

Use and knowledge of IOTN among GDPs in Scotland

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VERIFIABLE CPD PAPER

IN BRIEF

- Investigates the current use and knowledge of the index of orthodontic treatment need (IOTN) in Scotland and evaluates changes in patterns prior to mandatory introduction in 2011.
- Assesses the factors which influence use and knowledge of IOTN.
- Makes recommendations for the implementation of the index into clinical practice.

RESEARCH

Objectives To evaluate the use and knowledge of the index of orthodontic treatment need (IOTN) by general dental practitioners (GDPs) working within Scotland. **Setting** Scottish general dental services (SGDS). **Methods** Questionnaires were posted to randomly selected dentists ($n = 356$) working within the SGDS for self-completion and return. **Main outcome measures** Use of IOTN. Knowledge of IOTN. Participants were asked to match 12 malocclusions to the correct IOTN category. Kappa statistics evaluated agreement to a gold standard. **Results** The overall response rate was 64%. Sixty-one percent of respondents did not use IOTN. The most common reason for using the index was to assess treatment eligibility (40.2%). The main reason for non-use was that it was only considered suitable for secondary dental care (27%). Over half (56%) of respondents had received IOTN training at undergraduate level. Knowledge of the index was found to be low - the mean level of agreement was $k = 0.42$ (fair). 10.5% of respondents scored $k \geq 0.61$ (substantial). The factors most likely to contribute to both use and knowledge of IOTN were having a postgraduate qualification and carrying out orthodontic treatment in practice. **Conclusion** Overall use and knowledge of IOTN among GDPs in Scotland appears to still be low. More resources need to be directed towards improving both undergraduate and postgraduate orthodontic training with the focus on IOTN in particular.

INTRODUCTION

Oral health can be defined as the standard of health of the oral and related tissues which enables an individual to eat, speak and socialise without active disease, discomfort or embarrassment and which contributes to general well-being.¹

Malocclusion is an important contributor to oral health but differs from the majority of medical and dental conditions in that it is a spectrum of dental deviations, rather than a disease, and orthodontic treatment does not cure a condition but rather corrects variations from an arbitrary norm.²

Deciding on a cut-off point as to where a specific malocclusion should be treated has been the subject of much dispute.³ However, rational planning, assessing and allocating the resources required for orthodontic intervention is essential, particularly where such resources are finite and publically funded. The current method in use within the UK

to allocate orthodontic services is the index of orthodontic treatment need (IOTN).⁴ In Scotland, those scoring IOTN grade three (dental health component) combined with grade six (aesthetic component) and above, can be considered for treatment under Scottish general dental services (SGDS) arrangements. The index became a mandatory part of NHS dental services in England and Wales in April 2006, with NHS Scotland implementing it in October 2011. It is estimated that 90% of dental care takes place in general dental practices in Scotland, with the remaining (10%) in specialist or secondary care services.⁵ As a result, the majority of orthodontic treatment is carried out following initial referral from general dental practitioners (GDPs).

IOTN's implementation in Scotland had two aims: to allocate finite orthodontic treatment resources to those most in need, and to provide a consistent metric for general dentists when referring patients for NHS orthodontic treatment.

The provision of orthodontic treatment is highly reliant on appropriate referrals, however, little information exists to evaluate whether dentists use IOTN post-implementation, or whether they have sufficient knowledge to do so. This is despite the promise of relevant training being made available.⁶ Given the role of GDPs as

'gatekeepers' in recommending for specialist treatment, it is important to evaluate if they can correctly score IOTN grades to initiate an appropriate referral. Quantifying this information may indicate the use and perceived usage of IOTN in a general practice setting, highlighting the need for further resources allocated to awareness and training.

Aims of the study

- To evaluate the current use and knowledge of IOTN by GDPs in Scotland
- To assess changes in patterns of use after mandatory introduction in 2011
- To investigate which factors, if any, influence the use and knowledge of IOTN by GDPs.

