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ORIGINAL RESEARCH

Perspectives of Indonesian Orthodontists on the Ideal Orthodontic Treatment Time

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Objective: The aim of this study was to explore the types of orthodontic treatment provided by Indonesian orthodontists and to analyse their perspectives on the ideal time to initiate orthodontic treatment.

Materials and Methods: A cross-sectional survey was conducted using the Google Drive questionnaire template. This electronic questionnaire was sent to a sample of orthodontists across different regions of Indonesia. The participants were asked to report the stage at which they would start orthodontic treatment, as well as answer questions about occlusal abnormalities and functional problems. Descriptive statistics for all variables were determined, including both practice characteristics and orthodontic treatment timing.

Results: A total of 152 orthodontists agreed to participate in the study, of which 64.5% were female and 35.5% were male. Indonesian orthodontists prefer two-phase orthodontic treatment. Sucking habits and open bite were found to be the most frequent indications for treatment in the primary dentition. Anterior crossbite was found to be the most frequent indication for treatment during the early mixed dentition stage. Severe Class II was found to be the most frequent indication for treatment during the late mixed dentition stage. Indonesian orthodontists are more concerned about impacted canines and midline diastema than other occlusal deviations in the permanent dentition.

Conclusion: Based on the results of this study, we can conclude that Indonesian orthodontists favor two-phase orthodontic treatment. They also prefer to treat sucking habits and open bite in the primary dentition, anterior crossbite in the early mixed dentition, and severe Class II during the late mixed dentition stage.

Keywords: Indonesian orthodontists, orthodontics, treatment timing

Introduction

The prevalence of malocclusion in Indonesia is relatively high (80%),[1,2] yet the proportion of Indonesians who receive orthodontic treatment (0.7%)[3] is much lower. This has resulted in a high demand for orthodontic treatment services. Utari and Putri[2] investigated the need for orthodontic treatment among Indonesian adolescents (13–15 years of age) and reported that 61% of the subjects required orthodontic treatment, of which 63% had Class I malocclusion, 28% had Class II malocclusion, and 9% had Class III malocclusion.

A large focus has been placed on determining the appropriate time for orthodontic interceptive procedures, and there has been considerable debate between researchers regarding the optimal time and its clinical effectiveness.[4–9] This debate largely centers around the following questions: What is the best age to start orthodontic treatment for children? Should we begin treatment during the primary,

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mixed dentition, or wait until all of the permanent teeth are present? Is early treatment more effective than late orthodontic treatment? Are the outcomes significantly improved compared to those of a single-phase treatment approach? The most important areas of disagreement include clinical effectiveness, the outcomes of early treatment, the orthodontists' preference, psychological influences, treatment of crowding, treatment of Class II malocclusions, and treatment of Class III malocclusions. Grippaudo et al[10] reported that it is possible to formulate an effective treatment path by identifying the prevalence of malocclusions and their appropriate treatment time. Some authors advocate the use of two-phase treatment,[7] which comprises two phases. Phase one constitutes any treatment performed to correct a developing malocclusion or to simplify later orthodontic treatment, and this begins in the early mixed dentition between the ages of 6 and 8. Phase two is the finishing stage, which begins after the eruption of all permanent teeth. Other authors only support single-phase treatment - a comprehensive phase beginning in the late mixed or early permanent dentition, around the age of 11 years or older.[4,11]

From the first point of view, two-phase treatment is especially recommended in the management of malocclusion with a skeletal component, such as Class II and Class III malocclusions,[11] to address early manifestations, prevent risks associated with the malocclusion, and potentially produce a more significant improvement in the skeletal pattern at a period of maximal growth. On the other hand, orthodontists who prefer late treatment have argued that early treatment at deciduous or early mixed dentition offers no long-term benefits.[4] One-phase treatment has the advantage of avoiding patient burnout due to long treatment times[12,13] and preventing unpredictable growth changes that can occur at preadolescent ages. Maspero et al[14] concluded that both one- and two-stage treatments are effective in treating Class II malocclusions and there is no significant difference between the two modalities, except that the occurrence of incisor trauma was lower in early-treatment subjects. Additionally, one-phase is much cheaper than two-phase treatment.[4]

At this time, no related study has been published in Indonesia. It would, therefore, be of great interest to explore the type of orthodontic treatment provided by Indonesian orthodontists and to analyze the perspective of orthodontists practicing in Indonesia regarding the ideal time to initiate treatment.

