FEASIBILITY OF THE NEWLY DEVELOPED INDEX FOR INTERCEPTIVE ORTHODONTICS REFERRAL (IIOR) AND THE USER'S PERCEPTION: A PILOT STUDY

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Abstract
Introduction: The Index for Interceptive Orthodontics Referral (IIOR), a tool designed to guide the timely referral of developing malocclusion was recently developed and validated. The IIOR may facilitate the timely identification and referral of cases that may benefit from interceptive orthodontics. This pilot study aimed to assess the feasibility of the IIOR and perception among its users. **Objectives:** (1) To assess the feasibility of using IIOR among dental frontliners. (2) To investigate the perception of IIOR usage among dental frontliners. **Methodology:** Thirteen participants (6 dental officers, 3 orthodontic postgraduate students, and 4 dental therapists) were briefed about the IIOR through a pre-recorded video presentation. Subsequently, the participants were asked to grade 10 study models with a case summary of each, using the IIOR. The participants' responses were compared to the grading by experts on the 10 study models of various malocclusion using IIOR, which was established before this pilot study. After grading, they were asked to complete a questionnaire that assessed their perception towards the IIOR, in an interactive method. The questionnaire had undergone content and face validation. **Results:** The Fleiss Kappa scoring by the participants resulted in moderate agreement of 0.5. A total of 79.23% of participants matched the gold standard scoring. Additionally, 92.3% of the participants were happy to have a screening tool such as the IIOR to guide and assist them during patient screening. They found IIOR to be very useful, efficient, and easy to understand. **Conclusions:** In this pilot study, the IIOR was found to be feasible to use and was highly accepted by the dental frontliners. The IIOR was found to be simple and convenient to use by the dental frontliners during dental screening.

Keywords: Interceptive Orthodontics, Malocclusion, Referral, Orthodontic Index.

Introduction

Malocclusion is a common oral disorder among children (1). According to a recent scoping review, between 30% and 93% of children and adolescents experienced malocclusion in various geographical locations (2). Another study showed 76% of children have developing malocclusion in the mixed and early permanent dentition (3). Early intervention can be made to help reduce this problem if it can be detected early for interceptions. Interceptive orthodontics refers to any method used to improve or correct a developing malocclusion or dental abnormalities and prevent it from establishing further (4). However, dental frontliners must be able to identify suitable developing malocclusions timely to be referred to the orthodontist. Knowledge of the type of malocclusion that can be intercepted early has been widely discussed in the literature, but the lack of specific tools to recognize the developing malocclusions and refer them promptly has been a hindrance (3, 5). There was also a lack of confidence in identifying and referring these children with developing malocclusion (5, 6). This leads to the inability to identify the problem and refer the involved patients at the appropriate age and stage for the possibility of interceptive orthodontic treatment. These barriers caused further establishment of the malocclusion, resulting in a more complex and longer duration of orthodontic treatment in the future (7). Initially, an index to help identify and refer developing malocclusion accurately to the orthodontist was developed. This

newly developed, Index for Interceptive Orthodontics Referral (IIOR) was validated and reliability tested (3). Currently, in this pilot study, the aim was to determine the feasibility of using the IIOR and to evaluate the user perception among the dental frontliners towards this newly developed index.

Methodology

Ethics approval was obtained from Universiti Teknologi MARA (UiTM) Research Ethics Committee (REC/10/2022; PG/MR/238). Thirteen participants were recruited from the Faculty of Dentistry, UITM, consisting of six dental officers, four dental therapists, and three orthodontic postgraduate students who have an adequate understanding of English and basic exposure on orthodontics. The selection of the sample was based on the recommended number of a minimum of twelve samples for a pilot study (8). Information about the study was given and written consent was obtained from the participants.

