

Pathways to orthodontic care

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Abstract

Background The research described in this paper arose out of the need to address the growing waiting list for orthodontic treatment in Northamptonshire. Although the prevalence of dento-facial anomalies is the same across time, sex, race and socio-economic class, studies in the United States and this country suggest that certain groups are over-represented among patients who receive orthodontic treatment. The introduction of valid and reliable indices of therapeutic need such as the Index of Orthodontic Treatment Need (IOTN) will allow improved focusing of services. The aim of the study was to determine the variables affecting access to orthodontic care, and the extent to which services were delivered according to objective measures of need.

Methods Analyses were undertaken for speed, appropriateness, timing of referral, duration and complexity of the pathway for new referrals to specialist orthodontic care. Possible explanations for the length of pathway were examined, including socio-demographic factors, location of residence and the IOTN.

Results A total of 405 patients were approached, of whom 400 (99 per cent) agreed to participate. There was an over-representation among socio-economic groups I and V among patients referred to orthodontic treatment. By contrast, those of male sex and from socio-economic class IV were under-represented. This appeared to be the case irrespective of treatment setting. There was also a wide range of waiting times to treatment and complexity of pathway. Over a quarter of the sample had been inappropriately referred, and objective need as measured by the IOTN was not a determinant in the speed of access to specialist treatment. Adult patients waited longer for treatment.

Conclusions These results suggest that the delivery of care is neither based on objective need nor equitably distributed. More appropriate directing of resources is required, using the IOTN and agreed protocols, so that referrals are made to the most suitable provider.

Keywords: referral pathways, orthodontic services, appropriateness

Introduction

Orthodontics is the specialty of dentistry concerned with the correction of dento-facial anomalies.^{1–3} In common with the rest of dentistry, orthodontics in the National Health Service (NHS) is provided by the general (GDS), community (CDS) and hospital (HDS) dental services.⁴ Eighty per cent of orthodontic care in the United Kingdom is carried out in the GDS either by

general dental practitioners (GDPs) who undertake simple procedures, or by specialists in the GDS who take referrals from colleagues.

At a primary level, the GDS is responsible for meeting the routine dental needs of patients who have registered with a GDP. There are certain similarities between the GDS provided by GDPs, and general medical services (GMS) provided by general medical practitioners (GPs). However, unlike the GMS, the GDS is currently financed through a mixture of capitation fees and fee-for-service charges administered by a central body called the Dental Practice Board (DPB). As the GDS largely provides primary care, the service was the responsibility of Family Health Service Authorities (FHSAs), before FHSAs were merged with District Health Authorities. These combined health authorities now oversee both primary and secondary care.

By contrast, the CDS and HDS have previously been the responsibility of District Health Authorities, which purchased care from both services. The CDS is staffed by approximately 2000 salaried dentists.⁴ It has roles in public health (monitoring, assessment, health promotion and screening) focused particularly on children. In the area of treatment, the CDS acts as a safety net for patients whose needs are not being met through the GDS, including the disabled, elderly housebound or infirm, and some patients with challenging behaviour.

The provision of dental services in hospital (the HDS) is the responsibility of individual trusts. There are about 2500 hospital dentists who provide services for hospital patients, and specialized treatment in orthodontics and oral maxillo-facial surgery for cases.

In terms of orthodontic care, the GDS, CDS and HDS have complementary if overlapping roles. GDPs may undertake simpler procedures or refer patients to other practitioners within the GDS. Where patients have special needs or require more complicated treatment they may be referred to the CDS or HDS.

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The HDS offers complex treatments which are not available in the GDS or CDS.

Because of disparities in funding and organization across the GDS, CDS and HDS, there has been little opportunity to plan and co-ordinate orthodontic services. However, with the merger of FHSAs and DHAs, and the proposed integration of the GDS into the purchaser-provider system,⁵ newly combined Health Authorities will be increasingly involved in the local planning of orthodontic services.