MATERIALS AND METHODS

A self-completed questionnaire was designed and posted to GDPs working within Scotland (Appendix 1). Two pilot surveys were carried out to test for face and content validity of the questionnaire. Minor changes were subsequently made and the final questionnaire was sent to randomly selected GDPs working within the SGDS. The study was carried out from 30 September until 23 December 2013. The methods, conduct and design of the survey were informed by evidence based methodology.^{7,8}

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Ethical approval

Advice was sought from the East of Scotland Research Ethics Service, which indicated that no ethical approval was required for this study.

Questionnaire design

The questionnaire consisted of four sections. Section one investigated the current use of IOTN, specifically reasons for use or non-use; questions were included to allow direct comparison with a previous questionnaire conducted before mandatory introduction.⁹ Section two aimed to evaluate dentists' agreement with the IOTN's Dental Health Component (DHC) and their ability to allocate patients into the correct treatment need category. Twelve statements describing various malocclusion features were taken from the DHC of IOTN. The grades were removed and the various statements were arranged in a random order. Participants were asked to classify each malocclusion into the correct treatment need category from one to five, where grade one indicated no need for treatment and grade five indicated a great need for treatment. Section three examined previous training in IOTN and opinions on future training. Section four collected demographic information relating to the professional background of the respondents; participants were further able to provide any additional comments in a free-text response format.

Sampling

Permission was granted by the Practitioners Services Division, NHS Scotland, for a distribution list of all dental practitioners (n = 3,033) within Scotland to be accessible to the chief investigator (AP). This formed a sample frame. From this list the following were excluded: those who had already taken part in related pilot studies and those who were listed as practitioners restricted to orthodontic practice. A sample size of 356, based on a previous study was estimated.⁹ This was set to detect an 8% prevalence of use. The assumption that there would be no reduction in IOTN use since mandatory introduction was made.

Computer software (Excel 2007) was used to randomise the SGDP list order and then randomly select the 356 potential respondents. In order to conceal the allocation of participants, a researcher independent to this study carried this out.

Each questionnaire was given a code so that non-respondents could be targeted for a follow-up contact. This included postage of a reminder letter and a copy of the questionnaire. All respondent questionnaires were anonymous.