The participants were briefed about IIOR using a pre-recorded video which was developed by the researchers to standardize the information delivery. Then, there was a question-and-answer session to resolve any queries on the use of IIOR before the grading session. Grading of the 10 study models using the IIOR was obtained from three experts (two senior orthodontists and one senior dental paediatric specialist) prior to the commencement of the pilot study. Subsequently, the participants were asked to evaluate the 10 study models using the IIOR (Figure 1). Each study model was provided with a case summary which included age and intraoral findings. The participants were required to identify all the malocclusions present in the study model and grade them according to the IIOR. The highest grade identified was determined as the final referral grade. The time taken for the participants to grade the study model was also recorded. Subsequently, the participants' grading was compared against the experts grading. After finishing evaluation and grading of the ten study models, participants were given a 7-minute perception questionnaire which consisted of two parts (Figure 2). The first part was about the participants attitude towards the IIOR, and the second part was regarding the usability of the IIOR during the screening process. Statistical analysis was carried out using SPSS version 26. The Fleiss Kappa inter-rater agreement was also measured between the participants' grading.

Results and discussion

The Fleiss Kappa inter-rater agreement gave a moderate agreement of 0.5 with $p<0.0001$ which was highly significant (Table 1). As this was the first encounter of the participants with the IIOR, a moderate agreement between the participants showed an acceptable outcome. This may be due to limitations in the exposure and training time. Further continued usage and practice may improve the inter-rater agreement among participants (9). Frequent refreshers with the IIOR pre-recorded video and more interactive sessions may improve the efficiency of the IIOR usage. The repeated use of the index may also lead to fluency and improvement in determining the correct referral grade (9, 10).

Upon comparison of the participants' grades to the expert opinion grading, it was found that 79.23% (n: 10) of participants gave the same grade as the experts, and 20.77% (n=3) differed (Table 2). The disagreement on the grades between participants and expert opinion occurred in two study models. For the first study model, the expert graded as standard referral, but one participant graded it as urgent referral and the other graded it as monitor. As for the second study model, the participant graded it as standard referral but the experts graded it as monitor only. However, the results showed that overall, they were able to apply the index to identify the malocclusion from the list of malocclusion traits and the grades given. Thus, in clinical settings, patients with suitable malocclusion may be referred timely to orthodontists to encourage the possibility of interceptive orthodontics provision.

The mean time taken for the participants to grade each study model was 2.5 minutes. This was an appropriate time taken as compared to the regular dental screening duration (11). However, carrying out the grading in the clinical setting, especially in young patients may take more time, considering the level of cooperation of the child during screening. A study comparing the time taken to complete regular dental procedures showed that the mean time for a routine dental examination in children was about 7.6 minutes (11). Regarding the questionnaire, Question 3 of Part 1 of the user attitude towards IIOR (Figure 3), showed that 92.3% (n=12) agreed and strongly agreed that IIOR helped in the identification of the developing malocclusion.

Grade Component of Malocclusion	1 Monitor	2 Standard Referral	3 Urgent Referral
Supernumerary **S**		• All teeth well aligned	• Clinically missing permanent teeth • Crowding • Trauma • Displacement of tooth
Clinically missing teeth (excluding permanent canine) **M**	• Contralateral tooth erupting • Spaced arch		• With or without a palpable bulge • Fully erupted contralateral tooth
Clinically missing permanent canine **PC**	• Contralateral canine erupting • Presence of 'c'	• Labially palpable • Contralateral canine erupted • Not palpable by 10-11 years	• Palatally palpable
Early loss of deciduous canine **C**	• Presence of contralateral tooth • No dental centreline shift	• Presence of dental centreline shift	
Early loss of deciduous second molar **E**		• Inadequate space for eruption of successor	• Adequate space for eruption of successor
Midline diastema **D**	• Physiological	• >2mm diastema • Low frenal attachment	• Persistent diastema (>2mm) • Missing permanent teeth
Carious first permanent molar **PM**		• Asymptomatic • Presence of Crowding	• Symptomatic • Not restorable • Presence of crowding
Crowding **Cr**	• Cr <4mm • Over retained deciduous teeth	• 4≤Cr≤8mm • Over retained deciduous teeth	• Cr >8mm • Over retained deciduous teeth
Anterior crossbite **AnC**		• Present without displacement	• Present with displacement
Posterior crossbite **PoC**		• Present without displacement • Non-nutritive sucking behaviour	• Present with displacement • Non-nutritive sucking behaviour
Increased Overjet **OJ**		• 5<OJ≤9mm • Non-nutritive sucking behaviour	• OJ > 9mm • Non-nutritive sucking behaviour
Reversed overjet **RO**		• Present without displacement	• Present with displacement
Deep bite **DB**	• No palatal mucosa contact	• Complete to palatal mucosa • Non-traumatic	• Complete to palatal or labial mucosa • Traumatic
Open bite **OB**		• Absence of non-nutritive sucking behaviour	• Presence of non-nutritive sucking behaviour
Others (please specify)			