There are a number of difficulties that newly combined Health Authorities face in reconciling the normative, felt and expressed needs of their population, as well as the best form of orthodontic service for their residents. Ideal occlusion is seldom found, and so the presence of mild orthodontic anomalies does not necessarily translate into normative need.

What is the level of need?

In the United Kingdom, information concerning the dental health of the country is provided by decennial surveys of adults and children that have been carried by the Social Survey Division of the Office of Population Censuses and Surveys (OPCS) since the 1960s.⁶⁻⁸ These surveys demonstrate that orthodontic conditions are primarily a condition of childhood and adolescence. In the survey of children, nearly three-quarters had one or more orthodontic anomalies.⁷ At the age of nine years, half of children examined were assessed as having treatment need varying from moderate to very great.^{7,8} Crowding was the commonest condition, and was present in over 60 per cent of children from the age of eight.⁷

However, there are wide variations in the reported prevalence. Some of these can be accounted for by differences in the age groups of sampled studies, but this is unlikely to be the sole explanation as dento-facial anomalies cannot always be considered as diseases and so it is not correct to term every deviation from average as an abnormality. Some studies have addressed this issue by reporting the numbers of cases with severe need, or using indices of treatment need such as the Treatment Priority Index (TPI). In one US study, severe malocclusion was present in approximately 15 per cent of children.³ Studies in England using clinical criteria,⁹ or an index of treatment need,⁸ reported a similar prevalence, with 17 per cent of nine-year-olds and 19 per cent of 12-year-olds being in urgent need of orthodontic treatment. Where data have been collected in a uniform manner, the prevalence of dento-facial anomalies is the same across time, sex, race and socio-economic class.^{6-8,10}

Is there equity of access?

Studies in the United States and this country suggest that certain groups are over-represented among patients who have received orthodontic treatment.^{3,6,7,11} These include female patients from non-manual households in Southern England. There are also variations in intervention rates within the United Kingdom

and between different countries, which cannot be explained in terms of treatment need and may be due to a variety of factors including patient expectation, dental manpower, and diagnostic and referral practice.^{3,6,7,11} The introduction of valid and reliable indices of therapeutic need will allow improved focusing of services.

How appropriate are referrals to orthodontic care?

There are three aspects to appropriateness of referral to orthodontic services: the severity of the condition, the complexity of the treatment required and the timing of the referral. These three issues need to be dealt with separately. For instance, symptom severity and treatment complexity may not coincide, as some patients with severe symptoms may require fairly simple interventions, with implications for the most appropriate service for treatment.

For 70 per cent of individuals referred for orthodontic treatment, the GDP is responsible for initiating the referral, rather than the child or parent.¹² However, 30 per cent of patients referred to the hospital or specialist practitioner services were judged in one study to have been unlikely to gain worthwhile orthodontic benefit from treatment.¹² In one study, dentists' perception of orthodontic treatment need showed only fair agreement,¹³ and in another, GDPs failed to agree on the timing and complexity of treatment required, although agreement on treatment need was better.¹⁴ In most cases of disagreement, GDPs considered intervention earlier and regarded treatment as more complex than the orthodontist.¹⁴

A reliable and valid assessment scale, the Index of Orthodontic Treatment Need (IOTN), has been developed to identify those patients most likely to benefit from treatment.¹⁵ This has certain advantages over earlier indices such as the TPI, which relied on subjective weightings by the evaluator in determining score. The IOTN ranks malocclusion in terms of dental health and aesthetic impairment on separate five- and ten-point scores, respectively. Validity as measured against a panel of 74 experts was high, and inter-rater reliability was almost perfect as measured by kappa scores. The IOTN needs to be supplemented by assessments of the timing and complexity of treatment required, as it does not cover these areas.

