



# The British Orthodontic Society Clinical Effectiveness Bulletin

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### *Chairman's remarks*

## Evolution - not revolution

Anyone who works for the NHS these days will have experienced varying degrees of change within their daily working environment. The jury is still out when it comes to evaluating many of the changes that have happened over the last 18 months. In a similar vein, the Clinical Effectiveness Bulletin (CEB) also needs to move with the times and it has been recently decided that two "slimmer" issues of this popular publication will be produced each year. In addition, we will be introducing more colours to the pages of subsequent issues. These changes have been made in order to maintain the readability of the CEB as a single annual publication was becoming too weighty. You could say that it was becoming a victim of its own success under the astute editorship of Gavin Barry. The success of the BOS Clinical Effectiveness Bulletin has attracted the attention of other dental and medical specialties in recent times, a number of which plan to follow in our footsteps in the near future. This just goes to demonstrate what an innovative society we have. This fact has been most recently demonstrated by the exciting news that the BOS has won the bid to host the 8th meeting of the World Federation of Orthodontists (WFO) in London in 2015. This is a major coup indeed for U.K. orthodontists. I am sure that we will all rise to the challenge and help the Society to ensure that this international meeting is a resounding success and ably demonstrates the high quality of clinical and academic orthodontic standards being carried out in this country.

As with previous publications, this issue of the Clinical Effectiveness Bulletin contains an

exciting range of audit subjects including such topical items as the ominously awaited "18 week pathway", orthodontic therapists as well as cleft lip and palate outcome. It is also very pleasing to see an audit from a specialist orthodontic practice in Coleraine. I am keen to encourage more submissions from specialist practice in the future. With the March 2007 changes to the ISFE regulations, we are likely to find ourselves running short of literature reviews to publish in the very near future. However, it is hoped that Consultant trainers will continue to encourage their trainees to carry out relevant audit projects as well as concise literature reviews of the current scientific evidence available on a range of orthodontic topics. And, of course, to consider having their efforts published in the Clinical Effectiveness Bulletin. Personally, I have found these reviews to be extremely informative, succinct and topical.

It is sometimes refreshing to realise that not all changes are necessarily for the worse! I hope that you enjoy reading this latest issue of the Bulletin and that it influences your clinical practice in a positive way.

Finally, many thanks goes to Jeremy Knox who stands down as assistant editor of this Bulletin. Jeremy's invaluable help and guidance over the last four years is much appreciated.

**David Morris**

Chairman, BOS Clinical Standards Committee  
*July 2007.*

# Editor's Cut

**T**his issue sees more changes to the Bulletin. You will notice that this one is considerably smaller than issue No 19. This is not because of a reduced number of contributions, quite the contrary. The enthusiasm of the authors and the quality of their articles has caused the Bulletin to become too big to be published just once a year. We have therefore removed the closing date and decided to publish issues as and when there is enough material to fill the pages. The general consensus was that multiples of smaller editions would make 'a better read' than an increasingly larger single annual publication.

It also means that there will not be such a long delay between submission and publication. For Some articles this could have been upwards of a year, if sent in just as the previous edition was going to press. Admittedly we are not in the league of world-wide impact factor journals such as 'Nature' wherein

articles appear within a month, but that doesn't mean we shouldn't aim to raise our game.

So keep at it out there authors, and, readers please feel free to comment or feedback what you think.

Gavin Barry

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*Sarah Church, FTTA, St. Luke's Hospital, Bradford and Leeds Dental Institute*

# AN AUDIT OF ORTHOGNATHIC PATIENT SATISFACTION

Rachel Bradford, FTTA in Orthodontics, Kingston Hospital, Surrey

Keywords: Orthognathic, patient satisfaction, questionnaire

## INTRODUCTION

Clinical governance requires clinicians to continuously improve the quality of their service as well as ensuring that the patient's experience of treatment is positive. Patient satisfaction can be defined as a patient's attitude towards health care received<sup>1</sup>. It is well recognised that most patient complaints are concerned with poor treatment delivery.

Orthognathic cases form a significant part of the hospital orthodontist's caseload<sup>2</sup>. With the introduction of the European working time directive and consolidation of SHO on-call cover, orthognathic patients at Kingston Hospital had the surgical phase of their treatment undertaken at another regional hospital. Following a number of verbal and written complaints to the department regarding the standard of post-operative care received on the wards at this hospital, it was discussed with the surgical staff and agreed that a retrospective audit of orthognathic patient satisfaction should be undertaken.

## AIMS

- The aim of this audit was to assess patient satisfaction with regard to the:
- Information they received at the start of their treatment
- Treatment and care received at Kingston Hospital
- Treatment and care received at the other regional hospital
- Outcomes of their treatment

## STANDARDS

A review of the literature suggests that 92-100% of orthognathic patients are satisfied with the outcome of their treatment at the end of orthognathic treatment<sup>3</sup>. In view of the fact that our patients were surveyed in advance of completion of treatment and that the main focus of our interest was in patients' experiences of in-patient care received after surgery, the following standards were set:

- Information received by patients before treatment started 90%
- Treatment/care received at both hospitals rated excellent/good 90%
- Patient satisfaction with outcome of treatment 85%

## MATERIALS AND METHOD

The audit sample consisted of 60 consecutive orthognathic patients who were treated during the period of May 2005 to February 2006 and were approximately two months post operation. These patients were identified from their operation dates and were attending for routine appointments with the orthodontic clinical staff. Patients with facial deformities due to trauma or congenital malformations were excluded.

A questionnaire was designed and structured in conjunction with the Audit department at Kingston Hospital. It was quick and relatively easy to complete, consisting of 21 questions (mainly structured closed questions, however there were some open questions, which gave patients an opportunity to state their own views). The questionnaire was initially piloted on 15 orthognathic patients to assess readability, prior to being administered to the main audit sample. The patients were asked if they would be happy to participate in the audit and were given a covering letter of invitation along with the questionnaire. The patients filled in the questionnaire in the waiting room and returned it to a collection point in order to maintain anonymity.

## RESULTS

A 100% response rate was achieved and the information was collated and analysed using SNAP survey software (www.snapsurveys.com). The sample consisted of 40 (66%) females and 20 (33%) males. 24 (40%) were under the age of 20, 12 (20%) were aged 21-25 and 24 (40%) were over the age of 25. The majority of patients gave dissatisfaction with appearance as a reason for seeking orthodontic/surgical treatment - dental appearance (60%) and facial appearance (50%). 33% of patients mentioned eating difficulties as a reason to seek treatment. It should be noted that multiple responses to this question were possible.

Question	YES	NO	Audit Standard Achieved
Before you started orthodontic/surgical treatment			
Did you receive an adequate verbal explanation of what would be involved?	93%	7%	YES
Did you receive an adequate written explanation of what would be involved?	68%	32%	NO
Were you told that the surgical phase of your treatment would be carried out at another regional hospital?	92%	8%	YES

Table 1. Responses to questionnaire

Patients were asked if they were given an opportunity to speak to someone who had had this treatment done, only 18% responded yes but 100% stated that it had been useful. 55% of patients who had not spoken to anyone stated that they would have liked to have been given this opportunity

Question	Excellent / Good	Average/ Poor	Audit Standard Achieved
How would you rate the treatment / care you received at Kingston Hospital?	93%	7%	YES
How would you rate the treatment / care you received at the other regional Hospital?	52%	48%	NO

Table 1. Responses to questionnaire

Question	Very Satisfied or Satisfied	Dissatisfied	No Reply	Audit Standard Achieved
Outcome of treatment				
How satisfied are you with your facial appearance?	88%	0%	12%	YES
How satisfied are you with your dental appearance?	87%	0%	13%	YES

Table 3. Responses to questionnaire

Patients were asked if they would recommend this type of treatment to another patient with a similar complaint and 83% of them said they would.

## DISCUSSION

In the surgical correction of oro-facial deformities, patient satisfaction is a major goal of treatment. Patients must not only be satisfied with the outcome of the procedure but also satisfied with the process of the procedure for a complete assessment of quality of care. It is pleasing to see from this audit that orthognathic patients have a high level of satisfaction

with the outcome of their treatment, taking into account that it is not yet fully completed, however the audit highlighted areas of dissatisfaction. It is frequently cited in the literature that an important influence on patient satisfaction is the quality of information that is provided about treatment. Many studies have shown that patients who are well informed are more likely to be satisfied with the care they receive, these studies have also stressed the importance of supporting verbal explanations with written ones<sup>3</sup>. This audit showed that patients were satisfied with the amount of verbal information they received however disappointingly only 68% of patients felt that the written information provided was adequate. Interestingly, the patients who had had an opportunity to speak to someone who had been through a similar procedure (18%) all found it to be a useful experience and more than half of the patients audited said they would have liked to have had this opportunity.

