during the early or mixed dentition stage. The time required for treatment in adolescents and adults may be longer for some malocclusions.

The pros and cons of early versus late treatment have been discussed by other orthodontists. McNamara and Brudon<sup>4</sup> reinforce Moyers' argument that early treatment can eliminate or modify skeletal, muscular, and dentoalveolar abnormalities before the eruption of the full permanent dentition. Others have suggested specific conditions that are best treated in the deciduous or early mixed dentition. For example, Viazis<sup>5</sup> recommends treatment of dental habits in primary dentition and crossbite in early mixed dentition. However, he suggests that fixed appliances are equally effective for treating crowding, Class II malocclusions, deep bite, open bite, Class III maxillary deficiency, and mandibular prognathism in the permanent dentition. Ghafari<sup>6</sup> notes that crossbites and overjet that could cause trauma of the maxillary incisors should be treated in early or midchildhood. Nelson<sup>7</sup> concurs that crossbites, overjet greater than 8 mm in females, maxillary midface deficiency, moderate crowding, congenitally missing teeth, management of supernumerary teeth, some midline discrepancies, and habits would likely benefit from Phase I treatment. On the other hand, he points out that the benefits of early treatment of crowding and Class II malocclusions have not been fully answered by research.

Other orthodontists have opposed early orthodontic intervention for most patients. Gianelly<sup>8</sup> notes that crowding can be easily treated with a nonextraction approach in at least 85% of all patients when treatment is started in the late mixed dentition, unless conditions require the placement of a lingual arch at an earlier age. This conclusion is based on his analysis of mandibular models of 100 patients with mixed dentition. In a subsequent article, Gianelly<sup>9</sup> suggests that at least 90% of all growing patients can be treated in only one phase treatment in the late mixed dentition. In particular, he argues that Class II malocclusions with or without crowding can be corrected in 90% of children in the late mixed dentition. He bases these conclusions

on a review of earlier longitudinal studies of treatment for Class II malocclusions.

Pietila et al.<sup>10</sup> examined dentists' perceptions of need for treatment among 260 children aged 7-8 years who experienced functional and occlusal deviation, as well as some craniomandibular disorders. They found that the main indications for early intervention were Class II malocclusions, lateral crossbite, and crowding, which are not necessarily functional problems. Furthermore, the three general dentists in that study were more likely to recommend early intervention than the orthodontist.

In order to investigate the pros and cons of early treatment, several longitudinal clinical trials on the correction of Class II malocclusions have been undertaken. Their findings have recently been published. Based on the preliminary results of a clinical trial at the University of North Carolina, Tulloch et al.<sup>11-13</sup> suggest that early treatment with either headgear or functional appliances can reduce the severity of a Class II skeletal pattern, and improve the relationship of the jaws in most children. However, they point out that it is difficult to predict if all patients treated with headgear or functional appliances will show a favorable growth response.

On the basis of another randomized clinical trial at the University of Florida, Keeling et al.<sup>14-15</sup> concur with the University of North Carolina researchers that both headgear and bionator treatments in early ages (average age, 9.5 years) can result in stable skeletal changes. However, dental relapse was found at the 6-month follow-up even with the use of retainers on alternate nights. From the preliminary findings of the other randomized prospective clinical trial on the early treatment of Class II malocclusion, Ghafari et al.<sup>16</sup> suggest that treatment in late childhood may be as effective as in midchildhood. They also suggest that orthodontics in late childhood may be more practical and cost-effective because it reduces total treatment time. However, Tulloch et al.<sup>11-13</sup> point out that treatment timing is only important in the long term. If treatment outcomes are sustained over time, it may not matter whether orthodontic intervention was begun in early, middle, or late childhood.

## OBJECTIVES OF CURRENT STUDY

Given these debates among orthodontists and the mixed findings of clinical studies, the purpose of the current study was to understand orthodontists' perspectives with respect to the best time to initiate treatment, factors that preclude early treatment, and their experiences with compliance or adherence problems among their younger patients. The questionnaire was administered to practicing orthodon-

tists throughout the United States. In this manner, current patterns of orthodontic practice could be ascertained. A secondary aim of this study was to assess the relationship between orthodontists' perceptions and their gender, number of years of practice, and clinical experience with younger versus older patients.