Tick ALL the components of malocclusion and the corresponding grades as screened. Tick the immediate personnel for referral:

Dental Staff Nurse	General Dental Practitioner	Orthodontist	Others (please specify)

Figure 1: Index for Interceptive Orthodontics Referral (IIOR).

QUESTIONNAIRE

(Modified from Wan Suhaimi et al., 2020)

DENTAL FRONTLINERS' PERCEPTION TOWARDS INDEX OF INTERCEPTIVE ORTHODONTICS REFERRAL (IIOR)

ID Number : _____

Age : _____

Gender : _____

Designation : _____

Years of work experience : _____

(Please circle the response of your choice)

Part 1: User attitude towards IIOR.

No.	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Is IIOR simple to understand?	1	2	3	4	5
2	Is IIOR easy to use?	1	2	3	4	5
3	Do you find IIOR helpful during orthodontic screening?	1	2	3	4	5
4	Do you think IIOR is an important screening guideline in the timely referral of developing malocclusion for interceptive orthodontic possibility?	1	2	3	4	5
5	Do you think the referral of developing malocclusion is easier with IIOR?	1	2	3	4	5

Part 2: Usability of IIOR during screening.

No.	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Would you like to have a referral guideline such as IIOR?	1	2	3	4	5
2	Do you like to use IIOR?	1	2	3	4	5
3	Would you recommend others to use IIOR?	1	2	3	4	5

Do you have any comments on IIOR?

_____

_____

_____

Figure 2: Perception questionnaire.

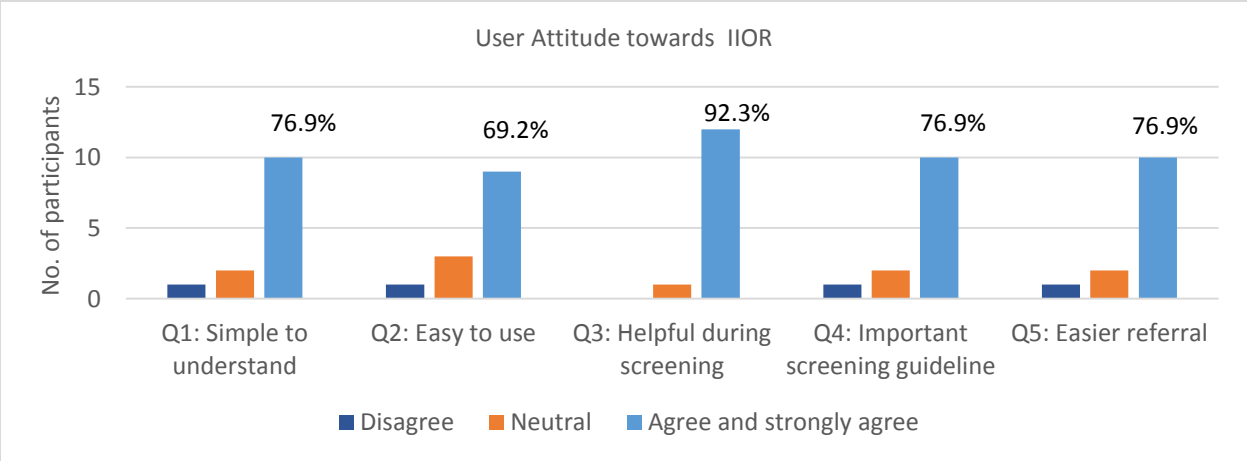

Figure 3: Result for Perception Questionnaire Part 1.