In general, the majority of patients were satisfied with the treatment and care they received at Kingston Hospital, many comments made by patients were positive and complementary however 2% of patients did complain that contacting the hospital was difficult, appointment times were inconvenient and parking was difficult. It is generally accepted that post-operative dissatisfaction is rarely related to the technical skill of the surgeon but rather from a failure to communicate and this audit supports this. It was the open questions that elicited the most useful information. Overall, 48% of patients stated that the treatment and care that they had received from the other regional hospital was average or poor. 20 (33%) patients commented that there was a problem with ward cleanliness, 16 (26%) patients complained that the post-operative care on the ward was poor and 16 (26%) patients commented that there were ward staff attitude problems and poor staff communication. It was strongly suggested by many patients that they felt that the ward staff were not in possession of sufficient knowledge of what procedures they had undergone, which was important in order to look after them properly in the post-operative phase, particularly concerning diet and care.

It was pleasing to see that nearing the end of treatment patients were pleased with their treatment outcome, 88% of patients were satisfied with their facial appearance and 87% were satisfied with their dental appearance. Another good indicator of satisfaction was that 83% of patients said they

would recommend their treatment to another patient who was considering undergoing the same procedure.

## CONCLUSIONS

- Patients were satisfied with the verbal information they received.
- Patients were dissatisfied with the written information they received.
- Patients were satisfied with the treatment / care received at Kingston Hospital.
- Patients were dissatisfied with the treatment / care received at the other regional hospital.
- Patients were satisfied with their facial and dental appearance near the end of treatment.

## RECOMMENDATIONS

With this data, address urgently the post-operative ward care received at the regional hospital.

- arrange meeting with ward managers and surgical staff to discuss issues raised by patients.
- provide more information to the ward staff about orthognathic surgery to help improve the care.

Improve the written information that patients receive at the start of treatment and give patients an opportunity to talk to others, if they wish, who have gone through a similar procedure.

Initiate talks to discuss the possible return of the surgical phase of treatment to Kingston Hospital.

Re-audit to be carried out in 6 months time.

## ACKNOWLEDGEMENTS

I would like to thank Anne Jones in the Audit department at Kingston Hospital for her help with the design of the questionnaire and in analysing the data.

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## A BASELINE AUDIT OF AVAILABILITY OF ORTHODONTIC CLEFT LIP AND PALATE RECORDS IN ORTHODONTIC UNITS IN SOUTH THAMES

*Audit lead Nigel Taylor and Audit Coordinator Helen Lew, South West and South East Thames Audit Groups. Alex Cash, Raymond Edler, Allan Jones, Lucy Davenport Jones, Trevor Hodge, Claire Hepworth, Austin Banner, Jaspal Panesar, Stephen Powell, Sharon Orton Gibbs, Allan Thom, Lindsay Winchester, Andrew DiBiase, Stephen Newell, Daniel Burford, Nicola Johnson, Jo Clarke, Alan Hall, Fran Coutts, Carmel Slipper, David Young, Don Vasey, Jenny Herold, Dirk Bister.*

Keywords: Cleft lip and palate, records availability

### INTRODUCTION

Prior to centralisation of cleft services in South Thames several different orthodontic units held information about patients under their care. In 2002 the newly formed cleft network board asked for an audit of availability of existing orthodontic records.

The CSAG report recommended the minimum orthodontic records that should be collected for patients born with cleft lip and / or palate malformations. Unilateral and bilateral

cleft patients are those cases requiring the most input from the cleft service and therefore the current audit concentrated investigation on this group of patients.

The project was originally supported by the Specialist Clinical Audit Programme (London, Kent, Surrey and Sussex). However in March 2004 this agency was disbanded and from April 2004 the Audit, Information and Analysis unit for London, Kent, Surrey, Sussex, Essex, Bedfordshire and Hertfordshire was established and continued supporting the project.

## AUDIT AIM

The purpose of this audit was to investigate the availability of orthodontic cleft lip and palate documentation for patients treated in local orthodontic units in the South Thames Region

## STANDARD

100% records should be available

## METHOD

Data collection categories were agreed following a series of regional meetings with clinicians and included the following: photographs (extra oral and intra oral), study models, lateral skull radiographs, dental pantomograms, anterior occlusal radiographs and bitewings. Both audit groups in South Thames identified possible units who may have cleft patients within their service. This list included units who were not part of the new cleft arrangements but who may have had patients under their care relevant to the audit protocol. The proforma was designed to record the availability of orthodontic records for patients with a history of repaired complete unilateral or bilateral cleft of lip and palate whose 5th, 10th and 15th birthday occurred during the audit period between the 1st April 2003 – 31st April 2005. Data was submitted directly from each participating to the AIAU.

## RESULTS

18 orthodontic units were invited to participate in the audit. 12 units (67%) had data which satisfied the audit criteria and submitted data collection forms for 88 Individuals.

Age	Number of records
5 years	56
10 years	50
15 years	22
<b>TOTAL RECORDS</b>	<b>128</b>

**Table 1. Number of records available for each age group**

Age	5 years	10 years	15 years
No of patients	56	50	22
% of patients	- Bitewings (2%) - Lateral skull (9%) - Dental pantomogram (18%)	- Bitewings (0%)	- Bitewings (0%)
0-25%	- Anterior occlusal or periapical (32%)		- Anterior occlusal or periapical (41%)
26 – 50%	- Models (61%)	- Lateral skull (52%) - Anterior occlusal or periapical (58%) - Models (60%) - Photos intra oral (74%)	- Photos extra oral (55%) - Models (55%) - Photos intra oral (59%) - Lateral skull (64%) - Dental pantomogram (73%)
51 – 75%	- Photos intra oral (79%) - Photos extra oral (86%)	- Photos extra oral (78%) - Dental pantomogram (86%)	
76 – 100%			

**Table 2. Percentages of records available for each age band**

TRUST CODE	A	B	C	D	E	F	G	H	I	J	K	L
<b>TOTAL RECORDS*</b>	<b>42</b>	<b>20</b>	<b>5</b>	<b>5</b>	<b>18</b>	<b>5</b>	<b>6</b>	<b>13</b>	<b>4</b>	<b>8</b>	<b>2</b>	<b>0</b>
<b>Photos extra oral</b>	95% (40)	65% (13)	60% (3)	100% (5)	94% (17)	100% (5)	83% (5)	31% (4)	75% (3)	25% (2)	100% (2)	0% (0)
<b>Photos intra oral</b>	88% (37)	55% (11)	40% (2)	100% (5)	94% (17)	100% (5)	83% (5)	31% (4)	75% (3)	38% (3)	100% (2)	0% (0)
<b>Models</b>	86% (36)	25% (5)	0% (0)	80% (4)	77% (14)	40% (2)	66% (4)	23% (3)	75% (3)	38% (3)	100% (2)	0% (0)

**Table 2. Percentages of records available for each age band**

The table above shows a comparison of Trusts with a breakdown of availability of orthodontic records.

% of records available	Photos extra oral	Photos intra oral	Study Models
0-25%	2 trusts	1 Trust	4 Trusts
26 – 50%	1 Trust	3 Trusts	2 Trusts
51 – 75%	3 Trusts	2 Trusts	2 Trusts
76 – 100%	6 Trusts	6 Trusts	4 Trusts

**Table 4. Percentage availability of records across different Trusts**

## DISCUSSION

This audit took place during a period of transition, before the South Thames Cleft service was fully operational. It is important to appreciate at the outset that the audit was carried out in orthodontic units and does not investigate current record availability in the new South Thames cleft service. Also the project was originally supported by one agency, replaced by another during the audit and the appointed audit coordinator unfortunately left the project in June 2005 due to ill health which delayed publishing the results.

The CSAG report 1998 recommended that all 5 year, 10 year and 15 year olds must have 100% documented orthodontic records. In this audit no units met this standard. It is likely that during this transitional period more records exist than were available for patients who transferred to the new service. Also over 15 years of record collection patients are likely to move house, move to a different orthodontist and also change their name which all influence availability of records.