## METHODS

### Sample

Questionnaires were distributed to 335 practicing orthodontists throughout the United States. Almost half ( $n = 162$ ) of these were orthodontists whose names were randomly selected from the 1997 directory of the American Association of Orthodontists. Another group consisted of 46 orthodontists from the directory of the Midwest Component of the Edward H. Angle Society of Orthodontists. Another 85 questionnaires were distributed at the 19th annual meeting of the College of Diplomates of the American Board of Orthodontics (CDABO). The fourth group consisted of 42 orthodontists whose names were obtained from the six colleagues around the country who collaborated on this study. Questionnaires were mailed to practitioners with 1 to 52 years of experience (mean, 18.07 years; standard deviation [SD], 8.86 years), representing 58 different orthodontic training programs throughout the United States. This group included 73 females (21.8%); 169 were board certified (50.5%).

These 335 orthodontists received a questionnaire with a letter describing the purpose of the study. They were asked to complete the questionnaire with no personal identifiers and return it in a postage-paid return envelope. Three weeks after the packets were mailed, reminder postcards were sent ( $n = 236$ ), excluding orthodontists who had previously declined our request to complete the questionnaire ( $n = 3$ ), who had requested results of the study after they mailed the questionnaire back to us ( $n = 11$ ), or who had attended the CDABO meeting ( $n = 85$ ). This resulted in a final sample of 137 completed questionnaires (40.9% completion rate).

### Instrument

To develop the questionnaire, a list of the most common malocclusions were obtained from the literature and textbooks. On the basis of that list, a first draft of the questionnaire was developed. The questions were then revised and refined by three faculty members in the Department of Orthodontics at the University of Washington Dental School and four orthodontists in private practice around the

country. With their input, other occlusal conditions were added to the list. The final list had 41 types of occlusal deviations; some of these distinguished between male and female patients and others specified extent of deviation (e.g.,  $> 6$  mm overjet,  $> 10$  mm overjet). Still others described potential effects of the deviation (e.g., anterior crossbite with signs of attrition, severe crowding with significant periodontal concerns). Other conditions requiring orthodontic treatment, such as oral-facial habits, mouth breathing, and temporomandibular disorders (TMD) were also listed. (See Appendix.)

In the second section of this questionnaire, respondents were asked to indicate any conditions that they perceived as precluding early orthodontic intervention. Finally in the third section, they were asked to indicate the proportion of cases they had treated with Phase I orthodontics in the past 3 years. Of this percentage, they were asked what proportion had been treated with headgear, expanders, functional appliances, and other methods.

Demographic information obtained from the respondents included length of time in practice, training program completed, gender, type of practice, and proportion of patients of different ages treated in the practice (i.e., 6 to 8 years old, 8 to 11 years old, 12 to 18 years old, and  $> 18$  years old), as well as the proportion treated with conventional versus surgical orthodontics. The questionnaires were designed to be anonymous, and took 20 to 40 minutes to complete.

### Statistical method

Because the primary purpose of this study was to examine variations in treatment timing, the first level of analysis was simple descriptive statistics. The frequency of treating each occlusal deviation at the specific ages was determined, along with the rank order of each condition for early versus late intervention.

Comparisons across groups (gender, practice experience, and proportion of patients in each age group) were conducted with a series of chi square tests of association for each occlusal deviation and condition that precluded early intervention.

## RESULTS

The 137 orthodontists who completed this questionnaire included 25 (18.8%) women, practitioners with 3 to 52 years of experience (mean, 20.6 years; SD, 10.41 years), and represented 46 different orthodontic training programs throughout the United States. Thus, the respondents were representative of

