Differences in factors influencing orthodontists' consideration of clear aligners, satisfaction, and stability levels in a capital city: a cross-sectional study

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ABSTRACT

Introduction: With the increasing number of adult orthodontic patients, there is also a growing demand for more aesthetic and comfortable treatments. Clear aligners are a quite new treatment technique in the field of orthodontics that is being developed using digital-based technology, and their usage is increasing due to their perceived aesthetic and comfortable nature. This research objective was to analyze differences in factors influencing orthodontists' consideration of clear aligners, satisfaction, and stability levels in a capital city. **Methods:** This comparative analytical study with a cross-sectional design was conducted to examine the perception of orthodontists in a capital city in Indonesia, Jakarta, regarding the use of clear aligners. Fifty orthodontists taken through Slovin sampling technique, were given a set of questionnaires and divided into two groups based on users and non-users of aligner. The survey utilized a questionnaire consisting of 17 questions with both clinical and satisfactionary criteria, which were sent online via WhatsApp Messenger to the respondents. To compare the data were analyzed by the chi square test statistically. **Results:** Most of respondent practiced in elite areas of South Jakarta, 52.2%, among other 4 differences cities were observed in the perception of orthodontists who were 46% users and 54% non-users aligner regarding periodontal health factors, treatment efficiency, pain complaints, root resorption, satisfaction levels, and treatment outcome stability. Both clear aligners users and non-users have similar perceptions regarding treatment cost factors influencing the usage of clear aligners, improved oral hygiene, minimal white spot lesions, and better aesthetics. **Conclusion:** Some parameters were not different, especially for the parameters of treatment cost as a negative perception, and oral hygiene, white spot lesion, and aesthetics, all of which gave similar positive perceptions rated by respondents. This is good considerably for an aligner producer.

Keywords

Clear aligner users and non-users, capital city, orthodontists perception

Perbedaan faktor-faktor yang mempengaruhi pertimbangan penggunaan clear aligners*, tingkat kepuasan, dan stabilitas oleh ortodontis di sebuah ibu kota negara: studi potong lintang*

ABSTRAK

***Pendahuluan**: Dengan meningkatnya jumlah pasien ortodontik dewasa, permintaan akan perawatan yang lebih estetis dan nyaman juga meningkat. Clear aligner merupakan teknik perawatan yang cukup baru di bidang ortodontik yang sedang dikembangkan menggunakan teknologi berbasis digital, dan penggunaannya semakin meningkat karena sifatnya yang estetis dan nyaman. Tujuan penelitian ini adalah untuk menganalisis Perbedaan faktor-faktor yang mempengaruhi pertimbangan penggunaan clear aligners, tingkat kepuasan, dan stabilitas oleh ortodontis di sebuah ibu kota negara. **Metode**: Metode penelitian analitik komparatif dengan desain potong lintang dilakukan melalui teknik sampling Slovin, untuk mengkaji persepsi ortodontis di Jakarta, sebuah ibukota negara, Indonesia, mengenai penggunaan clear aligner. Sebanyak lima puluh ortodontis di Jakarta, diberikan kuesioner dan dibagi menjadi dua kelompok berdasarkan pengguna dan bukan pengguna aligner. Survei menggunakan kuesioner dengan 17 pertanyaan tentang reaksi klinis dan kepuasan, yang dikirimkan secara online melalui WhatsApp Messenger kepada responden. Data dianalisis secara statistik dengan uji Chi-Square. **Hasil**: Sebagian besar responden berpraktik di kawasan elit Jakarta Selatan, 52,2%, di antara 4 kota lainnya perbedaan diamati pada persepsi ortodontis yang merupakan 46% pengguna dan 54% bukan pengguna aligner mengenai faktor kesehatan periodontal, efisiensi perawatan, keluhan nyeri, resorpsi akar, tingkat kepuasan, dan stabilitas hasil perawatan. Baik pengguna clear aligner maupun bukan pengguna memiliki persepsi yang sama mengenai faktor biaya perawatan yang memengaruhi penggunaan clear aligner, peningkatan kebersihan mulut, minimalnya white spot lesion, dan estetika yang lebih baik. **Simpulan**: Beberapa parameter tidak berbeda, terutama untuk parameter biaya perawatan sebagai persepsi negatif, dan kebersihan mulut, lesi white spot, dan estetika, yang semuanya memberikan persepsi positif yang sama yang dinilai oleh responden. Hal ini cukup baik bagi produsen dan pengguna aligner.*

Kata kunci

Pengguna dan non-pengguna clear aligner, Ibukota negara, persepsi ortodontis.