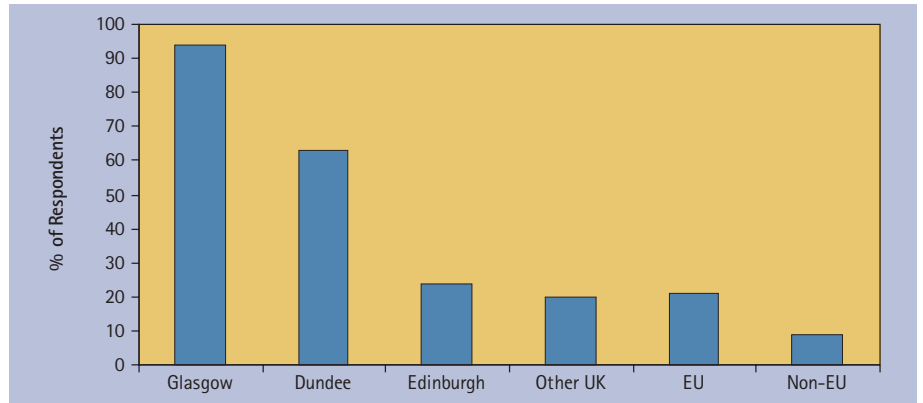


Fig. 1 Distribution of dental school qualified of GPs in Scotland

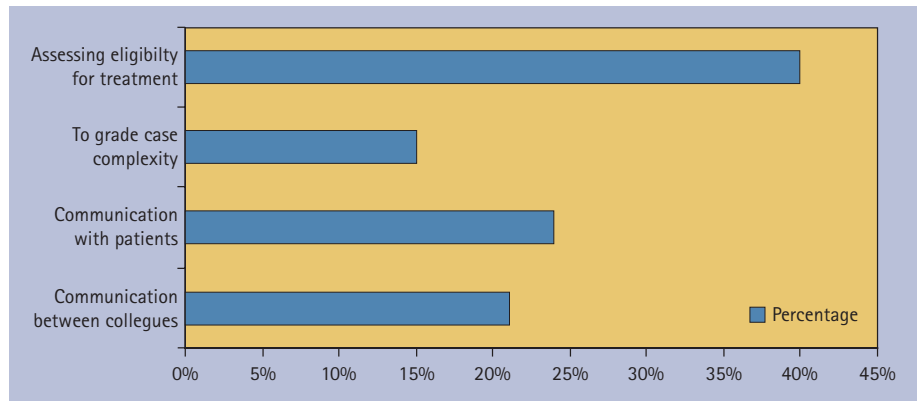


Fig. 2 Reasons for use of IOTN among GPs in Scotland

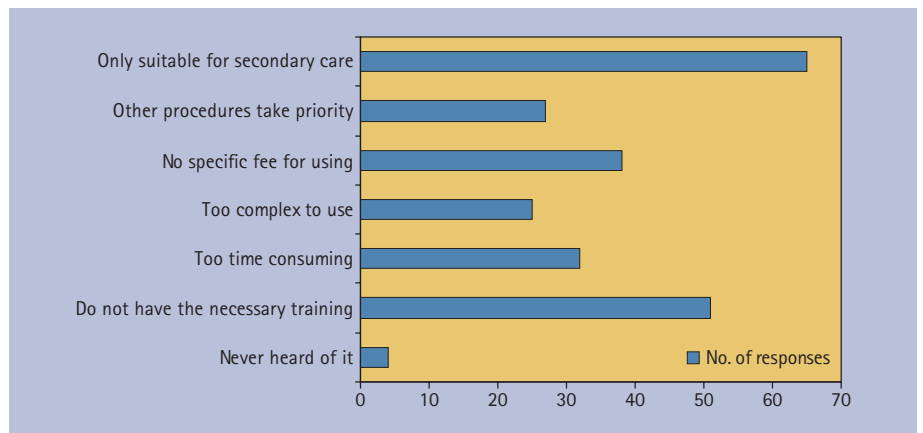


Fig. 3 Reason for non-use of IOTN among GPs within Scotland

Statistical analysis

Data were extracted manually from the returned questionnaires and entered into SPSS software (version 19) for statistical analysis.

Simple descriptive statistics (frequencies and percentages) were used to determine the distribution and range of GPs' responses to each question. For comparison of two or more categorical variables, the chi-square test was used. For continuous variables, comparison of the means between two groups was by use of a Student t-test; and for three or more groups one way analysis of variance (ANOVA) was used. The significance level of p <0.05 was used in all tests.

Knowledge of IOTN was determined by asking participants to allocate various malocclusion features into the correct treatment need category, as determined by the DHC of IOTN. The scores were compared against the gold standard previously established by the consensus of orthodontists who developed the index.^{4,10} Cohen kappa statistics were calculated for each dentist to assess the level of agreement from their scores compared to the gold standard. This was termed the 'IOTN knowledge score'. The Cohen's kappa represents the proportion of agreement over and above chance alone.

Binary logistic regression analysis was conducted in order to determine factors influencing the use of IOTN, giving odds

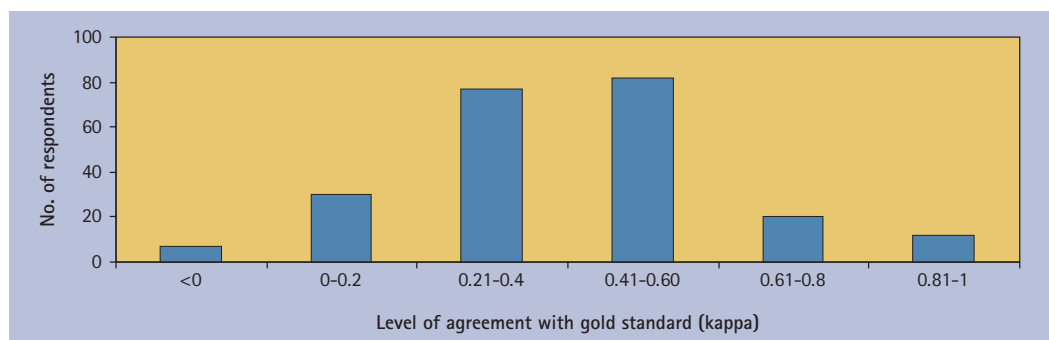


Fig. 4 Distribution of IOTN knowledge score

ratios. Multiple linear regression analysis was used to reveal factors which best explained knowledge level of IOTN.