Materials and Methods

A cross-sectional survey was conducted using the Google Drive questionnaire template. This electronic questionnaire was sent to a sample of orthodontists across different regions of Indonesia. An explanation of the purpose of the study and research procedures was also included. The questionnaire consisted of two parts. The first included demographic data such as age, gender, education, and type of practice, while the second part contained questions about occlusal abnormalities, functional problems and temporomandibular disorders. The questionnaire was obtained from the existing literature.[15–17] This is a non-random convenient sample study. The names of the orthodontists were acquired from the directory of the Indonesian Dental Society and the Indonesian Association of Orthodontics and/or any related authorities. A link was sent to the list via the WhatsApp application or by e-mail. Ethical approval of the study was attained from the Ethical Committee of the College of Dentistry, Taibah University, Kingdom of Saudi Arabia with study reference no: TUCDREC/20190123/THGunaid.

Statistical Methods

Descriptive statistics for all variables were determined. All statistical analyses were conducted using SPSS software (version 20, SPSS, IBM Corporation, USA).

Results

Indonesian Orthodontists' Characteristics

Table 1 outlines the demographic data of the participants. A total of 152 orthodontists agreed to participate, of which 64.5% were female and 35.5% were male. The majority of orthodontists were 31–40 years of age (38.8%), closely followed by those aged 41–50 (36.1%). 97.3% had graduated from Indonesian universities. Approximately 45.3% had 4–5 years of training and 35.5% had 2–3 years of specialty training. At the time of the study, most of the orthodontists were working in private practice (73%). The majority were practising in the western parts of Indonesia (63.8%), followed by the middle parts (25.6%).

Treatment Timing

The opinion of Indonesian orthodontists towards the preferred orthodontic treatment time is shown in Table 2. The majority of participants (63.8%) favor two-phase

Table 1 Demographic Data of Participants

Variable	Participants (n = 152)
Gender:	
Male	54 (35.5%)
Female	98 (64.5%)
Age:	
20–30 (years)	3 (1.9%)
31–40 (years)	59 (38.8%)
41–50 (years)	55 (36.1%)
51–60 (years)	29 (19%)
More than 60 years	6 (3.9%)
Highest qualification:	
PhD	20 (13.1%)
Master	78 (51.3%)
Board	13 (8.5%)
Spesialis Ortodonti	41 (26.9%)
Qualificaction place:	
Indonesia	148 (97.3%)
North America	1 (0.6 %)
Europe	1 (0.6%)
Australia and New Zealand	1 (0.6%)
East Asia	1 (0.6%)
Speciality training duration:	
2 years	3 (1.9%)
2–3 years	54 (35.5%)
4–5 years	69 (45.3%)
More than 5 years	26 (17.1%)
Practice type:	
Private practice	111 (73%)
Teaching institution	40 (26.3%)
Governmental Hospital	44 (28.9%)
Private Hospital	14 (9.2%)
Practice location:	
Western part of Indonesia	97 (63.8%)
Middle part of Indonesia	39 (25.6%)
Eastern part of Indonesia	16 (10.5%)
Experience (years):	
Less than 3 years	15 (9.8%)
3–5 years	20 (13.1%)
6–10 years	47 (30.9%)
11–15 years	33 (21.7%)
16–20 years	22 (14.4%)
More than 20 years	15 (9.8%)

Table 2 Participants Opinion on the Treatment Timing

Variable	Number 152 (%)
Treatment phase:	
Single-phase treatment	55 (36.2%)
Two-phase treatment	97 (63.8%)
Ideal age for first orthodontic assessment:	
Less than 6 years	7 (4.6%)
6 years	13 (8.5%)
7 years	39 (25.6%)
8 years	25 (16.4%)
9 years	20 (13.1%)
10 years	17 (11.1%)
11 years	8 (5.2%)
12 years	11 (7.2%)
Over 12 years	12 (7.8%)
Prefered time to initiate orthodontic treatment:	
Primary Dentition (4–6 years)	6 (3.9%)
Early mixed dentition (7–9 years)	83 (54.6%)
Late mixed dentition (10–13 years)	66 (43.4%)
Permanent dentition (14–18 years)	36 (23.6%)
Age determenation method:	
Dental age	69 (45.3%)
Chronologic age	62 (40.7%)
Brother/sister growth pattern	25 (16.4%)
Pubertal indicators	75 (49.3%)
Skeletal age based on hand-wris x-ray	55 (36.1%)
Skeletal age based on cervical vertebra	77 (50.6%)