INTRODUCTION

According to the American Association of Orthodontists, orthodontics is a branch of dentistry that studies the growth and development of teeth and surrounding tissues.[1] The British Society of Orthodontics defines orthodontics as the study of the growth and development of the jaw and face that affects the position of the teeth.[2] Orthodontics has developed very rapidly in treatment techniques and new technologies used to treat various types of malocclusion in orthodontic treatment.[2,3]

Malocclusion treatment in orthodontics continues to be developed both in the use of fixed appliances and removable appliances. Various new digital-based technologies have also begun to be introduced, such as cone-beam computed tomography (CBCT), intra oral scanner (IOS), face scanner (FS), computer-assisted design and computer-assisted manufacturing (CAD/CAM), Artificial Intelligence (AI) software and machines such as 3D printers for information gathering, case analysis, diagnosis, preparation of treatment plans and manufacture of tools that utilize digital technology such as insignia, incognito and also clear aligners.[3,4]

As the number of adult orthodontic patients increases, there is also an increase in demand for alternative treatments that are more aesthetic and comfortable compared to the fixed orthodontic appliances that are usually used. In the Taiwanese Journal of Orthodontists, it stated that Kesling first introduced a series of clear tooth positioners which could progressively align minor mispositions. The use of clear aligners is currently increasing considering the appearance that is considered more aesthetic and its use is more comfortable for patients.[5] Clear aligners have also evolved a lot since they were released to the market in 1999 and their development has also increased in the 21st century of digital technology.[5,6]

Based on statistical data from Align Corporate regarding the use of clear aligners (Invisalign) in 2015, there were 3.2 million cases sent to the company with a total of 45,580 dentists actively using Invisalign treatment.[6] Based on Olson et al., from the results of a survey conducted, the use of clear aligners in the United States increased from an initial number of enthusiasts of 16% in 2012-2014 to 27% of all total adult patients in 2015. As many as 10,000 orthodontists and almost 200,000 general dentists in the United States were stated to have used the device.[7,8]

Currently, clear aligners can be optimally utilized for various cases and types of malocclusion. In addition to providing aesthetic and comfortable treatment, this appliance is able to improve oral hygiene, reduce pain and can also reduce the number and duration of control.[9,10] Miller et al., compared orthodontic treatment in the first week using clear aligners with fixed orthodontics and reported that clear aligners were better at reducing pain significantly and were able to provide better psychosocial effects compared to patients treated with fixed orthodontic appliances.[11] However, on the other hand, clear aligners also have limitations in the form of production costs, dependence on the level of patient compliance in using the appliance and there are also several limitations in treating complex malocclusions such as limited ability to control root movement or correction of intermaxillary discrepancies, anterior extrusion, and rotational movements. Doctors who want to use clear aligners in orthodontic treatment must rely on their own clinical experience, expert opinion, and the results of publications that are still limited.[11,12]

Instead of the importance of technological progress in the field of orthodontics such as clear aligners, the result of digital developments, the important things were the effects that were arise and are produced, the orthodontists known so as to reduce doubts about using clear aligners or deciding not to use clear aligners because of the negative opinions of respondents.[13–16] Then it desired to did research according to orthodontists perception whom aligner users and non-users for orthodontic treatment. This research objective was to analyze differences in factors influencing orthodontists' consideration of clear aligners, satisfaction, and stability levels in a capital city.

METHODS

This study was a comparative analytical research between invisalign users and non users with a cross-sectional design, a research to fill in the research population gap which similar research had been done in other countries and had not been done in Jakarta. Jakarta was chosen as one of the capital cities, where in a capital city is the domicile of many prominent people and is able to afford health care.