**Table I.** Occlusal deviations rated as best treated in the early mixed dentition stage (*n* = 129 orthodontists)

Occlusal deviations	Percentage of orthodontists
Anterior crossbite with signs of attrition or periodontal abnormalities	85.9
Anterior crossbite with functional shift	83.0
Ectopic development and eruption of incisors	78.2
Anterior crossbite without signs of attrition or periodontal abnormalities	77.8
Anterior crossbite without functional shift	76.3

the larger group and of AAO members. The orthodontic training programs most widely represented by this sample were Northwestern University (*n* = 13, 9.7%), the University of Illinois at Chicago (*n* = 12, 9.0%), and the University of Iowa (*n* = 10, 7.5%). Most respondents indicated that they spent more than 80% of their time in either solo (64.4%) or group/partnership private practice (27.4%). Although many reported a wide range of patient age groups, the greatest proportion of orthodontists reported that their patients were adolescents/teens between 12 and 18 years old (mean, 44.4%; SD, 15.95), followed by children between 8 and 11 years old (mean, 26.6%; SD, 12.75), and adults (mean, 19.8%; SD, 11.03). Least common were young children between 6 and 8 years old (mean, 9.5%; SD, 7.85). Most of their treatment was conventional orthodontics (mean, 94.8%; SD, 4.45).

When asked to indicate the best stage to initiate orthodontic treatment for each occlusal deviation, orthodontists favored the mixed dentition stage for most conditions. Of 41 occlusal deviations, they would most likely treat 21 conditions in the early mixed dentition stage, 13 in the late mixed dentition stage, and 4 in either stage. They would treat 2 conditions, maxillary midline diastema > 2 mm and congenitally missing permanent teeth, in either the late mixed (35.3% and 43.0% respectively), or the permanent dentition stage (41.4% and 39.3% respectively). Only one condition, mandibular prognathism, was thought to be most appropriately treated in the adult dentition stage (33.3%).

Tables I and II present occlusal deviations that the majority of respondents would treat in the early or late mixed dentition stage. It is noteworthy that all four types of anterior crossbite described (i.e., with and without a functional shift and with and without periodontal outcomes) were the most likely of all malocclusions to be treated in the early mixed dentition stage. Among the four types of deepbite described on the questionnaire, the majority pre-

**Table II.** Occlusal deviations rated as best treated in the late mixed dentition stage (*n* = 129 orthodontists)

Occlusal deviations	Percentage of orthodontists
Deepbite (>5 mm without palatal impingement)	61.4
Deepbite (>5 mm without dental wear)	60.7
Moderate mandibular retrognathia in males	60.2
Moderate mandibular retrognathia in females	59.4
Overjet (>6 mm without interdental spacing)	58.2

ferred treating the condition in the late mixed dentition stage if there was no dental wear or palatal impingement. In fact, one fourth of respondents preferred to treat these problems in the permanent dentition stage. However, if the child showed signs of dental wear or palatal impingement, responses were mixed; half would treat earlier and almost half would treat in the late mixed dentition stage. These orthodontists also made few distinctions in timing the treatment of male versus female patients. The majority of the conditions they preferred to treat in the late mixed dentition stage would enhance the growth of a retrognathic mandible in both boys and girls at this age (60.2% and 59.4%, respectively). In contrast, they would prefer to correct maxillary midface deficiency in the early mixed dentition stage (56.7% and 59.0%, respectively).

The survey also asked at what stage various functional problems should be corrected. The majority of respondents reported that they would treat all these conditions in the early mixed or deciduous dentition. In particular, almost 90% would treat thumb/finger sucking early; 73% would correct malocclusion causing speech disorders early; and 63% would treat tongue posture abnormalities and swallowing problems at an early stage of development. The two remaining conditions (mouth breathing and faulty position of lower lip) would be treated in these stages by approximately 50% of respondents. More than 25% indicated that they would prefer to initiate orthodontics for these two conditions in the late mixed dentition.

The majority of respondents indicated that they would undertake orthodontic correction of most TMDs in the permanent dentition stage, if at all. Table III presents TMD conditions that require treatment in the permanent dentition stage. However, of all the malocclusions and functional problems listed, temporomandibular joint (TMJ) sounds and deviations on opening were most likely to be referred to a specialist (44.4% and 25.0%, respectively). More than one third (36.4%) would treat

**Table III.** TMJ conditions requiring treatment in the permanent dentition stage ( $n = 129$  orthodontists)

Temporomandibular disorders	Percentage of orthodontists
Pain on palpation in the TMJ area	35.1
Limitation in maximal opening	33.3
Spontaneous pain in the TMJ area	31.8
Bruxism	28.0
Episodic joint locking	26.2
Deviations in opening	20.5
TMJ sounds*	20.3

\*44.4% (the largest proportion) indicated that they would refer this condition to a specialist.