RESULTS

A total of 231 questionnaires were returned, giving an overall response rate of 65%.

Respondent demographics

Out of the total respondents, 125 (54%) were male, and 106 (46%) were female. The majority of respondents were most likely to have qualified from one of three Scottish universities: Glasgow ($n = 94$, 41%), Dundee ($n = 63$, 27%) and Edinburgh ($n = 24$, 10%) (Fig. 1). The range for time in practice was between 1–43 years. More than one third of respondents ($n = 81$, 35%) had obtained their primary qualification within the last ten years.

Overall, 28% of respondents had a postgraduate qualification; the most commonly held postgraduate qualification (81%) was a diploma from one of the Royal Colleges. The remainder tended to be in the form of a Master's degree from a university.

The majority of respondents carried out mainly NHS dental work ($n = 125$, 54%); 37% ($n = 85$) carried out a mixture of NHS and private dental work, and 9% ($n = 21$) of respondents carried out mainly private work.

Only 17% ($n = 40$) of respondents said they carried out some orthodontic treatment in their practice. For the majority, this was in the form of simple treatment normally involving a removable appliance ($n = 30$, 16%). Ten GDPs (5%) said they provided private orthodontic techniques, such as Invisalign®, Inman aligners® and 6-Month Smiles®.

Use of IOTN

Most respondents did not use IOTN ($n = 142$, 61%), while 39% ($n = 89$) said they did. The most frequently reported reason for using IOTN was to assess eligibility for treatment ($n = 66$, 40.2%). Other reported reasons were for communication with patients ($n = 39$, 24%); inter-colleague communication ($n = 34$, 21%) and assessing case complexity ($n = 25$, 15%) (Fig. 2).

The most common reported reason for not using the index was that it was only suitable

Table 1 Factors promoting use of IOTN

Factor	Odds ratios (95% C.I.)	p
Postgraduate qualification	2.38 (1.27–4.43)	0.006
Orthodontic treatment carried out in practice	4.26 (1.96–9.25)	<0.001

Table 2 Factors which best explain knowledge level of IOTN

Factor	B coefficient (95% C.I.)	p
Do you carry out orthodontic treatment for your patients?	0.063 (-0.009–0.135)	0.045
Postgraduate qualifications	0.1 (0.039–0.16)	0.001
Do you ever use the IOTN?	0.112 (0.055–0.17)	<0.001

for secondary care ($n = 65$, 27%). Twenty-one percent of respondents reported they did not have the necessary training. Other reasons for not using IOTN were due to the fact that no fee was provided; other procedures took priority; it was too complex or too time consuming to use. Four dentists said they had never heard of IOTN (Fig. 3).

Training

The majority of dentists had received previous training in using IOTN ($n = 134$, 58%), mainly obtained during undergraduate dental school ($n = 106$, 63%). Other methods were through attending a course on the index; via journals or online literature searches or from a visiting local orthodontic practitioner. The majority of respondents felt there should be more training in IOTN (74%). GDPs were further asked what methods they considered would most encourage use. Most felt there should be more courses available ($n = 100$, 37%). Others wanted better publicity for existing courses and more educational material available online. Free text responses from four GDPs recommended having IOTN posters up in surgeries to encourage further use of the index.