A further validated and reliable index has been developed to assess treatment quality and outcome: the Peer Assessment Rating Index (PAR Index).¹⁵

In addressing these issues, Northamptonshire Health Authority faced the problem of increasing waiting times for orthodontic treatment, particularly for the HDS.¹⁶ The reasons for this were unclear given the stable prevalence of orthodontic anomalies. It is possible that one factor had been changes in felt and expressed need in the population, particularly amongst adults. In the United States, 5 per cent of orthodontic patients in 1970 were adults, as opposed to 20 per cent by the mid-1980s.³ There are no comparable data for the United Kingdom. In addition, there were concerns that in the absence of referral

guidelines, GDPs were referring cases to the HDS that were more appropriately dealt with in other settings.

The aim of this study was to determine the variables affecting access to orthodontic care, and to establish whether services were directed according to objective measures of need, or whether delivery was affected by other variables. These might include demographic and geographic variables, or the views and perceptions of patients. The results were to be used to inform the drawing up of guidelines for referral to orthodontic services.

Method

All new patients referred for an orthodontic opinion were approached while awaiting their appointment in the waiting room and assessed for their eligibility to enter the study. Subjects included in the study were all those who were being referred for a new episode of care; this was defined as not having received treatment from the specialist service in the previous year. Patients included in the study were interviewed using a modified version of the 'Pathways Encounter Form'. This is a standardized, structured instrument which has been successfully used in primary and secondary care which records the following:^{17,18} the main problem presented, the duration of symptoms, the dental diagnosis, the profession of each previous carer, the main treatment offered and the duration of the patient's journey to the carer, as well as socio-demographic variables such as age, sex, marital status, occupation and postcode. Subjects were also asked to identify any concerns in seeking orthodontic care from a list of possible factors derived from previous research.¹⁹

The treating orthodontist completed a dental assessment form including the diagnosis, appropriateness of referral and management plan for each patient included in the study. The treating orthodontists assessed appropriateness in three areas: (1) condition severity as determined by the IOTN score; (2) appropriateness of the setting to which the patient was referred for the complexity of treatment required; (3) timing of referral.

All three types of orthodontic practices run throughout the county were used in the study. These were the Hospital Dental Service (at Kettering and Northampton General Hospitals), the Community Orthodontic Service run throughout the county in health clinics, and specialist practices, run by individual practitioners specializing in orthodontics.

Data analysis

Diagnosis was determined using the 10th version of the International Classification of Diseases (ICD 10). As the aim of the study was to assess the determinants of access to orthodontic care, analysis was restricted to the time interval from first presentation to a dental professional to arrival at the orthodontic clinic, rather than from the onset of symptoms or for referral waiting times. Analysis of the time from the first

onset of symptoms to inclusion in the study could have been affected by variations in illness behaviour on the part of patients, which was beyond the scope of the present research. Equally, referral waiting times are influenced by the length of waiting list and practice of the orthodontic facility rather than being an indicator of access to services.

Accessibility was defined in four ways: length of time between first approaching a health care professional and an appointment at the orthodontic clinic, numbers of professionals seen before referral to the orthodontist, and assessments by the treating orthodontist of the timing and destination of referral. These were compared across demographic factors, diagnosis, IOTN score and geographical area. Geographical area was assessed by whether the postcode of where a patient lived lay inside or outside Northamptonshire. Differences were analysed using the χ^2 test, *t*-test and analysis of variance as appropriate.

Results

Socio-demographic characteristics of the sample

A total of 405 patients were approached to participate in the study, of whom 400 (99 per cent) agreed to take part. Of these, 225 (56 per cent) subjects were recruited in the HDS (NGH or KGH), 35 (9 per cent) from the CDS and 140 (35 per cent) from the three participating orthodontists in the GDS.

The sex of the 400 new orthodontic patients was skewed in favour of females (62 per cent) compared with the 38 per cent of male referrals. The mean age of the 400 new patients interviewed was 12.4, with a range of 5 years to 42 years old. The majority of the new orthodontic patients were under 16 years old (358 or 90 per cent of the sample).