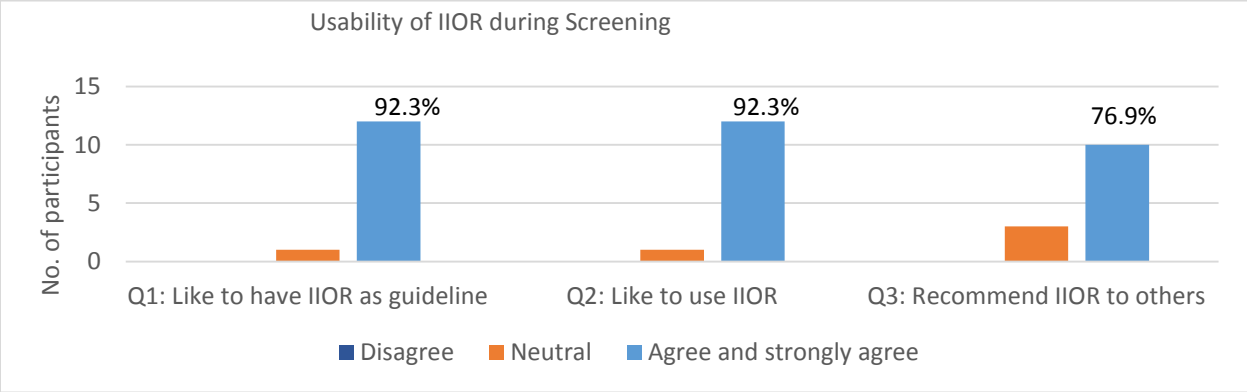

Figure 4: Result for Perception Questionnaire Part 2.

Table 1: Fleiss Kappa inter-rater agreement for IIOR grading.

Fleiss Kappa	P-value (<0.001)	Interpretation
0.5	0.000	Moderate Agreement

Table 2: Comparison of scoring of participants towards expert opinion.

Percentage of correct grade	Percentage of different grade
79.23% (n=10)	20.77% (n=3)

The IIOR was also easy to be used as agreed by 69.2% of the participants (n=9) in question 2. For questions 1, 4 and 5, 76.9% (n=10) agreed that apart from being simple to understand, the IIOR encouraged a convenient pathway for referral of the malocclusion. The same number of participants (n: 10) agreed in question 4 that IIOR was an important guideline or tool for timely referral of developing malocclusion for interceptive orthodontics.

One participant disagreed with four questions in Part 1 (Questions 1, 2, 4 and 5). The participant also suggested that the index would be more attractive and user-friendly if it was made more colourful and came with a comprehensive guideline for a better understanding of the index. The participants highlighted the need for a reference book or tool that includes the methods to understand and use the IIOR. The IIOR was available with a flipbook upon request that may serve as a reference while using the IIOR. Additionally, a colourful IIOR card had been created to be easily carried for quick referencing.

For the usability of the IIOR during dental screening (Figure 4), 12 out of 13 participants expressed a preference for an index like IIOR and indicated they would use it in their daily practice. Furthermore, 10 out of 13 participants expressed their decision to recommend the IIOR as a screening tool to their colleagues. These findings suggest that the IIOR was well-received and was proven to be practical and useful. Based on the pilot study, it was found to be systematic to follow the sequence of malocclusion on the left column from top to bottom in the IIOR table (Table 1) to ensure complete screening. This approach ensures that no malocclusion traits were overlooked during the examination for developing malocclusions.

Conclusion

This pilot study demonstrated that the IIOR was feasible to be used among the dental frontliners as a screening tool for the identification of developing malocclusion. It also showed that the IIOR was convenient to decide on the referral grades (monitor, standard, and urgent referral) for interceptive orthodontics provision possibility. The perception assessment of the dental frontliners on the IIOR showed that it was effective, simple to use and easy to understand during dental screening procedure. Therefore, the IIOR may be a recommended screening tool for the dental frontliners. Following this optimistic pilot study findings, this study will be conducted on a larger population of dental frontliners in Malaysia.

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Competing interest

Nil

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