Knowledge of IOTN

All respondents completed this section and subsequently no adjustment for missing data was necessary. There was a wide range of performance among respondents: the mean kappa (IOTN knowledge score) for

all respondents was 0.416, with a range of -0.15–1. Based on the guidelines from Landis and Koch,¹¹ a kappa of 0.416 represents a fair to moderate strength of agreement. The percentage of respondents with a substantial agreement (0.61 or above) was 10.5%. Seven respondents (3%) had a kappa value of less than zero, indicating no agreement (Fig. 4).

Factors likely to promote use of IOTN

The use of the IOTN and the knowledge score were cross tabulated against GDP characteristics, specifically: gender, year qualified, dental school, type of treatment undertaken, previous training in IOTN, postgraduate qualifications and whether orthodontic treatment was carried out. It was found that gender, undergraduate training, years qualified and type of treatment provided had no statistically significant relationship with both use and overall knowledge of the IOTN ($p > 0.05$).

The two variables in the logistic analysis that were found to have a significant effect on the use of IOTN were:

- Whether or not the GDP had a postgraduate qualification - GDPs with a postgraduate qualification were more than twice as likely to use IOTN
- Whether orthodontic treatment was done in the practice - these GDPs were more than four times as likely to use the index if they carried out some form of orthodontics in practice (Table 1).

Three variables were found which best explained the level of IOTN knowledge were whether or not the GDP carried out orthodontic treatment; had a postgraduate qualification and used IOTN (Table 2).

DISCUSSION

High response rates generate accurate and reliable results to surveys - response rates of over 70% are desirable. Low response rates may be related to questionnaire topics which are perceived as irrelevant, and tend to yield a lower response rate than those judged 'salient'.¹²

It is contended that the 65% overall response rate in this survey does provide an acceptable representation from the selected sample, given the salience of the topic.⁷⁻⁹ This is also a significant (20%) improvement in response rate *versus* the pre-introduction survey and may indicate an increased level of salience within the SGDS.^{9,13-17} The results from this study indicate relatively low penetration of IOTN in SGDS, with only 38.5% of GDPs reporting ever using the index.

These figures compare less favourably to those obtained from surveys conducted in secondary and tertiary care,¹⁴⁻¹⁶ however, an improvement has been found upon comparison to surveys carried out in primary dental care previously.^{9,17} In particular, the 2003 national Scottish survey estimated only 10% of GDPs used IOTN and a significant 48% had never heard of it. Additionally, a West Sussex survey found only 5.7% of GDPs reported always using the index, 17% often using it and 5.2% had never heard of it.^{9,17} Logically, the most likely factor increasing use is the introduction of mandatory use for SGDS eligibility in Scotland in 2011. Furthermore, there appears to be an enhanced awareness of dental aesthetics among the public, together with the greater acceptability for orthodontic appliances. This has resulted in higher demands being placed upon the limited resources of publicly funded systems of care.¹⁸

When the index was used, it tended to be for one of its core purposes - the assessment of eligibility for publically funded orthodontic treatment (40.2%). Approximately 15% of GDP respondents inappropriately used IOTN to grade case complexity; this continues to be a persistent issue.

When asked why IOTN was not used, the majority of respondents said it was only suitable for use after referral (27%) indicating that someone else should carry out the grading, thereby exhibiting evidence of abdicating the 'gatekeeper' role. This is consistent with previous findings.¹³

Knowledge of the IOTN was found to be low. The mean kappa for all respondents

was 0.41, indicating only a fair to moderate agreement. Only 10.5% of respondents were found to have a kappa score of 0.61 (substantial agreement) or above. Again, these results do not significantly differ from previous studies which have found generally low orthodontic knowledge among GDPs.¹⁷

The main factors which appeared to contribute to higher knowledge and use of the index were whether or not the GDP had a postgraduate qualification and unsurprisingly, whether or not any orthodontic treatment was carried out within practice.

The most commonly held postgraduate qualification by GDPs tended to be in the form of a diploma qualification from one of the Royal Colleges of Surgeons. These qualifications are based on the document 'A curriculum for UK dental foundation programme training', which informs the requirement of individuals to be competent in carrying out an orthodontic assessment using IOTN. It is predicted that this qualification should have resulted in improved knowledge and confidence in the use of occlusal indices, which was perhaps not achieved during undergraduate training.