Table 1 shows the overall gender and socio-economic profile of the entire sample in comparison with 1991 Census figures for Northamptonshire. The numbers of patients from socio-economic class I were more than double that which would have been expected had the sample reflected the socio-economic profile of the county, the figure for Northamptonshire lying outside 95 per cent confidence intervals. The findings from socio-economic classes IV and V were contradictory (Table 1). Those from socio-economic class IV were under-represented, whereas those from socio-economic class V were over-represented in the sample, the figures for socio-economic classes IV and V in Northamptonshire falling outside 95 per cent confidence intervals (Table 1).

Patients' postal codes were distributed over a wide area, with the majority being inside Northamptonshire borders (337, or 84.3 per cent). Just over one-third of patients (39.4 per cent) came to the clinics directly from school or work.

Presenting symptoms and diagnoses

Anomalies of tooth position (K07.3) was the commonest ICD 10 diagnosis reported by the treating orthodontists (93 per cent),

Table 1 Social class distributions across the county and within the survey

Demographic variable	Number in survey	% in survey	95% CI	% in country
Sex				
male	152	38.0	33.2–42.8	48.6
female	248	62.0	57.2–66.8	51.4
Total	400	100	–	100
Socio-economic class*				
I	47	12.0	8.6–14.9	5.4
II	114	29.0	24.0–32.9	30.5
III(N)	49	12.5	9.0–15.5	11.3
III(M)	91	23.2	19.0–27.3	31.7
IV	42	10.7	7.6–13.7	14.4
V	50	12.6	9.4–16.0	4.1
Total	393	100	–	100

* Data on socio-economic class were missing on seven forms.
CI, confidence interval.

with the remainder (7 per cent) having anomalies of the dental arch relationship (K07.2).

As regards patients' concerns, 177 (44 per cent) expressed no concerns about their future orthodontic treatment. Of the remainder (223), just over a quarter (28 per cent) were primarily worried about the possible impact of treatment in terms of discomfort or pain. Other concerns, such as the effect on appearance (3 per cent), other peoples' experiences of treatment (3 per cent), a general dislike of dentistry (2 per cent), possible cost (2 per cent) or reaction of peers (1 per cent) were relatively uncommon.

There were no differences between clinic types in terms of age, sex or socio-economic class, apart from the fact that there were significantly fewer adults attending hospital out-patients departments (Table 2).

Duration of pathway

The period between the time that the patients first saw a professional about the presenting symptom and the interview spanned from 4 to 1040 weeks (20 years). The distribution was very positively skewed to the right (SD=106, skew=3.2, kurtosis=19.8). The median was 52 weeks. Broken down into yearly intervals, 181 (45.3 per cent) patients first contacted a carer within the last year, 94 (23.2 per cent) patients contacted someone between one and two years ago, and 125 (31.6 per cent) contacted someone for the first time more than two years ago.

Possible factors that could be associated with differing times to orthodontic care were analysed by dividing the sample into two groups about the median value of 52 weeks: patients with

Table 2 Differences between settings

	Treatment setting			Significance
	Hospital (column %)	CDS (column %)	Specialist (column %)	
Sex				
male	87 (39%)	10 (29%)	55 (39%)	$\chi^2 = 1.4$, df = 2, $p = 0.48$
female	138 (61%)	25 (71%)	85 (61%)	
Mean age at interview (SD)	12 (4.7)	12 (3.2)	13 (3.9)	$F = 0.50$, df = 2, $p = 0.62$
Child (under 16)	201 (89%)	27 (77%)	130 (93%)	$\chi^2 = 7.4$, df = 2, $p = 0.03$
Adult (16 and over)	24 (11%)	8 (23%)	10 (24%)	
Socio-economic class*				
I	26 (12%)	6 (18%)	15 (11%)	$\chi^2 = 7.7$, df = 10, $p = 0.66$
II	64 (29%)	5 (15%)	45 (32%)	
IIIN	26 (12%)	6 (18%)	17 (12%)	
IIIM	55 (25%)	8 (24%)	28 (20%)	
IV	25 (11%)	2 (6%)	15 (11%)	
V	25 (11%)	6 (18%)	19 (14%)	