orthodontic treatment, while 36.2% use single-phase treatment. Only 25.6% of orthodontists recommend 7 years as the ideal age for the first orthodontic assessment, followed by 8 years (16.4%). Of the participants, 54.6% reported that the best time to initiate orthodontic treatment is in the early mixed dentition, while 43.4% prefer treatment to begin in the late mixed dentition.

As for the age determination method, it was found that 50.6% of Indonesian orthodontists rely on the cervical vertebra to determine the patient's age. Another 49.3% choose pubertal indicators and 45.3% use dental age.

Indications for Treatments

Table 3 displays the most frequent indications for orthodontic treatment at each stage. The sucking habit was found to be the most frequent indication for treatment in the primary dentition (44.7%). The majority of orthodontists claimed anterior crossbite to be the most indicated problem during the early mixed dentition (74.3%) and this was followed by incisor ectopic eruption (54.6%). Severe Class II division 2 malocclusion with severe deep bite is the most frequent indication for treatment in the late mixed dentition (62.9%), accompanied by Class II division 1 malocclusion with increased overjet (59.9%). In the permanent dentition, impacted canines were found to be the

Table 3 Most Frequent Indications for Orthodontic Treatment in Each Stage

Primary Dentition (4–5):	
Anterior crossbite	18 (11.8%)
Posterior crossbite	7 (4.6%)
Sucking habit	68 (44.7%)
Open bite caused by sucking habits	43 (28.3%)
Dental manifestations of tongue thrust	37 (24.3%)
Mouth breathing	42 (27.8%)
Severe Class III malocclusion	14 (9.2%)
Early mixed dentition (7–9 years):	
Anterior crossbite	113 (74.3%)
Posterior crossbite	64 (42.1%)
Sucking habit	75 (49.3%)
Open bite caused by sucking habits	77 (50.7%)
Dental manifestations of tongue thrust	79 (52%)
Mouth breathing	82 (54.3%)
Incisor ectopic eruption	83 (54.6%)
Moderate crowding (3–6 mm)	55 (36.2%)
Severe crowding (>6 mm)	48(31.6%)
Maxillary midline diastema > 2 mm	28 (18.4%)
Severe Class II division 1 with increased overjet	63 (41.4%)
Severe Class II division 2 with severe deep bite	49 (32.5%)
Severe Class III malocclusion	70 (46.1%)
Skeletal open bite	47 (31.3%)
Late mixed dentition (10–13 years):	
Anterior crossbite	34 (22.4%)
Posterior crossbite	78 (51.3%)
Sucking habit	31 (20.4%)
Open bite caused by sucking habits	46 (30.3%)
Dental manifestations of tongue thrust	48 (31.6%)
Mouth breathing	45 (29.8%)
Incisor ectopic eruption	55 (36.2%)
Moderate crowding (3–6 mm)	72 (47.4%)
Severe crowding (>6 mm)	72 (47.4%)
Maxillary midline diastema > 2 mm	78 (51.3%)
Impacted canines	74 (48.7%)
Severe Class II division 1 with increased overjet	91 (59.9%)
Severe Class II division 2 with severe deep bite	95 (62.9%)
Severe Class III malocclusion	70 (46.1%)
Skeletal open bite	64 (42.7%)
Permanent dentition (14+ years):	
Anterior crossbite	9 (5.9%)
Posterior crossbite	19 (12.5%)
Open bite caused by sucking habits	10 (6.6%)
Dental manifestations of tongue thrust	13 (8.6%)
Mouth breathing	12 (7.9%)
Incisor ectopic eruption	21 (13.8%)
Moderate crowding (3–6 mm)	40 (26.3%)
Severe crowding (>6 mm)	48 (31.6%)
Maxillary midline diastema > 2 mm	58 (38.2%)
Impacted canines	82 (53.9%)
Severe Class II division 1 with increased overjet	56 (36.8%)
Severe Class II division 2 with severe deep bite	58 (38.4%)
Severe Class III malocclusion	45 (29.6%)
Skeletal open bite	60 (40%)

most indicated case for treatment (53.9%), followed by severe Class II division 2 malocclusion with severe deep bite and midline diastema > 2mm (38%).