Access to and participation in postgraduate education has been found to have a similar value in promoting use *versus* remuneration or imposed use.⁹ Previous undergraduate training, years since qualification and dental school of training did not appear to have a statistically significant effect on the use and knowledge of the IOTN. This may support the contention that undergraduate training alone is not sufficient to enable the confident clinical application of orthodontic skills, that resources should be directed at improving undergraduate training and in the provision of postgraduate education.

In relation to orthodontics being undertaken within practice, a total of 17% of GDPs said they carried out such treatment. The majority of these treated less than ten patients per year, and most used removable appliances. However, a small number of GDPs reportedly provided commercial, privately funded orthodontic techniques, such as Invisalign®, Inman aligners® and 6-Month Smiles®. Individuals carrying out such treatment will have been expected to attend various certified commercial or corporate courses, which should have increased awareness in assessment, diagnosis and eligibility for orthodontic treatment. However the focus of these courses will naturally be on the commercial aspects of whichever system they are promoting and not on eligibility for NHS orthodontics.

Previous studies have also promoted the dissemination of orthodontic guidelines to help improve the competence skills in

orthodontic assessment and diagnosis before referral.^{17,19} The currently available orthodontic guidelines have perhaps failed to reach at least one of their target groups.^{22,23}

CONCLUSIONS

- The current use of IOTN among GDP's in Scotland appears to be low. In addition, knowledge relating to overall orthodontic treatment need was less than satisfactory, with only 10.6% of GDP's conforming to the gold standard
- While there is an increase in the perceived salience of IOTN compared to previous studies, presumably due to mandatory introduction, GDPs continue to place a relatively low value on the utility of it; most prefer a specialist to make the necessary grading. This seems to relate to a continued lack of general orthodontic knowledge
- Previous undergraduate training, years since qualification and dental school of training did not appear to have a statistically significant effect on the use and knowledge of the IOTN
- There appears to be an explicit value in formal, non-commercial, dental postgraduate education which positively impacts on applied knowledge, enhancing the engagement of GDPs with IOTN use.

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Appendix 1 Questionnaire on orthodontic treatment need

Thank you for agreeing to help with this survey. Your answers will give us valuable information on current practice in Scotland.

The questionnaire should only take approximately 5 minutes to complete. Most questions involve ticking a box. All answers and comments will remain confidential.

It would be a great help if you could return your completed questionnaire as soon as possible in the envelope provided

SECTION ONE

1. Do you ever use the Index of Orthodontic Treatment Need (IOTN)?
 Yes - Proceed to question 2 No - Proceed to question 3
2. Which of the following best describes how you most commonly use IOTN? Please tick one box only
 Communication between colleagues Communicating with patients To grade potential case complexity
 Assessing eligibility for treatment Other, please specify
3. If you DO NOT regularly use IOTN please indicate the main reason. Please tick one box only
 Never heard of it Do not have the necessary training Too time consuming
 Too complex to use No specific fee for using Other procedures take priority
 Only suitable for secondary care or specialist practice use Other, please specify

SECTION TWO

Please grade the following features into the most appropriate treatment need category you feel is correct as below:

Grade 1 = no treatment need

Grade 2 = little treatment need

Grade 3 = moderate/ borderline treatment need

Grade 4 = need for treatment

Grade 5 = very great need for treatment

Please circle the grade you feel is correct:

Overjet greater than 9 mm	1	2	3	4	5
Impacted canine tooth	1	2	3	4	5
Submerged or retained primary tooth	1	2	3	4	5
Crowding of 1 mm or less	1	2	3	4	5
Anterior open bite of 1 mm	1	2	3	4	5
Deep overbite complete on gingival or palatal tissues, with no soft tissue trauma	1	2	3	4	5
One congenitally missing tooth in any one quadrant	1	2	3	4	5
Overjet of 5 mm with lips apart at rest	1	2	3	4	5
Reverse overjet of 3 mm with reported eating and speech difficulties	1	2	3	4	5
Crowding of 4 mm	1	2	3	4	5
Increased overjet of 4 mm with lips together at rest	1	2	3	4	5
Posterior crossbite with no displacement on closure	1	2	3	4	5