The figures for individual records show good record availability of individual orthodontic records particularly extra oral photographs for 5 and 10 year olds, 86% and 79% respectively. However when availability of photographs and study models is combined, availability of records decreases to around 50%. Study models are less widely available than photographs however the finding for availability of models of 5 year olds at 61% is not surprising as taking impressions of 5 year olds can be difficult. However the finding of 60% and 55% for 10 and 15 year olds respectively is disappointing.

Most 10 year olds have a dental pantomogram (86%) and 58% have an anterior occlusal radiograph available. More than half have a lateral skull radiograph available. At 15 years nearly two thirds of patients have a lateral skull radiograph and three quarters a dental pantomogram available. The availability of these records offers the opportunity for future audit.

There is a very wide variation of available records between trusts varying from 100% to 0% availability of records and therefore the mean of 50% may present a misleading picture of performance across the units investigated, particularly as sample sizes in individual units varies from 2 to 42.

## CONCLUSIONS

1. Most patients had an incomplete set of records available.
2. 50% of orthodontic records are available overall. However there is a wide variation between trusts and between different records. The most available records are extra and intra oral photographs in 5 and 10 year olds. Dental pantomograms were commonly available for 10 year olds (86%).
3. 5% patients had no records available.

## RECOMMENDATIONS

1. The results of the audit show improvements in record handling are required.
2. Attendance for audit records to be taken at the cleft centre could lead to a significant improvement in record collecting and availability providing patients are prepared to attend.
3. An electronic record of patient notes would overcome many of the problems of non availability of records photographic records.
4. A repeat audit of availability of records should be carried out in the future to assess if improved availability has occurred.

## ACKNOWLEDGEMENTS

Maria Yeomans from the Audit, Information and Analysis unit for London, Kent, Surrey, Sussex, Essex, Bedfordshire and Hertfordshire

# JOINT ORTHODONTIC AND RESTORATIVE CLINIC AUDIT AT LIVERPOOL UNIVERSITY DENTAL HOSPITAL: AN AUDIT OF ACTIVITY IN THE SHADOW OF THE 18 WEEK PATIENT JOURNEY

K.A.Young, J.E.Harrison.

Keywords: joint orthodontic and restorative, waits, 18 week journey

## INTRODUCTION

New guidelines, published by the Department of Health propose another government target to be achieved by providers of NHS secondary and tertiary care - the 18 week patient journey.<sup>1</sup> By 2008, from the moment an initial GDP referral is received, the hospital service will have 18 weeks in which to start treatment if indicated. This will be a challenge for the provision of standard orthodontic treatment let alone when treatment involves more than one specialty. With Primary Care Trusts (PCT) now directly funding hospital services we all need activity data to demonstrate the nature of our work and the value we currently provide to the PCT. Importantly, such data may be used to provide a business case to acquire additional funding should existing services need to improve. This audit of the joint orthodontic and restorative clinic was carried out to assess our proximity to the 18 week goal.

## AIMS

To ascertain (1) basic demographic details (2) clinic activity (3) patient waiting times (4) site and severity of hypodontia (5) patient outcomes including restorations provided for patients attending the joint orthodontic and restorative clinic.

## AUDIT STANDARD

All patients seen on the joint clinic, who required treatment, should have started appropriate treatment by 18 weeks from receipt of referral.

## METHOD

A retrospective audit of patients who had attended the joint orthodontic and restorative clinic was carried out from September 2000 - November 2004. This involved examination of case-notes and radiographs to record a wide range of data using a data collection sheet which was then character read by an Optical Character Reader (OCR) to facilitate data entry and subsequent analysis.

## RESULTS

134 new patients were examined on 35 clinics over the audit period - see Table 1

Number of Joint Clinics held	35		
Number of New Patients	134 (M 60: F 74)		
Number of Patients seen (includes reviews)	206		
Mean Number of Patients per clinic	6		
Mean Age at Referral	20.9 years SD 11.5	Max 60.6	Min 5.8
Mean wait for New Patient Clinic	16.8 weeks SD 10.8	Max 53.4	Min 2.4
Mean wait for Joint Clinic	21.5 weeks SD 14	Max 86	Min 1
Mean wait to start Orthodontic treatment	40.2 weeks SD 35.8	Max 276	Min 2.8
Was Pre- Restorative Orthodontics required?	YES 110/134 (82%)		
Number starting orthodontic treatment	71/110 (65%)		

**Table 1. Demographic Data & Waiting Times**

Three “waits” were identified in the system before any definitive treatment started. Firstly, there was an initial wait to be seen at the hospital - either on a restorative or an orthodontic new patient clinic (mean wait 16.8 weeks). Secondly, there was then a wait to be seen on the joint clinic (mean 21.5 weeks) - see Figure 1. A third and final wait occurred whilst waiting for orthodontic treatment to commence (mean 40.2 weeks). This represents a mean combined wait from initial referral to the start of orthodontic treatment, if required, of 1.5 years.

The most commonly missing teeth noted in the audit are shown in Table 2 - with the upper right lateral incisor (UR2) being the most frequently missing tooth.

UR 7	UR 6	UR 5	UR 4	UR 3	UR 2	UR 1	UL 1	UL 2	UL 3	UL 4	UL 5	UL 6	UL 7	364
20	12	34	32	19	59	12	8	48	20	29	42	9	20	
19	13	44	17	8	20	35	36	23	10	18	45	15	22	325
LR 7	LR 6	LR 5	LR 4	LR 3	LR 2	LR 1	LL 1	LL 2	LL 3	LL 4	LL 5	LL 6	LL 7	689

Most frequently missing teeth  $\frac{54 \ 2 \ | \ 2 \ 45}{5 \ 11 \ 5}$

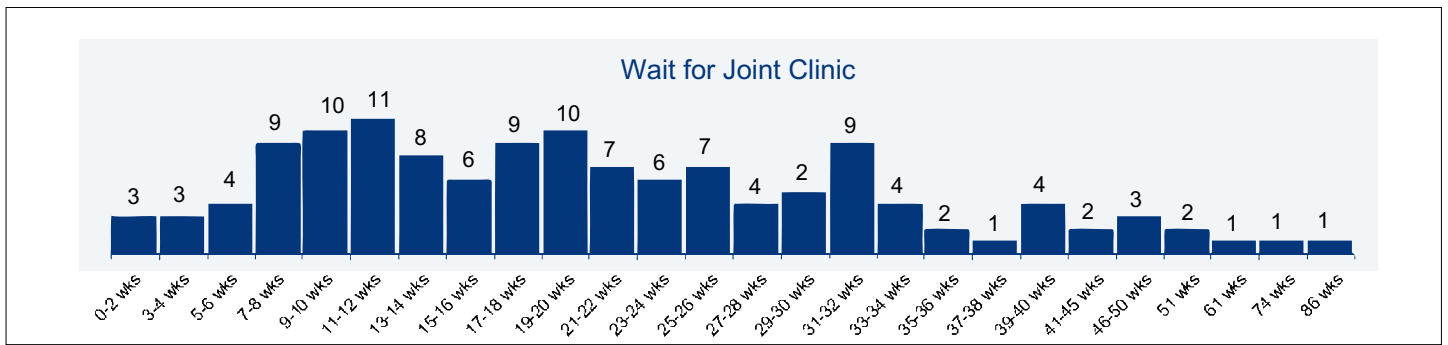
**Table 2. Distribution of Missing Teeth (n=689)**

Table 3 gives reference to the number of missing teeth excluding molars (molars were excluded because these could have been absent due to previous extraction although a genetic basis to congenitally absent molars is known to exist). Of importance to note, **50 of the 134 new patients had >6 teeth missing (excluding any missing molar teeth) - representing severe hypodontia.**

Number of teeth absent when looking at upper & lower 5-5 only	Number of Patients	Percent of Patients
0-1	29	21.6%
2-3	32	23.9%
4-5	23	17.2%
6-7	17	12.7%
8-9	16	11.9%
10-11	5	3.7%
12	8	6.0%
>12	4	3.0%
<b>Total</b>	<b>134</b>	<b>100%</b>
<b>≥6 teeth missing when looking at upper and lower 5-5 only</b>	<b>N=50</b>	<b>37.3%</b>

**Table 3. Number of missing teeth (excluding missing molars)**

Table 4 gives reference to the actual definitive restorations provided. We found only low numbers of definitive restorations were provided within the hospital service during this audit period. In particular, low numbers of endosseous implants had been provided.