**Table IV.** Factors that would preclude early orthodontic treatment ( $n = 132$  orthodontists)

Concerns	Percentage of orthodontists
Child with behavior problems	97.7
Poor compliance with appliance wear	96.2
Poor oral hygiene	94.0
Child objects to treatment	90.1
Financial difficulties of parents	77.4
Child with medical complications or disabilities	75.9
Child with other disruptions (e.g. new school, recent move)	57.9
Child with family disruption	57.1

patients with spontaneous TMJ pain, and 45.5% would treat bruxism in the mixed dentition stage.

Table IV presents factors that were likely to preclude early orthodontic treatment. By far the greatest concerns of these orthodontists were related to the child's behavior and attitudes regarding treatment. Children who demonstrated management problems were of greatest concern (97.7%), followed by poor compliance (96.2%), poor oral hygiene (94.0%), and objection to treatment (90.0%). Family disruptions were less of a concern (57%), with financial difficulties and medical complications presenting a concern for more than three fourths of the orthodontists (77.4% and 76%, respectively).

The second aim of this research was to test the association of treatment timing with orthodontists' gender, years of practice, and experience with child patients. Chi square tests showed that the female orthodontists who completed the questionnaire had been in practice for a shorter period than male orthodontists; 72% had practiced less than 12 years ( $\chi^2 = 35.5$ ;  $df 3$ ;  $p < 0.001$ ). Both male and female orthodontists with less than 12 years of experience have more child patients than more experienced orthodontists ( $\chi^2 = 9.52$ ;  $df 3$ ;  $p < 0.03$ ). The

**Table V.** Proportion of orthodontists who prefer treating early mixed dentition as a function of experience with young patients

Condition	Percentage of Child patients		p
	>25%	<25%	
Overjet >10 mm without spacing	71%	52%	0.02
Midline Discrepancy >2 mm	16	4	0.01
Skeletal openbite >1 mm	55	30	0.02
Deepbite >5 mm	21	7	0.001
Moderate crowding	27	11	0.002
Severe crowding with esthetic concerns	74	51	0.01
Severe crowding with asymmetry	73	53	0.03

number of years of practice experience was also associated with board certification; non-board certified orthodontists (41%) generally had less than 12 years of experience ( $\chi^2 = 38.17$ ;  $df 6$ ;  $p < 0.001$ ). The type of practice was also linked to the patient age group. Orthodontists in solo practice had more child patients and fewer adult patients than did orthodontists in group or institutional practice ( $\chi^2=7.40$ ;  $df 2$ ;  $p < 0.03$ ).

Chi square tests also showed that orthodontists' decisions in treatment timing are influenced by several individual characteristics. For example, orthodontists with more than 20 years of experience would most likely treat obvious skeletal openbite > 1 mm in the late mixed dentition stage, rather than the early mixed dentition stage chosen by less experienced orthodontists ( $\chi^2 = 16.68$ ;  $df 6$ ;  $p < 0.01$ ). Female orthodontists would more likely treat moderately retrognathic mandibles in the early mixed dentition stage, whereas male orthodontists chose the late mixed dentition stage ( $\chi^2 = 8.58$ ;  $df 1$ ;  $p < 0.003$ ). For severe crowding with significant esthetic concerns, orthodontists in solo or group practice would more likely initiate treatment in the early mixed dentition stage, whereas orthodontists in dental school chose the late mixed dentition stage ( $\chi^2 = 9.53$ ;  $df 2$ ;  $p < 0.01$ ).

Experience with patients of diverse ages also influenced orthodontists' decisions in treatment timing. Those who have more patients of younger ages in their practice would correct occlusal deviations earlier, whereas orthodontists with fewer younger patients would initiate treatment later. For example, if young patients (6 to 8 years) made up more than 10% of a practice, orthodontists would treat mandibular prognathism and posterior crossbite earlier than orthodontists with fewer than 10% young patients ( $\chi^2 = 12.26$ ;  $df 4$ ;  $p < 0.02$ ; and  $\chi^2 = 7.69$ ;  $df 2$ ;  $p < 0.03$ , respectively). Tables V, VI, and VII present the findings on the association between

**Table VI.** Proportion of orthodontists who prefer treating early mixed dentition as a function of experience with teen patients