* Data on socio-economic class were missing on seven forms

Table 3 Appropriateness of referral

Total	Appropriate place for referral		Appropriate timing	
	Count	%	Count	%
Yes	308	77.2	294	73.4
No	92	22.8	102	25.6
Total	400	100	396*	100

* Data on timing were missing on four forms.

fast pathways who reached orthodontic care within a year of first presenting to a health care professional with their symptoms, and those with slow pathways who were seen after a year. No particular socio-demographic or geographic variables were associated with a slow or fast pathway. Condition severity, as measured by a dental IOTN score of greater than three was not significantly associated with length of time to reaching hospital orthodontic care either (data not shown). Similar findings were demonstrated for pathway times of more than or less than six months, and more than or less than two years.

Numbers of carers before reaching hospital orthodontic care

Seventy-two per cent ($n=288$) of patients were seen by only one health care professional before being seen by an orthodontist, giving a total of two pathway steps. A further 18 per cent ($n=72$) were seen by two carers before referral (three pathway steps), and 10 per cent ($n=40$) by three. In all but two cases, the first health care professional who was consulted was the patient's GDS. No demographic, geographic or clinical factors were significantly associated with the number

of carers on the pathway to orthodontic treatment (data not shown).

Appropriateness of destination for the complexity of treatment required and timing of referral

Approximately three-quarters of the patients were judged by the treating orthodontist to have been referred to the appropriate clinic for the complexity of treatment required and at the correct time for their symptoms (Table 3). Of the other 26 per cent, who had not been referred at the right time, 8 per cent had been referred too early whereas 18 per cent were judged to have been referred too late for treatment.

Patients of older age, and adults as opposed to children, were significantly more likely to have been referred to a setting inappropriate to their treatment needs (Table 4). Otherwise, there were no other demographic differences between the two groups.

In terms of clinical features, a score on the IOTN of greater than three was significantly associated with being referred to the correct setting for the complexity of treatment required (Table 4). Patients attending the HDS were significantly less likely to be judged to have been referred to the correct setting (63 per cent), compared with those in the CDS and GDS (95

Table 4 Factors associated with appropriateness of place and timing of referral

Factor	Place of referral appropriate to complexity of treatment			Appropriate time of referral		
	No $n=92$ (row %)	Yes $n=308$ (row %)	Significance	No $n=102$ (row %)	Yes $n=294$ (row %)	Significance
Mean age (SD)	14.0 (6.5)	12.0 (3.2)	$t=4.75$, $df=398$, $p=0.001$	13.0 (5.2)	12.0 (3.8)	$t=-2.03$, $df=398$, $p=0.04$
Child (under 16)	75 (21%)	283 (79%)	$\chi^2=8.1$, $df=1$, $p=0.004$	88 (25%)	268 (75%)	$\chi^2=1.9$, $df=1$, $p=0.13$
Adult (16 and over)	17 (41%)	25 (59%)		14 (35%)	26 (65%)	
IOTN dental score*						
≤3	42 (36%)	76 (64%)	$\chi^2=17.1$, $df=1$, $p=0.0004$	28 (24%)	90 (76%)	$\chi^2=0.41$, $df=1$, $p=0.52$
>3	46 (17%)	230 (83%)		74 (27%)	202 (73%)	
Setting						
HDS	83 (37%)	142 (63%)	$\chi^2=56.0$, $df=2$, $p=0.0000$	64 (29%)	157 (71%)	$\chi^2=12.9$, $df=2$, $p=0.001$
CDS	2 (6%)	33 (94%)		15 (43%)	20 (57%)	
GDS	7 (5%)	133 (95%)		23 (16%)	117 (84%)	