**Figure 1. Distribution of waiting time for a joint clinic appointment having initially been seen on either a restorative or orthodontic new patient clinic (n=132 due to some non recorded data)**

Type of Restoration to be provided at LUDH	Number of Patients	Percent of Restorations Provided
Endosseous Implant	3	7.9%
Bridge	14	36.8%
Denture	12	31.6%
Mixture	9	23.7%
Total	38	100%

**Table 4. Restoration to be provided at LUDH during this period**

**DISCUSSION**

Demographic data are presented. All patients seen had one or more missing teeth and a substantial proportion had severe hypodontia. However, this represents under reporting of the actual amount of hypodontia seen within the hospital as not all patients with missing teeth are managed through this joint clinic.

The vast majority of patients (82%) who were seen required pre-restorative orthodontics.

With an average wait of 1.5 years from referral to starting treatment we have a very long way to go before we are able to achieve the 18 week patient journey. There may potentially be some room for improved booking efficiency but this can only occur in conjunction with our referring colleagues and requires accurate information on the referral letter along with receipt of good quality records to aid diagnosis and treatment planning.

A low level of endosseous implant provision was found during this audit period. This is now being addressed utilising published clinical guidelines which identify priority groups for endosseous implant provision - such as those with congenital hypodontia.<sup>2</sup> Ultimately the 18 week proposal can only realistically be achieved with substantially improved resources.

**RECOMMENDATIONS**

In order for patients with hypodontia, who need multi-disciplinary care, to start their treatment within the proposed 18-week target there needs to be:

1. Better quality referral letters and records sent from the GDP.
2. More frequent joint planning clinics.
3. Facility for patients to go straight into treatment once seen on a joint clinic.
4. Provision and funding for restorative treatment for this group of patients which needs to be identified and protected

Points 1-4 will all require additional resources either at the primary care level or within the hospital departments. Repeat of the audit in 2 years to assess the impact of any changes made is required.

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**TMD AND THE ORTHODONTIC PATIENT**

Pamela Ellis, Dorset County Hospital

Keywords: Management of TMD, COG survey

**INTRODUCTION**

Despite there being little sound evidence for a link between occlusal discrepancies and temporomandibular joint dysfunction (TMD) there is a lack of conformity amongst orthodontists as to the management of orthodontic patients with TMD. This audit of members of the Consultants Orthodontists Group (COG) of the British Orthodontic Society (BOS) records current practice and serves as a baseline against which future changes in attitudes and management can be measured.

**AIMS**

- To audit current practice in the diagnosis, treatment planning and management of the orthodontic patient with TMD
- To audit whether Consultant Orthodontists consider present or future TMD in their treatment approach to orthodontic patients
- To audit the basis of the treatment approach adopted

**STANDARDS**

There should be agreement by Consultant Orthodontists on:

- Recording TMD prior to treatment
- Treating patients because of present TMD problems
- Treating patients to avoid future TMD problems

**METHOD**

- A pilot survey of 20 members of the Wessex Orthodontic Audit Group was carried out in Nov 2005.
- The questionnaire from this survey formed the basis of the current survey
- An e-mail questionnaire was sent to the 256 members of the Consultant Orthodontic Group in Feb 2006 (Copy of questionnaire available on request from the author)
- A follow up e-mail was sent to those who did not respond
- A postal version with SAE was then sent in May 2006 to any remaining group members who had not responded to the two e-mails

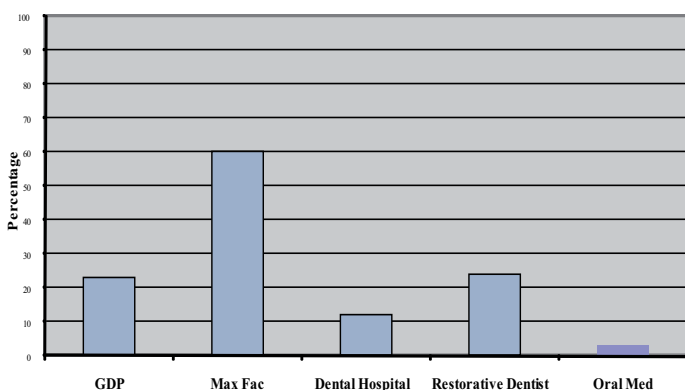
## RESULTS

- 195 of the 256 questionnaires were returned (76% response rate)
- For routine orthodontic patients: 59% of respondents have a section on their diagnostic sheet for recording TMD disorders, 63% routinely ask their patients whether they have jaw joint problems and 50% would routinely carry out a TMJ examination.
- Over half the group (54%) would never carry out orthodontic treatment to prevent future TMD. Of the 3% who would and the 41% who would sometimes treat to prevent future TMD, the main malocclusions corrected were crossbites with displacement (42%), followed by anterior open bites (10%), deep overbites (10%), scissorbites (0.5%) or large overjets with posturing (0.5%)
- When questioned about specific treatment aims which are or might be considered TMD related, 52% would aim to provide canine guidance, 62% avoided non-working side contacts and 49% would aim to seat the condyle in centric.
- The basis of these treatment goals was mainly from their orthodontic postgraduate training programme (57%). Other main sources of information included: articles in journals (26%); postgraduate courses (24%); advice from orthodontic (11%) or other colleagues (16%); restorative courses (14%). A few individuals based their treatment approach on Section 63/Study circle lectures, information from the World Orthodontic Conference in Paris in 2005, the Angles Society and lastly from 'life's experience'.
- If a patient reported a minor TMD problem (e.g. asymptomatic click, occasional pain or occasional locking) 92% of respondents would carry out a TMD exam.
- Table 1 lists the advice given to patients who reported minor TMD problems

An explanation of how the joint and disc work	83%
Reassurance	88%
Advice on analgesics and a soft diet	74%
An explanation that orthodontic treatment is unlikely to improve the problem	81%
An explanation that the problem is likely to temporarily improve whilst the appliances are in place	30%
A pre-prepared specific advice/information leaflet	23%
No advice	1%

**Table 1. Advice offered to patients reporting minor TMD problems**

- Figure 1 shows where orthodontists advise their patients with TMD problems to seek help.



**Figure 1. Where do you advise patients to seek further help?**

- For patients with more severe problems (e.g. severe or constant pain) the majority (94%) would delay orthodontic treatment until the acute symptoms have resolved. 8% would always and 51% would occasionally refuse to carry out orthodontic treatment.
- Most (72%) of orthodontists would look at the TMJ's on a symptomatic patients OPG radiograph but most (84%) would not take any further views of the joints.
- Of the 16% who would request further radiographs there was no common view requested and varied from high condylar OPG's or open/closed views to MRI scans
- Very few (11%) of the group were routinely involved in the assessment and management of patients referred primarily for TMD. Of these the majority worked in a multidisciplinary setting, with only 2% managing TMD problems on their own.
- Most of the group (63%) have been asked to treat patients to manage their TMD. 18% have carried out treatment for this purpose, 44% have sometimes and 18% never.

## DISCUSSION

There are differences amongst the COG in all areas of management of orthodontic patients with regard to TMD. For routine orthodontic patients, around 40% of the group do not record pre-existing signs and symptoms. A similar percentage would treat certain occlusal features or work to specific treatment goals to avoid future TMD problems. The basis of this approach is mainly what is taught on the Postgraduate Training Programmes.

For patients reporting problems there is a little more agreement. Here the majority would carry out a TMD exam and offer similar advice for conservative management. Also the majority would delay treatment until acute symptoms had settled. However there is disagreement on whether to then proceed with orthodontic care.

Most of the COG are not routinely involved in the assessment and management of patients with TMD problems, but most of the group have been asked by colleagues to treat patients in this group. Again there is little agreement over whether or not to carry out such treatment.

## RECOMMENDATIONS

- To increase conformity by clearly taught, evidence based messages in the Postgraduate Training Programmes.
- Consideration may be given to the formulation of BOS guidelines on this topic
- It will take time for changes in attitudes and management to take place, but a follow up survey could be considered in 5 years.

## IMPLEMENTATION

The web- based National Orthodontics Programme, hosted by Bristol University contains a Module on TMD and the orthodontic Patient. Increased use of this teaching medium should standardise teaching in this area. It is essential that the module is kept up to date.

## ACKNOWLEDGEMENTS

Thanks are extended to all COG members for completing and returning the questionnaire. Dr Friedy Luther for advice in preparation of the questionnaire and this report.