Table 4 illustrates the preferred appliances used at each developmental stage. Removable orthodontic appliances are the most favored type used in the primary and early mixed dentition stages (46.1% for primary, 64.5% for early mixed), but functional appliances/activators are also popular (38.2% for primary, 46.7% for early mixed). During the late mixed dentition, the partial arch fixed appliance is the first choice for Indonesian orthodontists (51.3%), followed by the functional appliance (46%). At the permanent dentition stage, 98.1% of Indonesian orthodontists are using a full-arch fixed appliance.

Discussion

Orthodontic treatment timing has been a debated topic between professionals, and many studies have been conducted to support either early or late orthodontic treatments.[7,11] However, little is known about the preferred ideal orthodontic treatment timing among Indonesian orthodontists. This study has aimed to provide insight into the orthodontic specialty in Indonesia, as well as provide a preliminary distribution map of the orthodontic practice in this country.

The number of orthodontists who agreed to participate in this study was about a fifth of the registered members of the Indonesian Association of Orthodontics. Among the interesting findings in this study, one is that the majority of orthodontists in Indonesia are female (64.5%). One likely explanation is that the number of graduated female dentists across the country each year is greater than males,[18] which is reflected in the admission rates of postgraduate orthodontic programs. The study also reveals that 97% of Indonesian orthodontists received their training inside Indonesia, which could explain why there was less variation in treatment timing protocols found in the questionnaire results. Most orthodontists are practicing in the western parts of Indonesia (64.2%) and so it seems that the geographic distribution of specialists does not match

Table 4 Preferred Appliances Used in Each Developmental Stage

Appliance	Primary Dentition	Early Mixed Dentition	Late Mixed Dentition	Permanent Dentition
Quad Helix	7 (4.6%)	14 (9.2%)	20 (13.2%)	29 (19.1%)
Removable appliance	70 (46.1%)	98 (64.5%)	61 (40.1%)	17 (11.2%)
Functional appliance/activator	58 (38.2%)	71 (46.7%)	70 (46%)	19 (12.5%)
Clear Aligners (eg Invisalign, eCligner)	0 (0%)	0 (0%)	0 (0%)	34 (22.4%)
Full arch fixed appliances	13 (8.6%)	5 (3.3%)	52 (34.2%)	149 (98.1%)
Partial arch fixed appliances (ie 2X4)	14 (9.2%)	56 (36.8%)	78 (51.3%)	13 (8.6%)
Protraction facemask	12 (7.9%)	22 (14.5%)	27 (17.8%)	19 (12.5%)
Rapid maxillary expander	19 (12.5%)	49 (32.2%)	61 (40.1%)	42 (27.6%)
Headgear	10 (6.6%)	16 (10.5%)	21 (13.8%)	14 (9.2%)
Chin-cup	10 (6.6%)	15 (9.9%)	14 (9.2%)	4 (2.6%)
None used	49 (32.2%)	10 (6.6%)	2 (1.3%)	0 (0%)
Other	2 (1.4%)	0 (0%)	0 (0%)	6 (3.9%)

well with the registered number of orthodontists in the country. A feasible explanation for this is that most post-graduate orthodontic programs are located in Java Island (Airlangga University, Padjadjaran University, University of Indonesia, Gadjah Mada University), as well as the University of Sumatra Utara, situated in the northern part of Sumatra. Moreover, the development of Indonesia is more advanced in the west, which is better equipped with human and natural resources and financially and scientifically more progressive.

As already mentioned, ideal orthodontic treatment time is considered to be one of the controversial topics in the field of orthodontics, with most of the debate centered around the preference for two-phase versus single-phase orthodontic treatments. Generally speaking, Indonesian orthodontists favor two-phase orthodontic treatment (63.8%). This may be due to the preventative benefits that this method brings: the early treatment can be used to prevent the occurrence of abnormality, rather than waiting until the problem has fully developed, and then utilizing growth during the growth spurt period. This is consistent with the results of Kluember et al[11] who suggested that it may be appropriate to begin treatment at an earlier age in order to improve self-esteem and prevent trauma. It has also been reported that early treatment improves the chances for acceptability, and the rate of acceptable morphology has been found to be higher in early- than in late-timing health centers.[19] In line with previous studies, Fleming[5] stated that a direct comparison of the merits of early or late treatment is complicated, but that there is little evidence to suggest initiating treatment before the age of 10 years old.