* Data on IOTN score were missing on six forms.

per cent) (Table 4). This difference remained even when controlling for severity of condition as measured by the IOTN score: 19 out of 59 (33 per cent) referred to the appropriate setting in the HDS as opposed to 57 out of 59 (96 per cent) in the other two settings ($\chi^2 = 50.6$, $df = 1$, $p < 0.0001$ for IOTN score ≤ 3); 122 out of 161 (75 per cent) referred to the appropriate setting in the HDS as opposed to 108 out of 115 (94 per cent) in the other two settings ($\chi^2 = 14.6$, $df = 1$, $p = 0.0001$ for IOTN score > 3).

As regards timing of referral, there were no statistically significant associations between socio-demographic variables and being referred at an inappropriate time for treatment, other than for younger age being associated with an appropriate time for referral (Table 4). IOTN score was unrelated to appropriateness of timing (Table 4).

Further statistically significant results emerged when reasons for being referred at an inappropriate time for treatment were considered. Of the 14 adult patients referred inappropriately, all were judged to have been sent to specialist care too late for treatment. By contrast, of the 88 children who were referred at an inappropriate time, one-third (32) were referred too early and two-thirds (56) were referred too late for specialist treatment ($\chi^2 = 11.6$, $df = 2$, $p = 0.003$).

Discussion

The present study is the first to describe referral patterns to specialist orthodontic care in terms of duration and number of steps to referral, and to directly compare need, as determined by an objective index of severity (the IOTN), with other factors in determining speed of access to services. It demonstrated that socio-demographic factors appeared to be more important than IOTN score in determining the speed of access to orthodontic care. The study has also shown that patients attending the HDS were significantly less likely to have been referred to the correct setting given the complexity of treatment required.

Sufficient numbers of patients were recruited overall to detect statistically significant differences and there was a high participation rate amongst subjects approached (99 per cent). In addition, the treating orthodontists completed all the orthodontist assessment forms for patients included in the study. As regards individual settings, the study covered orthodontists working in the HDS, CDS and GDS in Northamptonshire. It was not possible to recruit a large number of new patients in the CDS in the three months covered by the study because of the low number of new referrals that can be seen by this service. The results from this setting need to be treated with caution because of these small numbers.

The pathways technique has been successfully applied in a variety of settings and has been demonstrated as being reliable and valid.^{17,18} It is, however, retrospective in design and may therefore be subject to recall bias. In addition, although the present study has suggested inequity in the delivery of orthodontic services, it could not determine at which stage

this occurred and the relative importance of each step. These include treatment seeking behaviour by patients, access to general dental services or referral by GDPs to specialist treatment. A prospective, community based study would be the optimal research design for addressing these issues. Such a study could be feasible given the prevalence of orthodontic anomalies in the population.

In addition, the IOTN only covers one aspect of appropriateness, that of symptom severity, and does not include ratings of treatment complexity or timing of referral. In the absence of an objective rating scale for these areas, it was necessary to supplement the IOTN scores with clinical ratings of appropriateness of referral setting made by the treating orthodontists. Given the possibly subjective nature of these ratings, this may have been a factor in the lower levels of appropriateness of referral destination in the HDS. On the other hand, this difference remained even after stratifying for symptom severity on the IOTN.

As expected, the sample was predominantly of adolescent age and only 10 per cent of subjects were over the age of 16. This is in contrast to US studies, which have shown a steady rise in the number of adults being referred for orthodontic treatment to nearly 20 per cent of the total.³

Of particular note was the gender and socio-demographic balance of the sample. In spite of the uniform prevalence of orthodontic anomalies in the population, 62 per cent of subjects were female and 25 per cent were from social classes I and V. The latter is more than double the figure that would be expected if the sample had reflected the socio-demographic profile of Northamptonshire. By contrast, those from socio-economic class IV were under-represented. This finding suggests a U-shaped curve with enhanced access for those at opposite ends of the Registrar-General's classification.