SECTION 3

5. Have you ever received any training in the use of IOTN?
 YesProceed to question 6 No.....Proceed to question 7
6. If YES, indicate how this training was carried out: Please tick one box only
 Undergraduate school Course Journals/ literature search Other, please indicate
7. Do you feel there should be more training in IOTN available?
 Yes.....Proceed to question 8 NoProceed to SECTION FOUR

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Appendix 1 Questionnaire on orthodontic treatment need. Continued from page 403

8. If YES, which of the following do you feel would most beneficial to encourage IOTN use?

Please tick one box only

- More IOTN courses More publicity for existing IOTN courses Educational material available online Other, please state

SECTION FOUR

9. Your gender (please tick)

- Male Female

10. Dental School you obtained your BDS (and year obtained)

11. Postgraduate qualifications (and year obtained)

12. Do you carry out orthodontic treatment for your patients?

- No Yes, if yes, approximate number of orthodontic patients per year

Please use the space below to add any comments:

COMMENTARY

In the current political climate, we are constantly being told of the 'difficult economic times' in which we live. NHS resources are 'at crisis point' and efficiency appears to be the watchword of the day. As such, it is important that there are clear criteria for referral to specialist care services and access to treatment for these cases. However, the value of these criteria are only useful if used appropriately by the gatekeepers of these services, the general dental practitioner. The IOTN has been in use for over 25 years and is an integral part of undergraduate orthodontic teaching. In order to ensure that resources are directed to the patients most in need, it is important that the GDP is fully aware of IOTN. Failure in this would lead to unnecessary referrals to NHS services, loading an already stretched budget. Currently, it may only be necessary for the GDP to know that a patient with an IOTN of 3.6 is eligible for NHS funded treatment but in the advent of managed clinical networks, a more nuanced understanding of which cases can be seen in specialist practice and which are appropriate for hospital services may become necessary.

In this article, the authors ask a very important question, which is relevant to all secondary care services. If the gatekeepers are unsure of when to 'open the door', how useful are these referral criteria, particularly when all children have the right to an NHS orthodontic consul-

tation. Steps such as the recent orthodontic themed issue of the *BDJ* will help raise awareness as well as articles such as these. Our instinct may be to institute training courses and CPD events but with increasing mandatory and strongly recommended CPD in medical emergencies, radiography, infection control, ethics, complaints, safeguarding and oral cancer screening, it is all too easy to see how orthodontic referral criteria drops down the to-do list.

The authors of this paper have raised some very important issues regarding the role of GDPs within our future orthodontic provision and, like most good research, have probably left us with more questions than answers.

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AUTHOR QUESTIONS AND ANSWERS

1. Why did you undertake this research?

The IOTN became a mandatory part of NHS dental services in England and Wales in April 2006, with NHS Scotland implementing it in 2011. General dental practitioners have a vital role in acting as 'gatekeepers' in referring for specialist treatment, however little information is available to evaluate if they can correctly score IOTN grades to initiate an appropriate referral.

2. What would you like to do next in this area to follow on from this work?

In future it may be beneficial to review any trends in GDPs' awareness and attitude towards orthodontic screening, particularly for publically funded orthodontic services within Scotland and the UK as a whole. One interesting finding in this study was the number of GDPs providing alternative private orthodontic treatment for adult patients. This is an area that may well continue to grow in the future and studies could investigate this type of treatment modality in relation to previous orthodontic training, as well as its impact on GDP referral patterns. Finally, due to the relatively poor penetration of the IOTN into general dental services, future studies could investigate the most useful and effective methods to improve adoption of guidelines into day-to-day clinical practice. This would allow the appropriate strategies to be put into place to allow for a more efficient, transparent and robust healthcare system.