This research study was conducted in 5 cities in Jakarta. The subjects of this research study were orthodontists in Jakarta who met the inclusion criteria, namely having an orthodontic specialist degree (Sp.Ort), still actively practicing in the Jakarta area, users or non-users of Invisalign brand clear aligners. On the other hand, exclusion criteria was respondents who had a specialist degree in orthodontics but are no longer actively practicing. Sampling method was purposive sampling, research time was 2 months in 2024.

The research instrument questionnaire, stages of this study were as follows. First, prepare a questionnaire about the perception of the use of clear aligners by orthodontists containing 17 questions in the form of yes/no and multiple choice that have been adapted from the original journal by conducting forward translation from the original language (English) to the target language (Indonesian) by a sworn translator from the International Language Institute of the University of Indonesia.[17] Conduct back translation by the translator from Indonesian to English again, then reviewed it again by the supervisor and experts to produce a final manuscript.

The questionnaire used in this study was a modified version of the instrument developed by Raghav et al.[17] After obtaining permission from the ethics committee, the questionnaire was then tested for validity and reliability in a pilot study involving 20 subjects. Instrument reliability was assessed using Cronbach's alpha, with values greater than 0.70 indicating acceptable reliability and values above 0.80 reflecting strong internal consistency. Specifically, alpha values between 0.70 and 0.90 indicate high reliability, 0.50–0.70 suggest moderate reliability, and values below 0.50 denote low reliability, implying that one or more items may not be consistent. Only items that demonstrated both validity and reliability were retained for inclusion in the final questionnaire distributed to respondents.

This study was conducted on all orthodontists (385 members) in Jakarta registered with Indonesian Association of Orthodontists (IAO) Jakarta Branch (IKORTI PENGWIL JAYA) who met the inclusion criteria. This questionnaire was sent via WhatsApp to orthodontists practicing in Jakarta registered in IKORTI PENGWIL JAYA. Respondents filled out the questionnaire within the specified time period, within 2 months, until the sample size was met, minimal sample 24 respondent per group, rounded up to 50 respondents referred to Raghav et al, with total 60 sample, minimal 15 sample per respondent groups, through this formula for cross sectional research according to Slovin technique

When respondents accessed the link provided, they would be directed to a survey sheet containing Section 1 for informed consent of the orthodontist to fill in the main questioner and demographic data, Section 2 was the main questionnaire to answer the research aimed containing seventeen questions that appeared sequentially. The data was inputted into Microsoft Excel 2010 (Microsoft Corp.) and then analyzed using SPSS 24.0 for Windows (SPSS Inc.) for univariate and bivariate analysis.

RESULTS

The demographic characteristics of the research subjects were analyzed, consisting of age, gender and work area. Based on Table 1, it could be seen that in clear aligner users, the number of women was greater than men with an age range of 30-61 years. In non-clear aligner users, the number of women is also greater with an age range of 29-76 years.

Table 1. Respondent characteristics by gender and age

Respondent	n	Gender		Age
		Male	Female	Min-Max
User orthodontists	23	8(34.8%)	15(65.2%)	30-61 yrs
Non-user orthodontists	27	5(18.5%)	22(81.5%)	27-76 yrs

Based on table 1, it could be concluded that there is a difference between orthodontists using clear aligners, which was 46% and orthodontists not using clear aligners 54%. Table 2 also showed that in clear aligner users, orthodontists with the highest percentage come from South Jakarta with a total percentage reaching 52.2% when compared to other areas such as Central Jakarta (17.4%), West Jakarta (8.7%), East Jakarta (4.3%) and North Jakarta (17.4%). It was describing not comparing, and can be seen very differently in eye balling looking.

Table 2. Clear aligner user analysis by city of orthodontic practice

City	Percentage
Central Jakarta	17.4
West Jakarta	8.7
East Jakarta	4.3
North Jakarta	17.4
South Jakarta	52.2
Total	**100.0**

Then a Chi-square test was conducted to see the differences in various factors. Parameters that influence the consideration of using clear aligners by orthodontists with a significance level of $p<0.05$ (Table 3).