When it comes to the ideal age for the first orthodontic assessment, about 25% of Indonesians orthodontists are following the recommendations of the American Orthodontic Society in that the optimal age is 7 years old. However, Indonesian orthodontists have not yet reached general agreement on the ideal age. Grippaudo et al[10] stressed the importance of early multidisciplinary assessment and orthodontic screening for promoting normal growth and development, as well as eliminating possible interferences and malocclusions.

With regard to the age determination method, it was found that orthodontists mainly rely on the cervical vertebrae maturational stage (CVMS) to determine the patient's age and pubertal indicators. A comparable study conducted with Canadian orthodontists produced similar results.[17]

Sucking habits and open bite were found to be the most frequent indications for treatment in the primary dentition. This is inconsistent with the findings reported in earlier studies.[16,20,21] Anterior crossbite was the most frequent indication for treatment during the early mixed dentition stage. Not only does this support Al-Shayea's results for orthodontists practicing in Saudi Arabia,[15] it is also in accordance with the opinion of Canadian orthodontists.[17]

There is general consensus between Indonesian orthodontists regarding the importance of treating Class II cases in the late mixed dentition, rather than in the early mixed dentition. This is in line with the research of Harrison et al,[22] who concluded that early treatment for Class II cases with protruded upper anterior teeth is no more effective than it is in early adolescence. Surprisingly, Indonesian orthodontists seem to be more concerned

about impacted canines and midline diastema than other occlusal deviations in the permanent dentition. This may be due to the influence of canines and diastema on smile esthetics, as they are located in the esthetic zone. The result could also be attributed to the high prevalence of impacted canines among Indonesians.

This study has also shown that removable orthodontic appliances and functional appliances are the predominant ones being used in primary, early and late mixed dentition stages in Indonesia. This may be the case for several reasons. Firstly, specialists in the field may be using these appliances in an attempt to reduce the treatment cost as much as they can. Maharani and Rahardjo[18] reported that receiving dental care services in Indonesia depends largely on the ability to pay rather than the need for care, which is in line with our present findings. Secondly, Indonesian orthodontists believe that children who are treated with removable or functional appliances tend to have better treatment outcomes in the presence of growth. Finally, the fact that health centers have limited orthodontic resources could also have influenced these decisions. The selection of appliances found in this study is not the same as those reported in previous research of Finnish orthodontists, who mainly use quad helix and headgears.[20] It was interesting to find that partial arch fixed appliances (2x4 appliance) were the first choice for Indonesians in the late mixed stage (51.3%). In support of these findings, McKeown and Sandler[23] stated that the 2x4 appliance is a versatile technique for more effective tooth movement, as it offers three-dimensional control and the correction of rotations, diastemas, wrong inclinations and angulations.

Despite these results, there has been a global increase in demand for clear aligner appliances as a result of them being more esthetic, comfortable, and providing better periodontal health than fixed appliances. However, only 22.4% of Indonesian orthodontists are adopting clear aligners in their practice in the permanent dentition stage (Table 4). This could be related to their belief that this type of appliance can only treat simple cases and has low treatment efficiency, high costs, and little published evidence.[24]

Conclusion

Based on the results of this study, we can conclude that Indonesian orthodontists favor two-phase orthodontic treatment. They also prefer to treat sucking habits and open bite in the primary dentition, anterior crossbite in the early mixed dentition, and severe Class II during the late mixed dentition stage.

Disclosure

The authors report no conflict of interest in this work.