The higher number of those from socio-economic class I could be due to a number of factors. It might be an effect of different registration or attendance patterns. If those from socio-economic class I are more likely to be registered with a GDP and attend the dental surgery more frequently, they may be more likely to be referred for specialist orthodontic care. Alternatively, it may be due to different referral behaviour by the treating GDP, or because families from socio-economic class I have higher treatment expectations. By contrast, it might be that those from socio-economic class V have more ready access to professionals who are prepared to articulate their needs on their behalf. A further explanation might be that subjects from classes I and V are more able to have time to attend for specialist treatment. A prospective study of patients attending their GDP would be the only certain way of determining this.

Another finding from the study was the lack of difference in the socio-demographic characteristics of patients attending different settings. It might have been expected that patients in the CDS would be from more deprived socio-demographic backgrounds. This was, however, not demonstrated by the

present study, which showed that the percentage of patients from higher socio-economic groups was as high in the CDS as in other orthodontic settings. In addition, the study showed that the CDS was only able to deal with a small proportion of the new cases referred by GDPs. This is of concern given that the Government has envisaged that the CDS would increasingly act as a safety net for patients unable to otherwise gain access to dental services.⁵ On the basis of the current study, it is unlikely that the CDS could undertake further treatment.

In common with the finding of epidemiological surveys,^{6,7} crowding of teeth was the commonest orthodontic anomaly, followed by dental irregularity. As regards the duration and complexity of the pathway to orthodontic care, the median value was 52 weeks, with the majority of patients reaching an orthodontist within two years. In common with other pathways studies, a small number took very long periods to care.^{17,18} This is an area of concern and requires further investigation. Just under three-quarters of the sample were judged by the orthodontist to have been appropriately referred. Shaw *et al.* reported a similar finding, with 70 per cent of patients referred to specialist orthodontic services being judged by the specialist as being likely to gain worthwhile benefit from treatment.¹² This compares with figures from medical out-patients of 80 per cent and surgical out-patients of 91 per cent.^{20,21}

The main finding of the study was that symptom severity, as determined by the IOTN score, was not predictive of pathway duration or complexity. This was confirmed by a census of all GDPs in Northamptonshire; 83 per cent of GDPs practising in the county replied, of whom only 19 per cent used the IOTN in assessing the need for orthodontic referral.²² Even if referring GDPs do not use the IOTN, it would be expected that referrals would still be based on clinical need so that those in greatest need reached orthodontic care more rapidly.

As regards appropriateness of referral for the complexity of treatment required, there were two main concerns. Older age was associated with a greater likelihood of inappropriate referral, and patients were significantly less likely to have been referred appropriately to the HDS given the complexity of treatment they required.

Of other factors that might have affected referral, distance of place of residence from the hospital or patient attitude to treatment were not associated with delay to treatment. The fact that one-third of patients had come directly from school or work as opposed to home may have disguised home address as a contributory variable.

Conclusions

The findings from this study suggest that a more appropriate focusing of resources is required, using the IOTN and agreed protocols, so that referrals are made to the most suitable provider given the complexity of treatment indicated. Greater use by GDPs of specialists within the GDS and CDS for assessment of conditions requiring more simple interventions is

indicated, thereby leaving the HDS to deal with the more complex cases. This would help to address both the rising waiting lists for orthodontic treatment and inequities in the delivery of orthodontics. In addition, there should be an integrated purchasing approach across the full range of orthodontic treatment settings so that patients receive the appropriate treatment in the appropriate orthodontic service.

In addition, there should be more education for GDPs to improve the recognition, management and referral of patients. This might include the funding of additional study leave for GDPs to undertake further postgraduate training and the provision of further clinical assistantship sessions in the HDS for GDPs.

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