Condition	Percentage of teen patients		p
	<25%	>25%	
Overjet >10 mm without spacing	71%	52%	0.02
Midline discrepancy > 2 mm	16	4	0.01
Skeletal openbite > 1 mm	55	30	0.02
Deepbite > 5 mm	21	7	0.001
Moderate crowding	27	11	0.002
Severe crowding with esthetic concerns	74	51	0.01
Severe crowding with asymmetry	73	53	0.03
Congenitally missing permanent teeth	23	8	0.03
Ectopic development of cuspids	42	22	0.03
Retrognathic mandible (male patients)	10*	33*	0.005

\*None would treat in early mixed dentition. These reflect *late* mixed dentition as earliest preferred stage.

experience with patients of different ages and the orthodontist's decision to initiate treatment in the mixed dentition. It is apparent that orthodontists who treat younger patients are more comfortable with initiating treatment in the early mixed dentition. They are particularly more likely than orthodontists with fewer young patients to recommend early treatment for overjet > 10 mm, severe crowding, and skeletal openbite (see Table V). Conversely, orthodontists with more teen/adolescent patients are less likely to initiate treatment for many conditions until the late mixed or permanent dentition stage (see Table VI). Orthodontists with more Phase I experience were also more likely to recommend early intervention. As shown in Table VII, most of the same conditions in Table VI would be corrected earlier by orthodontists who had more experience with Phase I patients.

For most TMDs, orthodontists with more than 20 years of experience were more likely to treat patients complaining of TMJ sounds ( $\chi^2 = 19.77$ ; df 6;  $p < 0.003$ ) and deviations in opening ( $\chi^2 = 20.72$ ; df 6;  $p < 0.002$ ) than less experienced orthodontists; the latter were more likely to refer such patients to TMD specialists or would choose not to initiate orthodontic treatment at all. These results are consistent with reports of treatment decisions regarding specific malocclusions; the longer an orthodontist has been in practice, the more likely he or she is to treat a broader array of occlusal conditions.

## DISCUSSION

As mentioned earlier, there has been considerable debate with respect to the ideal time to initiate orthodontic treatment. Much of the debate has emerged from individual orthodontists' own experi-

**Table VII.** Proportion of orthodontists who prefer treating early mixed dentition as a function of Phase I experience

Condition	Patients treated with Phase I orthodontics		p
	>45%	<45%	
Midline discrepancy >2 mm	23%	7%	0.02
Skeletal openbite >1 mm	69	36	0.01
Posterior crossbite	31*	4*	0.001
Deepbite >5 mm without palatal impingement	39	6	0.001
Deepbite >5 mm without dental wear	34	6	0.001
Moderate crowding	48	10	0.001
Severe crowding with significant asymmetries	85	56	0.01
Congenitally missing permanent teeth	28	11	0.002
Ectopic development of cuspids	58	26	0.003
Retrognathic mandible (male patients)	40†	16†	0.02

\*Based on preference for treating condition in deciduous dentition.

†None would treat in early mixed dentition. These reflect *late* mixed dentition as earliest preferred stage.

ences. The findings of clinical studies suggest that Phase I orthodontics may be appropriate for some conditions but can also result in more relapse, reduced patient motivation for the second phase of treatment, and other potential hazards.<sup>5-10</sup> Nevertheless, the experiences of many practitioners who have published their opinions suggest that early intervention has many advantages.

Although the results of this study concur with these previous reports in most cases, the 137 orthodontists who responded to this survey recommended early treatment for more varied conditions than previously reported. For example, in a study of practitioners' decisions regarding treatment of actual cases, Pietila et al.<sup>10</sup> found that the conditions most likely to be treated with Phase I orthodontics were Class II malocclusion, lateral crossbite, and crowding. The orthodontist and three general dentists in that study were least likely to initiate early treatment for functional problems. In the current survey, orthodontists generally preferred early intervention for thumb/finger sucking, tongue posture abnormalities, problems with swallowing, and malocclusions resulting in speech disorders.