*Editor's note. For those wishing to see the questionnaire used please contact the authors at:*

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# AN IOTN AND PAR AUDIT OF TREATED PATIENTS IN SPECIALIST ORTHODONTIC PRACTICE

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Keywords: IOTN, PAR, consecutive cases

## INTRODUCTION

Clinicians in practice have a duty to ensure quality assurance systems are in place to produce treatment outcomes of acceptable standard. The new Orthodontic Contract introduced in England and Wales has an in built monitoring system so that 10% of treated cases or 50 treated cases (whichever is larger) are assessed for treatment need (using IOTN) and quality of treatment outcome (using PAR score). A similar contract may be introduced in Northern Ireland and this audit was carried out to assess the severity of malocclusion treated and the standard of treatment outcome in a specialist orthodontic practice.

## AIMS

- 1) To assess the need for orthodontic treatment using IOTN in 787 consecutively treated orthodontic cases.
- 2) To assess the degree of improvement using the Par score system in 700 consecutively treated orthodontic cases.

## STANDARDS

1. As outlined in the new Orthodontic contract<sup>1</sup> all cases with an IOTN of 4 or 5 qualify for treatment as they are “greatly in need” of treatment. If patients have an IOTN of 3 they qualify for treatment if the aesthetic component is 6 or more. Ideally all patients treated should fall into one of these categories
2. The average percentage improvement in PAR score should be at least 70% with 5% in the “no change/worse off category”<sup>2</sup>.

## METHOD

801 consecutively treated orthodontic cases were examined. 14 cases were excluded due to incomplete records. This left 787 patients who started treatment and were assessed as part of the IOTN section of the audit.

A further 87 patients failed to complete their treatment and did not present for taking of post-treatment records (the vast majority of these patients did not reach the fixed appliance stage of treatment). These cases were excluded so this left 700 patients in the PAR score section of the audit, for which final records were available and NHS treatment fees were claimed. All patients were treated using pre-adjusted edgewise fixed, removable and functional appliances, or a combination of these. 26 patients had treatments which consisted of only a removable appliance or only a functional appliance. It was decided to include these patients in the audit to accurately reflect the mix of patients treated in specialist practice. Also, the new contract does not specifically exclude patients treated only with removable appliances from the monitoring system. The patient’s age, sex, malocclusion, type of treatment, length of treatment, and number of visits were recorded for the 700 patients in the PAR section of the audit.

All cases were treated by the same clinician (the author) in a newly established specialist practice between 2002 and 2005. Pre-treatment study models were scored for IOTN (DHC and AC)<sup>3-6</sup>, and pre and post treatment study models were PAR scored<sup>7</sup> by the author (calibrated in IOTN and PAR score). An error study was carried out with 32 randomly selected study models being PAR scored a second time and compared with the original scorings. There were no significant differences between the 2 groups and this confirmed PAR scoring was consistent.

## RESULTS

The average age of the patients at the start of treatment was 13.7 years, with 41% males and 59% females.

The results of the IOTN section of the audit are as follows: 589 (75%) patients fell into IOTN (DHC) groups 4 and 5 with 72 (9%) patients having an IOTN of 3 and an AC greater than or equal to 6 (Figure 1).

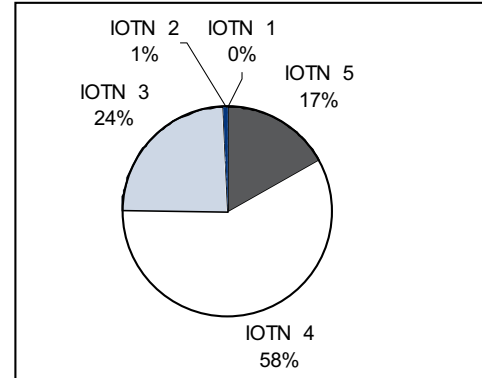


Figure 1. Distribution of DHC grades of IOTN

This meant that 661 (84%) patients achieved the audit standard for treatment need as assessed by IOTN.

The average pre treatment PAR score (for the patients within the PAR score section of the audit) was 25.7 and post treatment was 6.8 with an average percentage improvement in PAR score after treatment of 70.2%. 264 patients (38%) had a PAR score which was greatly improved, 408 (58%) were in the improved

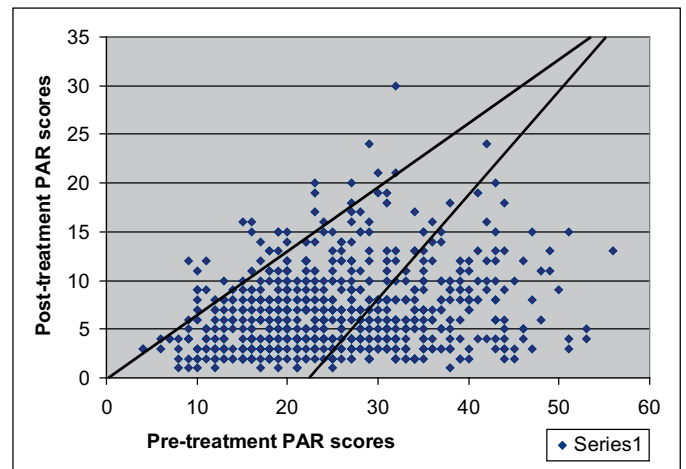


Figure 2. Normograph treatment PAR changes

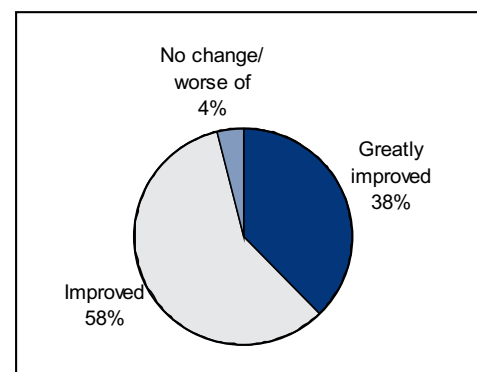


Figure 3. Post treatment changes in PAR score

The average treatment time was 19.7 months (SD 6.1 months) with 14.6 visits on average per patient. The average treatment time for IOTN 3 cases was 17.8 months and for IOTN 4 & 5 cases was 24.7 months. Of the 26 patients who did not have fixed appliances, 21 had only an upper removable appliance and 5 had only a functional appliance. 674 (96%) patients had fixed appliances with 54 of these patients also having functional appliances and 298 were treated in combination with removable appliances. 79% of patients had one or more extractions and the type of malocclusions treated were as follows: 279 (40%) had a Class I malocclusion, 313 (45%) Class II div 1, 63 (9%) Class II div II and 40 (6%) had Class III malocclusion.

## DISCUSSION

84% patients achieved the audit standard for treatment need as assessed by IOTN. This meant 126 (16%) patients treated would not be in great enough orthodontic need to qualify for treatment under the new orthodontic contract as it stands. If these patients were excluded from treatment it may have the effect of reducing the treatment waiting list by approximately 5 months.

The average percentage improvement in PAR score after treatment was 70.2 % with 4% of patients in the no change/worse category which achieved the audit standard. If the 26 patients who were treated without fixed appliances were excluded the average percentage improvement in PAR score was little changed at 70.8%. In previous studies McMullan<sup>8</sup> recorded an 84 % improvement in par score in a group of 823 patients treated by UK consultant orthodontists. C Purkiss<sup>9</sup> looked at 100 treated cases by specialists and clinical assistants and found a 90% par improvement although discontinued and interceptive treatments were excluded. It has long been recognised that upper and lower fixed appliances are best at achieving the greatest reduction in PAR score<sup>10</sup> and 90 % of patients in this audit did have upper and lower fixed appliances. When the 28 patients in the no change/ worse of category were more closely examined, 14 had upper and lower fixed appliances, 6 had single arch fixed appliances and 8 had only a removable appliance. It was observed that a residual overjet at the end of treatment was the main reason the fixed treatment cases fell into this category possibly due to insufficient

anchorage/ poor anchorage control during treatment.

## CONCLUSION

The 700 cases assessed in the PAR score audit were treated to a high standard in specialist practice with a 70.2 % average reduction in PAR score achieving the audit standard for treatment outcomes. 84 % of patients who started treatment were in need/great need for treatment and would qualify for treatment under the new contract. More monitoring is required to ensure all patients fall into this category before the possible introduction of any new contract. The audit will be continually updated.

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## AN AUDIT TO INVESTIGATE THE REASON FOR PATIENT ATTENDANCE AT HOSPITAL REVIEW CLINICS.