References

1. Oley AB, Anindita PS. Kebutuhan perawatan orthodonti berdasarkan indox of orthodontic treatent need pada usia remaja 15–17 tahun. *e-Gigi*. 2015;3(2):13–17.
2. Utari TR, Putri MK. Orthodontic treatment needs in adolescents aged 13–15 years using orthodontic treatment needs indicators. *J Indones Dent Assoc*. 2019;2(2):49–55.
3. KKR Indonesia. Badan Penelitian dan Pengembangan Kesehatan. Riset kesehatan dasar (RISKESDAS) 2013. Lap Nas 2013. 2013:1–384.
4. Gianelly AA. One-phase versus two-phase treatment. *Am J Orthod Dentofac Orthop*. 1995;108(5):556–559.
5. Fleming PS. Timing orthodontic treatment: early or late? *Aust Dent J*. 2017;62(Suppl 1):11–19.
6. Sunnak R, Johal A, Fleming PS. Is orthodontics prior to 11 years of age evidence-based? A systematic review and meta-analysis. *J Dent*. 2015;43(5):477–486.
7. Almeida MR, Almeida RR, Oltramari-Navarro PV, Conti AC, Navarro RD, Camacho JG. Early treatment of class III malocclusion: 10-year clinical follow-up. *J Appl Oral Sci*. 2011;19(4):431–439.
8. King GJ, Brudvik P. Effectiveness of interceptive orthodontic treatment in reducing malocclusions. *Am J Orthod Dentofac Orthop*. 2010;137(1):18–25.
9. Wheeler TT, McGorray SP, Dolce C, King GJ. The timing of class II treatment. *Am J Orthod Dentofac Orthop*. 2006;129(4):66–70.
10. Grippaudo C, Paolantonio EG, Luzzi V, Manai A, La Torre G, Polimeni A. Orthodontic screening and treatment timing in preschoolers. *Clin Exp Dent Res*. 2019;5(1):59–66.
11. Kluemper GT, Beeman CS, Hicks EP. Early orthodontic treatment: what are the imperatives? *J Am Dent Assoc*. 2000;131(5):613–620.
12. Hsieh T-J, Pinskaya Y, Roberts WE. Assessment of orthodontic treatment outcomes: early treatment versus late treatment. *Angle Orthod*. 2005;75(2):162–170.
13. Tulloch JFC, Proffit WR, Phillips C. Outcomes in a 2-phase randomized clinical trial of early class II treatment. *Am J Orthod Dentofac Orthop*. 2004;125(6):657–667.
14. Maspero C, Galbiati G, Giannini L, Guenza G, Farronato M. Class II division 1 malocclusions: comparisons between one- and two-step treatment. *Eur J Paediatr Dent*. 2018;19(4):295–299.
15. Al-Shayea E. A survey of orthodontists′ perspectives on the timing of treatment: a pilot study. *J Orthod Sci*. 2014;3(4):118–124.
16. Yang EY, Kiyak HA. Orthodontic treatment timing: a survey of orthodontists. *Am J Orthod Dentofacial Orthop*. 1998;113(1):96–103.
17. Eileen L. *Provision and Timing of Interceptive Orthodontic Treatment by Certified Orthodontists and Pediatric Dentists in Canada* [Thesis]. Winnipeg: University of Manitoba; 2010.
18. Maharani DA, Rahardjo A. Is the utilisation of dental care based on need or socioeconomic status? A study of dental care in Indonesia from 1999 to 2009. *Int Dent J*. 2012;62(2):90–94.
19. Pietilä I, Pietilä T, Svedström-Oristo A-L, Varrela J, Alanen P. Acceptability of adolescents' occlusion in Finnish municipal health centres with differing timing of orthodontic treatment. *Eur J Orthod*. 2010;32(2):186–192.
20. Pietilä I, Pietilä T, Pirttiniemi P, Varrela J, Alanen P. Orthodontists' views on indications for and timing of orthodontic treatment in Finnish public oral health care. *Eur J Orthod*. 2008;30(1):46–51.

21. Trends in Finnish public orthodontic care from the professionals' perspective. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2836789/. Accessed March 29, 2020.
22. Harrison JE, O'Brien KD, Worthington HV. Orthodontic treatment for prominent upper front teeth in children. *Ochrane Database Syst Rev*. 2007;3:CD003452.
23. McKeown HF, Sandler J. The two by four appliance: a versatile appliance. *Dent Update*. 2001;28(10):496–500.
24. Buschang PH, Shaw SG, Ross M, Crosby D, Campbell PM. Comparative time efficiency of aligner therapy and conventional edgewise braces. *Angle Orthod*. 2014;84(3):391–396.