The results of this study also show that practice characteristics affect orthodontists' decisions regarding orthodontic treatment timing. Experience with Phase I orthodontics and with different patient age groups was most likely to influence their decisions. Of 41 occlusal deviations, treatment timing of 14 conditions was likely to be influenced by the orthodontists' experience. That is, respondents with more patients in the younger age groups were likely

to recommend early intervention, whereas those with more adolescent or teen patients preferred to postpone treatment until this age. Thus, a self-fulfilling prophecy apparently emerges for most practitioners: "If I obtain good outcomes by initiating treatment at a younger/older age, then I must be making the right decision as to when to recommend treatment."

These results underscore the conclusions reached by Tulloch et al.<sup>11-13</sup> that treatment timing does not matter as long as the desired outcomes are sustained over time. More importantly, these findings suggest that the decision to initiate orthodontics early or to postpone it should be based on the preferences of the child and the parents. The varied experiences of orthodontists in this survey reveal the wide range of acceptable treatment timing, and the need to thoroughly discuss with potential patients the advantages and disadvantages of single and two-phase orthodontics before imposing one's own treatment bias on these patients.

A few orthodontists who participated in this study pointed out that their diagnosis and treatment plans would generally be based on dental, skeletal, facial, functional, and radiographic findings. Because of the survey nature of this study, the questionnaire did not include details about each condition, nor was each condition described in the context of a real patient. As a result, the orthodontists' responses represented their "ideal world" decisions. The fact that practice experience influenced their tendency toward early versus later intervention suggests that the questionnaire fulfilled its purpose, i.e., to determine variations among practicing orthodontists in their preferences for treatment timing and what factors influence these decisions. The findings also offer some reassurance that patients can experience successful outcomes, regardless of whether orthodontic treatment is initiated early or completed later in a single phase.

We acknowledge the valuable suggestions offered by several colleagues in developing the questionnaire and providing names of orthodontists for the sample. In particular, we thank Drs. Anne-Marie Bollen, Rebecca Poling, Douglas S. Ramsay, Tom M. Graber, Gregory J. King, R. William McNeill, E. Dianne Rekow, David M. Sarver, and David Turpin for their input on this study.

#### REFERENCES

1. Moyers RE. Handbook of orthodontics, 4th ed. Chicago: Year Book Medical Publishers; 1988. p. 346-7, 433-4.
2. Dugoni SA, Lee JS. Mixed dentition case report. Am J Orthod Dentofac Orthop 1995;107:239-44.
3. Erikson E. Identity: Youth and crisis. New York: Norton; 1968. p. 128-34.

4. McNamara JA Jr, Brudon WL. Orthodontic and orthopedic treatment in the mixed dentition. Ann Arbor: Needham Press; 1993. p. 3-6.
5. Viazis AD. Efficient orthodontic treatment timing. Am J Orthod Dentofac Orthop 1995;108:560-1.
6. Ghafari JG. Emerging paradigms in orthodontics. Am J Orthod Dentofac 1997; 111:573-80.
7. Nelson G. Phase I treatment. Am J Orthod Dentofac Orthop 1997;111:239-40.
8. Gianelly AA. Crowding: timing of treatment. Angle Orthod 1994;64:415-8.
9. Gianelly AA. One-phase versus two-phase treatment. Am J Orthod Dentofac Orthop 1995;108:556-9.
10. Pietila T, Pietila I, Vaataaja P. Early screening for orthodontic treatment. Community Dent Oral Epidemiol 1992;20:208-13.
11. Tulloch JFC, Phillips C, Proffit WR. Early versus late treatment of Class II malocclusion: preliminary results from the UNC clinical trial. In: McNamara JA Jr, editor. Orthodontic treatment: outcome and effectiveness. Craniofacial Growth Series. Ann Arbor: Center for Growth and Development, University of Michigan; 1995. p. 113-38.
12. Tulloch JFC, Phillips C, Koch G, Proffit WR. The effect of early intervention on skeletal pattern in Class II malocclusion: a randomized clinical trial. Am J Orthod Dentofac Orthop 1997;111:391-400.
13. Tulloch JFC, Proffit WR, Phillips C. Influences on the outcome of early treatment for Class II malocclusion. Am J Orthod Dentofac Orthop 1997;111:533-42.
14. Keeling SD, King GJ, Wheeler TT, McGorray S. Timing of Class II treatment: rationale, methods, and early results of an ongoing randomized clinical trial. In: McNamara JA Jr, editor. Orthodontic treatment: outcome and effectiveness. Craniofacial Growth Series. Ann Arbor: Center for Growth and Development, University of Michigan; 1995. p. 81-112.
15. Keeling SD, Wheeler TT, King GJ, Garvan CW, Cohen DA, Cabassa S, et al. Anteroposterior skeletal and dental changes following early Class II treatment with bionators and headgears: result from a randomized controlled trial. Am J Orthod Dentofac Orthop 1998;113:40-50.
16. Ghafari JG, Shofer FS, Laster LL, Markowitz DL, Silverton S, Katz SH. Monitoring during orthodontic treatment. Semin Orthod 1995;1:165-75.