Table 3. Analysis of differences in perception factors of clear aligner users and non-users

Factors	Users	Non-Users	p value
Treatment Training	17(34%)	7(14%)	0.002*
Cost Saving	2(4%)	1(2%)	0.450
Improved Oral Hygiene	20(40%)	20(40%)	0.250
Improved Periodontal Health	19(38%)	14(28%)	0.020*
White Spot Lesions (minimal)	19(38%)	18(36%)	0.200
Esthetics	21(42%)	22(44%)	0.310
Treatment Efficiency	16(32%)	11(22%)	0.040*
Pain Complaints	6(12%)	19(38%)	0.002*
Root Resorption	2(4%)	12(24%)	0.005*

*Chi-square test, significant if p value <0.05

In table 3, the total for each parameter was 100% consisting of user and non-user perception data, for example, root resorption, plus those that were not shown in the table that were not perceived to experience resorption. Not shown in the table was intended to clarify the values to be compared.

The results of the study using chi-square (Table 3) showed that there was no significant difference in the perceptions of orthodontists using and not using clear aligners regarding cost factors, increased oral hygiene, and white spot lesions, but there was a significant difference between the perceptions of orthodontists using and not using clear aligners based on periodontal health factors, treatment efficiency, pain complaints and root resorption.

Table 4 showed a significant difference between the perceptions of orthodontists of clear aligner users and non-users. The satisfaction level factor obtained an average result of users perception showing a score of 3 (quite satisfied) upon the treatment using clear aligners, but non-users perception showed an average score of 2 (not satisfied) of the use of clear aligners.

Table 4. Analysis of differences in satisfaction and stability levels, and percentage of patients between clear aligner users and non-users

	Users mean	SD	Non-Users Mean	SD	p value
Satisfaction Level	3	0.891	2	0.724	0.004*
Stability Level	3	0.736	2	0.636	0.000*

Significant if p value<0.05

Likewise, in the stability factor where the average score of users on the use of clear aligners showed fairly stable results perception, but non-users showed unstable results perception.

DISCUSSION

Clear Aligner had appeared in the world of orthodontics since 1946 by Dr. Harold Kesling who introduced the use of thermoplastic tools to straighten teeth. This product had become increasingly developed since Align Technology (USA) introduced the Invisalign system to the market in 1999. The use of this digital-based tool was increasingly widespread by utilizing computer data processing based on CAD/CAM (computer-assisted design and computer-assisted manufacturing) and could produce images and treatment plans virtually.[10,13] (Table 2)

This aligner is a gradually improved technique in orthodontics appliances and is being developed worldwide because currently many orthodontic patients are looking for new treatment options using more comfortable and more aesthetic tools. Treatment using clear aligners is usually combined with the use of other tools such as additional attachments, elastics and interproximal reduction procedures to gain space and also extraction. This tool is considered to improve oral hygiene, periodontal tissue, and reduce the duration of control.[10]

The results of the analysis based on demographic characteristics (Table 1) showed that the most orthodontists who use clear aligners were women with an age range of 30-61 years. Likewise, in the group of non-user orthodontists with the highest percentage also women with an age range of 29-76 years (Table 1). Meanwhile, the study by Perillo et al showed that the percentage of male orthodontists (51%) was greater than women (49%) with an age range of 24-61 years. Regarding the demographics of clear aligner patients, Azaripour et al also showed the demographic factors of clear aligner patients who were predominantly women (78%) with an age range of 31.9 years and the study by Baxmann et al with a total of 68.4% female patients with an age of around 30 years.[15,16]

Jakarta is the capital city of Indonesia, with the largest population and the most advanced physical and social development. Until now, there has been no research in Jakarta that provides a picture or perception of orthodontists regarding the use of clear aligners. Therefore, this study was conducted using an online survey method (WhatsApp Messenger) to orthodontists registered in Jakarta to obtain conclusions about their perceptions regarding the use of the device, especially to evaluate the factors that influence the frequency of use. Based on the results of the analysis of the percentage of clear aligner use in this study, it can be seen that the amount of orthodontists who have not used the device are still more than users (Table 1).