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Keywords: Review clinics, attendance criteria

## INTRODUCTION

There is a great deal to be gained from reviewing patients both pre- and post-treatment and when this is undertaken in a teaching environment the benefits are amplified. Information can be gained about growth patterns, the rate of dental development and the effects of interceptive measures before treatment is started. A study of referrals by Bowden et al.<sup>1</sup>, showed that a quarter of new patient referrals were subsequently reviewed. Likewise, after treatment, we learn about growth changes, the effects of treatment mechanics employed, the effectiveness of the retention regimes used and the consequences of poor compliance with retention. Mid-

treatment reviews with consultants are sometimes arranged when treatment being carried out in primary care is being monitored and in teaching settings for advice and opinion for junior members of staff.

While in an ideal world, we would like to review patients as many times as we would like, this is not usually possible. Numerous reviews can be inconvenient for the patient and the limited resources and strict time restraints of hospitals can also prohibit the recalling of patients as often as we might want. This is particularly pertinent in the current climate of the 18 week wait target where from 2008 no patient should have to wait more than 18 weeks from the time of initial referral to the start of their hospital treatment.<sup>2</sup>

## AIM OF THE AUDIT

To examine the practice of reviewing patients and to establish criteria for review clinics in a consultant led hospital setting.

## STANDARD

The authors are unaware of any accepted standards for reviewing orthodontic patients in the published literature. Therefore, the audit standard set was based on previous experiences in the department with ideally 80% of patients seen on the review clinic having:

- No more than one pre-treatment review
- No more than two post-treatment reviews.

Mid-treatment reviews should be carried out on an ad hoc basis. Combined clinic review appointments were excluded from the investigation.

## MATERIALS AND METHOD

Records for all review clinics during the month of November 2006 were collected. This amounted to 7 clinics in total. Demographic data and information on the reason for that attendance were recorded along with the number of previous review attendances and the outcome of the current appointment. Data were entered into SPSS for Windows version 10.0.1 for analysis.

## RESULTS

A total of 71 patients were planned for review and all patient records were recovered. 53 patients (75%) attended with 17 patients (24%) failing to attend and 1 (1%) cancelling. 30 (42%) patients booked were male and 41 (58%) were female. The age distribution for the attending patients is shown

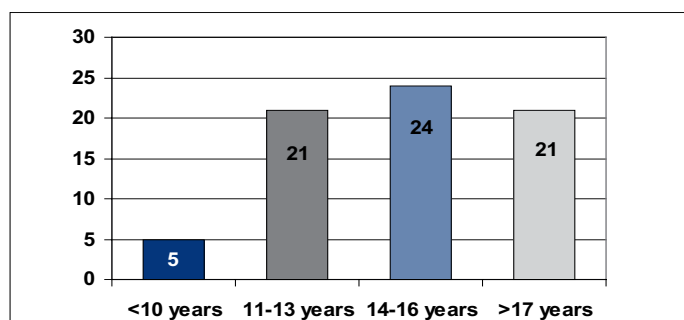


Figure 1. Age distribution of patients seen on the review clinics.

The reason for review was divided into three groups as follows:

- Pre-treatment – 37 patients (52%)
- Mid-treatment – 12 patients (17%)
- Post-treatment – 22 patients (31%).

## PRE-TREATMENT REVIEWS

Patients who attended a pre-treatment review had their first consultation between 4½ years and 1 month previously. The number of previous reviews is shown in table 1 with 62% of patients having previously been seen at least once

Number of Previous Reviews	Frequency	Percentage
0	14	38
1	18	48
2	3	8
3	1	3
4+	1	3

Table 1. The number of previous pre-treatment reviews.

The reason for these reviews is shown in table 2. At least half of the patients (51%) were seen to check dental development. Monitoring growth (19%) which was generally in Skeletal III patients and checking of oral hygiene (14%) were the next two most common reasons.

Reason for Pre-treatment Review	Frequency	Percentage
Check dental development	19	51
Monitor interception	2	5
Monitor growth	7	19
Check oral hygiene	5	14
Make a decision	1	3
Await PDD control	2	5
Take radiographs	1	3

Table 2. Reason for current pre-treatment review (PDD = periodontal disease, Take radiographs was included because on the previous visit, the radiograph machine was out of operation).

19 (51%) of patients reviewed pre-treatment were thought to be ready for treatment within 1 year, 13 (35%) within 1-2 years and 5 (14%) after 3 years.

## MID-TREATMENT REVIEWS

Patients who attended a mid-treatment review had their treatment started between 2 years and 6 months previously. 7 (59%) had not been seen for a mid-treatment review before, 3 (25) had been seen once, 1 (8%) had been seen twice and 1 (8%) had been seen three times.

The reasons for this review episode were many. 6 (50%) were to monitor treatment provided in practice by general dental practitioners under the supervision of hospital consultants and consisted of checking of upper removable appliances, functional appliances and Michigan splints. The remainder of patients were seen for confirming a treatment plan, establishing commitment to treatment, taking impressions for a retainer and to check post-surgery orthognathic patients.

## POST-TREATMENT REVIEWS

Patients who attended a post-treatment review had their retainers fitted between 2 years and 2 months previously. 21 of these patients (95%) were seen for checking of retainers with the other patient (5%) attending for a retainer re-fit.

7 (32%) had not been seen for a post-treatment review before, 10 (45%) had been seen once, 3 (14%) had been seen twice and 2 (9%) had been seen on four or more occasions.

## OUTCOME

The outcome of these review appointments is shown in table 3 with at least a third of patients in each category being given another review appointment. 17 patients failed to attend and of these 12 (71%) were discharged, 4 (23%) were left open for the patient to make contact for a new appointment and 1 (6%) was given a new appointment.

Outcome	Pre-treatment		Mid-treatment		Post-treatment	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Re-review	13	35	4	33	13	59
Treatment Waiting List	8	22	0	0	0	0
Direct book	2	5	4	33	0	0
To Joint Clinic	1	3	0	0	0	0
Await Contact	0	0	3	25	1	5
Discharged	13	35	1	9	8	36

Table 3. Outcome of the review clinic appointment

## DISCUSSION

While the criteria set in this audit appear somewhat strict, they must be viewed in the context of the targets set for the NHS to be achieved by 2008.<sup>2</sup> These include a maximum 18 week wait from initial referral to the start of hospital treatment and a maximum 5 week wait from initial referral to the first outpatient consultation. Although certain provisions are made for orthodontic referrals that require a period of monitoring<sup>3</sup>, the use of resources for reviewing patients must be carefully managed particularly where orthodontic treatment waiting lists are several years long.

The failure to attend rate was high (24%) and this resulted in 71% of these patients being discharged. This should reduce the likelihood of having repeat offenders being booked again. A policy of needing a re-referral to be seen again has been implemented.

For the pre-treatment reviews 62% of patients were being seen for a second or more review. This figure should be much lower with the standard being set at 20% (i.e. 80% should be reviewed up to a maximum of once prior to being placed on the waiting list). This standard was therefore not met. This highlights that more patients should be discharged and re-referred when further development or growth has been completed. It should be noted that over a third (35%) of these patients went away with an outcome of another review appointment! Another reason for review was to check oral hygiene (14%) and perhaps again a much harder line should be taken for the patients to be discharged and re-referred when the primary care practitioner considers mouth care to be suitable. It is perhaps for this reason that the standard was not met.

The mid-treatment reviews were thought appropriate for it is the only method by which orthodontic treatment being provided in primary care can be monitored. This monitoring

may become increasingly important if the potential workforce planning changes are implemented<sup>4</sup>. Non-specialist dental practitioners could begin to undertake increasing amounts of orthodontic treatment in the primary care sector which may require an element of consultant supervision.

As expected, the post-treatment reviews were mainly for retainer checks and 77% had been seen once or less post-treatment. The standard was set at 80% (i.e. a maximum of two post-treatment reviews including the current visit). Again, it must be noted that more than half of the patients (59%) went away with an outcome of another review appointment! This standard was therefore not met. Each orthodontist is likely to have a post-treatment review regime that they find most suitable for them. To our knowledge there are no set criteria for post-treatment reviews and the lack of guidelines in this area may be resulting in more reviews than is necessary.

## RECOMMENDATIONS

1. Discharge more patients who are not ready for treatment and ask that they be re-referred when they are ready.
2. Develop guidelines for reviewing patients post-treatment with clear objectives for each review.