#### APPENDIX

##### 1. List of malocclusions\*

*Instructions:* For each condition below, at which stage of development would you prefer to initiate orthodontic treatment (i.e., not record taking, but ordering extractions, placing fixed and removable appliances)? Assume you have been following the patient's occlusal development since age 4-6 years (taking appropriate records along the way). Circle the number that represents the stage when you would most likely want to initiate orthodontic treatment for a child who has one of these conditions listed below as their primary orthodontic problem.

\*Response scale for each question:

X 1 2 3 4 5

where: X = No treatment needed

1 = Deciduous dentition (4 to 6 years)

2 = Early mixed dentition

3 = Late mixed dentition

4 = Permanent dentition

5 = Adult dentition (16+ years)

##### A. OCCLUSAL DEVIATIONS

1. Moderate mandibular retrognathia
  - a. males
  - b. females
2. Overjet
  - a. >6 mm with interdental spacing
  - b. >6 mm without interdental spacing
  - c. >10 mm with interdental spacing
  - d. >10 mm without interdental spacing
3. Moderate maxillary retrognathia (Maxillary mid-face deficiency)

- a. males
  - b. females
  4. Mandibular prognathism
  5. Full anterior crossbite (4 incisors)
  6. Maxillary midline diastema  $>2$  mm
  7. Anterior crossbite (at least one tooth in crossbite)
    - a. without obvious signs of attrition or periodontal abnormalities
    - b. with obvious signs of attrition or periodontal abnormalities
    - c. with functional shift
    - d. without functional shift
  8. Severe upper arch constriction (with posterior crossbite)
  9. Posterior crossbite (more than one tooth in crossbite)
  10. Posterior crossbite (one tooth in crossbite)
  11. Posterior scissors-bite (at least one tooth in reverse crossbite)
  12. Midline discrepancies  $>2$  mm (without posterior crossbite)
  13. Obvious skeletal openbite  $>-1$  mm
  14. Apparent dental openbite  $>-1$  mm
    - a. without oral habit
    - b. with apparent contributing oral habit
  15. Deepbite  $>5$  mm
    - a. with palatal impingement
    - b. without palatal impingement
    - c. with dental wear
    - d. without dental wear
  16. Moderate crowding in maxillary or mandibular arch
  17. Severe crowding in maxillary or mandibular arch
    - a. significant esthetic concerns
    - b. significant periodontal concerns
    - c. significant dental asymmetries
    - d. excessive gingival display with smiling
  18. Missing permanent teeth
    - a. congenitally missing
    - b. missing due to trauma and/or pathology
    - c. ankylosed primary teeth with permanent teeth missing
  19. Ectopic development and eruption
    - a. incisors
    - b. cuspids
    - c. molars
  20. Conditions with potential for resorption of roots of permanent teeth (e.g. maxillary, lateral, and cuspids)
  21. Supernumerary teeth (found clinically or on x-ray)
  22. Moderate attrition (wear) of permanent dentition
- B. FUNCTIONAL CONCERNS**
1. Faulty position of lower lip
  2. Mouth breathing
  3. Problems with swallowing
  4. Tongue posture abnormality
  5. Thumb/finger sucking
  6. Speech disorders
- C. SIGNS AND SYMPTOMS OF TMD DISORDER**
1. TMJ-sounds
  2. Deviations in opening
  3. Spontaneous pain in the TMJ area (reported by patient)
  4. Pain on palpation in the TMJ area
  5. Limitation in maximal opening
  6. Episodic joint locking
  7. Bruxism
- D. OTHER**
1. Oral hygiene concerns
  2. Functional shift due to premature contacts
  3. Periodontal concerns (e.g. deep bite, recession due to malposition)