However, the number of orthodontists using clear aligners in Jakarta has reached 46% of the total sample obtained in this study, which shows that this device has begun to be widely used by orthodontists practicing in Jakarta, especially in the South Jakarta area (Table 2)A , which is one of the elite areas in Jakarta. This is also in accordance with statistical data from Align Corporate which shows that many doctors are actively using clear aligners (invisalign)[8] and also research by d'Apuzzo et al where the research provides the results of the perceptions of orthodontists and general dentists from 25 countries with the majority of respondents coming from Italy (69%), UK (3%), Switzerland (3%) etc.[8,14]

According to Table 3, Chi-square test based on factors of periodontal health improvement, treatment efficiency, pain complaints and root resorption using clear aligners shows a significant difference in perception between orthodontist users and non-users where the number of patients who are considered to experience pain, root resorption and periodontal problems and treatment efficiency when using clear aligners is less in the user and non-user groups. In the study, Alami et al also stated that 63.2% of patients experienced pain when using aligners (54.4% felt pain for 1-2 days). As many as 55.9% of patients were stated to be able to tolerate pain during use and 4.4% had to use analgesics.[14] This study also stated that 41.2% of patients were satisfied with the overall treatment time (efficiency). Raghav et al's study also stated that the number of orthodontists who reported an increase in periodontal health, faster and more efficient treatment was also seen significantly in the group of clear aligner users with experience of more than 5 patients per year.[10,15,17]

The results of the chi square test (Table 3) on cost factors, increased oral hygiene, minimal white spots and aesthetics showed no significant difference between the perceptions of orthodontists who were used and non-used. Where orthodontists who used and non-used them both considered that clear aligner patients still had problems with the expensive cost of treatment compared to other devices, but both groups had the same perception regarding clear aligners which could improve oral hygiene, minimize white spots and provide aesthetic value.

According to research from Perillo et al where orthodontists who use and do not use clear aligners both stated that the reason patients do not use them is also due to cost factors, but Brandelli C et al stated that 91.2% of patients were satisfied with the transparent color of clear aligners and this is one of the major advantages for patients. [14,16] Furthermore, the results of statistical tests related to the level of satisfaction and the level of stability also showed different perceptions where the user group showed quite satisfied and quite stable while the non-user group showed dissatisfaction and instability in using clear aligners.

Alami et al's research also stated that 91% of patients in their study were satisfied with the final results of treatment using clear aligners, but in Kunchio et al's research after seeing the picture of the treatment results after three years of using retainers, relapse also occurred in both types of treatment, namely fixed orthodontics and clear aligners, but leveling on the anterior maxilla was much more stable in treatment using fixed orthodontics compared to clear aligners. In Lee et al's research, it was also stated that fixed appliances produced a better smile line than the clear aligner group (Invisalign).[16,18,19]

The study was done in a capital city as could be seen orthodontist and the aligner user most lived in the capital and elite region. In the capital city of Taiwan, although clear aligners are effective for mild to moderate one advantages were reported for better aesthetics, comfort at early stage, easier oral hygiene maintenance, improved periodontal health, and less root resorption as compared with fixed appliances. A meta analysis study of 127 articles in Taiwan, concluded based on the available evidences, clear aligner was effective in managing minor malocclusion, could achieve comparable treatment outcome to that of the fixed orthodontic appliance in nongrowing patients with mild malocclusion.[20] Comparing user and non users perception of orthodontists could be the strength of this research as perceptions could be referral for ones who would to use Invisalign. The limitation of this research could not be generated to other cities in Indonesia as there is a very wide range of social life and other conditions among those cities.

CONCLUSION

There was a difference in the percentage of orthodontists as a clear aligner user and non-user in a capital city. There was a difference in perception between the group of users and non-users of clear aligners regarding periodontal status, treatment efficiency, pain

during treatment, level of satisfaction and stability of treatment results and there was no difference in the perception of orthodontists as user and non-user clear aligners regarding cost factors, oral hygiene, white spots and aesthetics. The implication of this research provides the latest research in medical journals to gain insight about clear aligners for future studies or practitioners.

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