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# ORTHODONTIC THERAPISTS – IS THERE A PLACE WITHIN THE ORTHODONTIC COMMUNITY? A SURVEY OF OPINIONS WITHIN THE SOUTH WEST OF ENGLAND

Wendy Lee, Sarah Bain and Christian Day DCP School, Bristol Dental Hospital

Keywords: Orthodontic therapists, role, training, opinion survey

## INTRODUCTION

The face of dentistry is evolving, both in terms of its workforce composition and skills mix as well as delivery to the patient. In the past the typical dental practice environment consisted of a dentist, dental nurse and receptionist. Today we now employ practice managers, hygienists, therapists and hygiene-therapists. These changes have been associated with a Government drive to improve patient access and availability to NHS dentistry throughout the country. A cornerstone of these changes was brought about due to changes in the Section 60 Orders of the Dentists Act 1984<sup>1</sup> which came into force in July 2006, which has promoted the recognition, development and, ultimately, professional registration of Dental Care Professionals (DCP).

Within the group of DCP's we have seen the emergence of the Orthodontic Therapists (OT), whose role is to assist in the provision of orthodontic care to the population. The specific duties of an OT are in the mechanics of orthodontic treatment under the direction of a dentist and not in the diagnosis of malocclusion or planning of its correction. In the United Kingdom this is a relatively new addition to the orthodontic skills mix, although in other countries OT have been successfully established for some time.

Within its established DCP School, Bristol Dental Hospital

is in an ideal position to provide the educational training to individuals who wish to become OT. However, the desire for OT within the UK orthodontic workforce has yet to be established. It is important to determine that if OT were to be trained would they be able to find suitable employment? A further issue is that although the syllabus and standards of training for OT have been established, the specific structure of OT training in terms of the balance between the academic and clinical components is open to interpretation. Another area of concern is around the issue of work based placements. Clearly this would need to have the highest level of quality assurance attached to them. In order to determine the views of the orthodontic providers with regards to OT training a survey was carried out of all specialists and consultants within the South West of England.

## MATERIALS AND METHOD

87 Surveys were delivered by post to orthodontists on the GDC specialist list, whose address was within the South West of England. Sixty-two surveys were returned –representing a 71% response rate.

The survey covered three principle topics

- General information
- Utilisation of OT – To determine opinion of the roles to which OTs' would be most suited AND which roles the OT should not be involved in.
- Training requirements – To determine the appropriate academic: clinical balance that would be required to fulfil OT training.

# RESULTS

## General Information

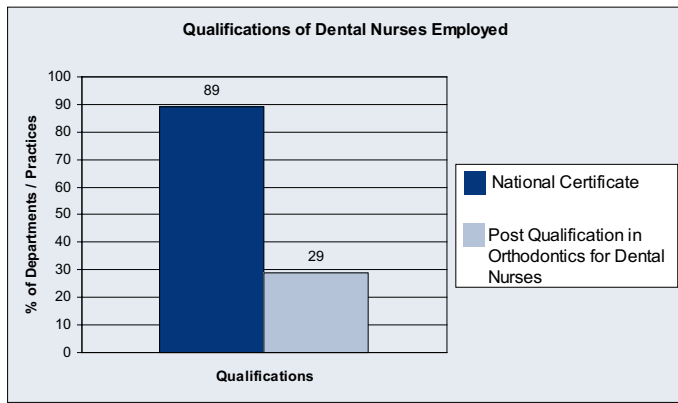


Figure 1. The level of qualification of Dental nurses currently employed within the South West region

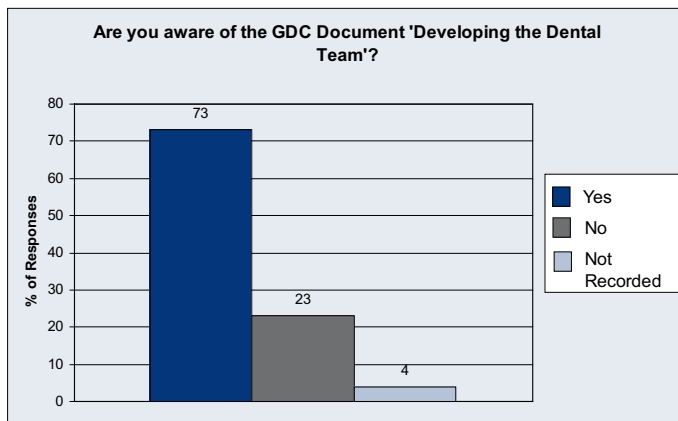


Figure 2. Practitioner awareness of the GDC document 'Developing the Dental Team'

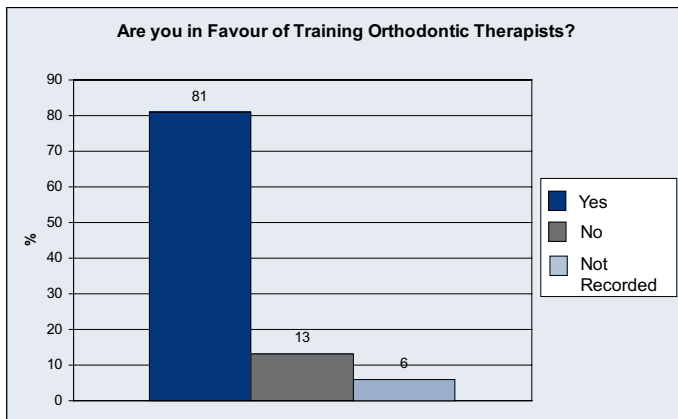


Figure 3. Are you in favour of training OT?

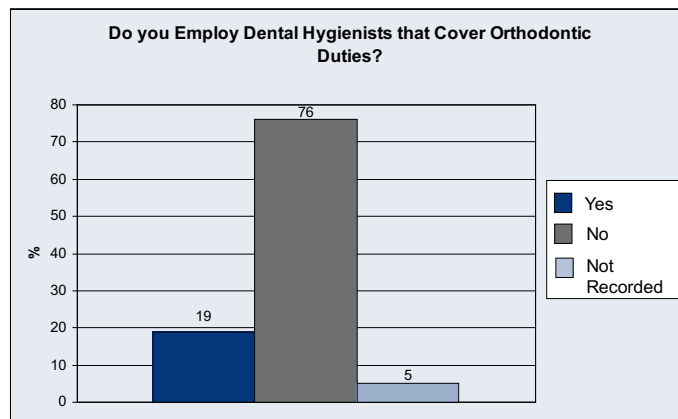


Figure 4. Do you currently employ Dental Hygienists that cover Orthodontic duties e.g. taking impressions and the cleaning off composite from teeth after a debond?

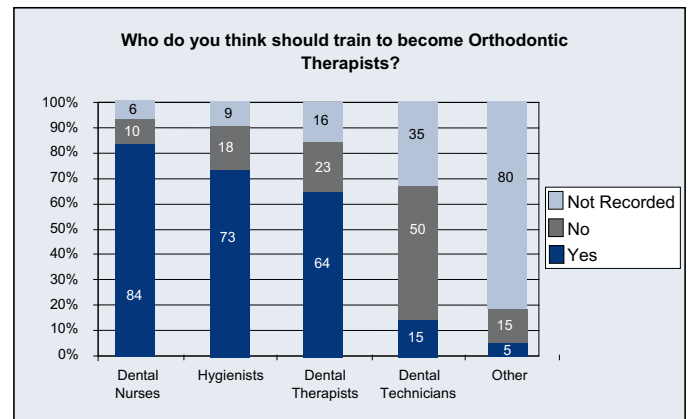
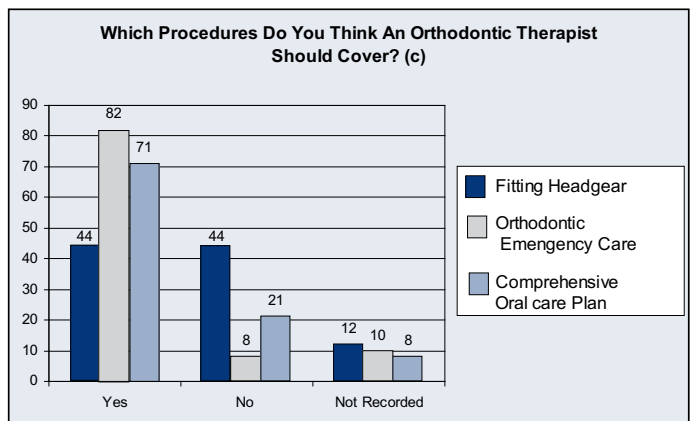
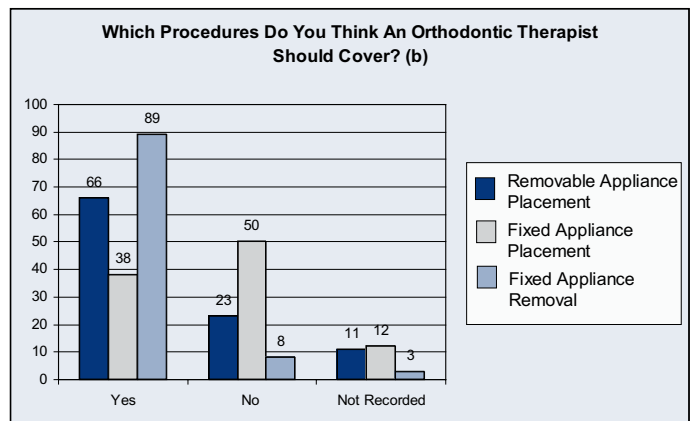
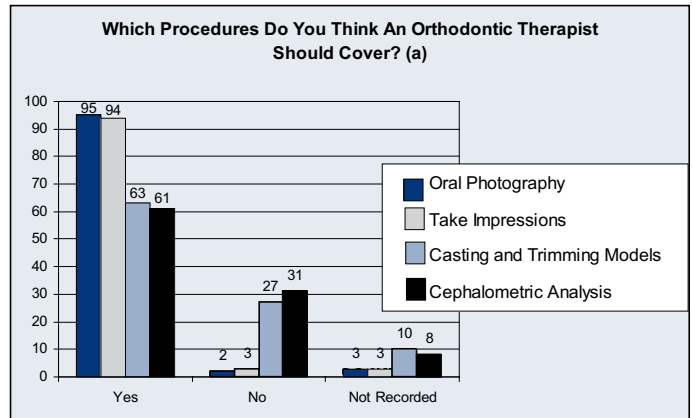


Figure 5. Which staffing groups should train to become Orthodontic Therapists?



Figures 6 (a, b, c). Procedures that an Orthodontic Therapist should be capable of

## TRAINING REQUIREMENTS

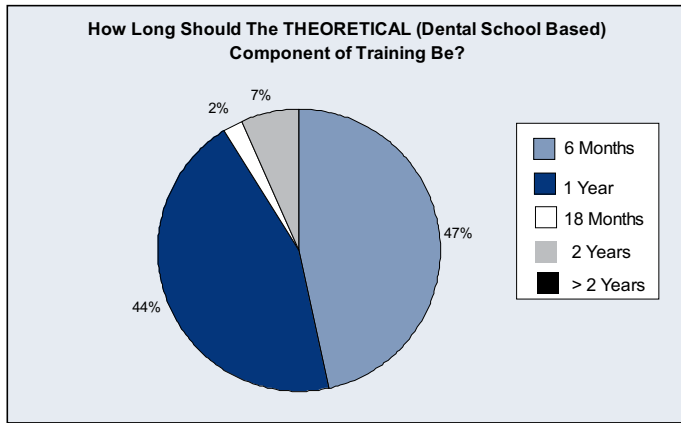


Figure 7. Length of training – Dental School based

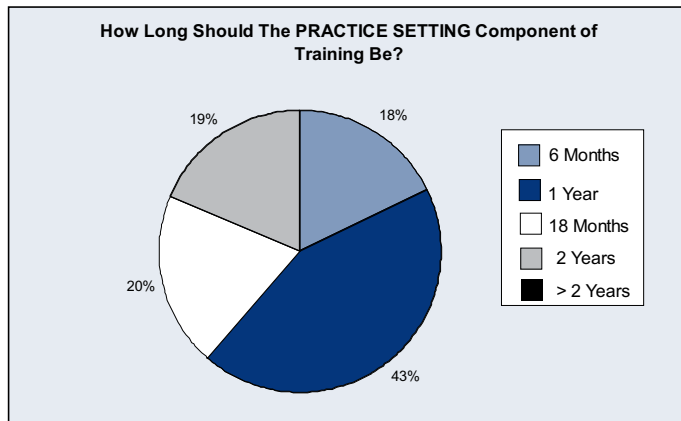


Figure 8. Length of training – Practice / department based

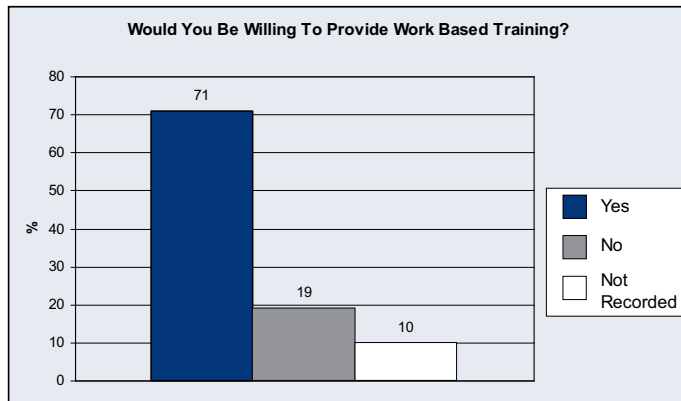


Figure 9. Provision of work based supervision and training

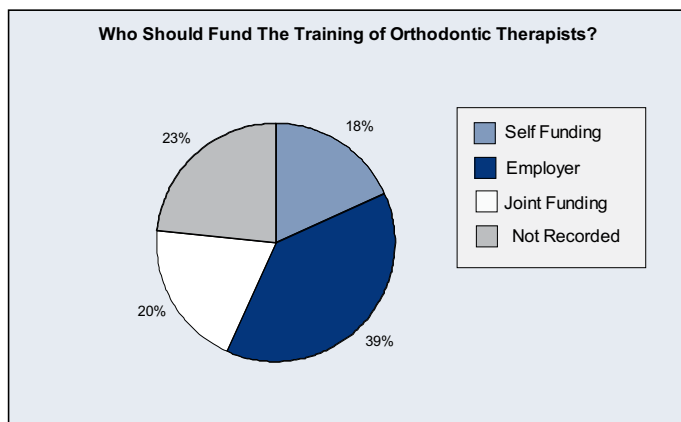


Figure 10. Funding of OT training

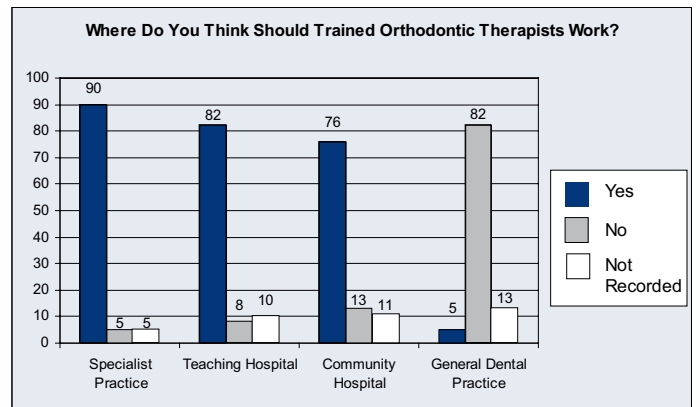


Figure 11. Where do you think trained orthodontic therapists should OT work following qualification?

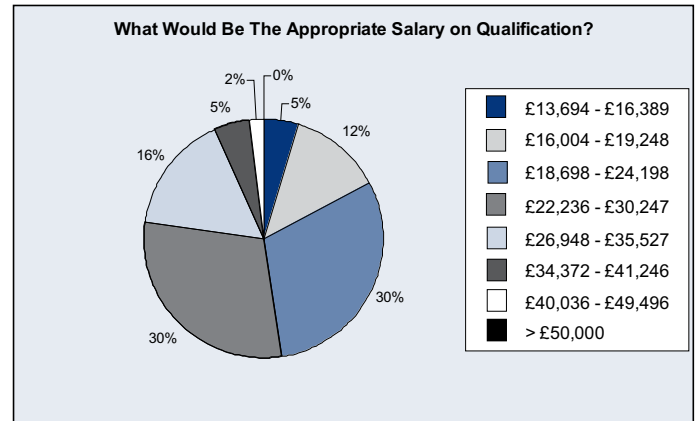


Figure 12. Starting salary on qualification

## DISCUSSION

Orthodontic Therapists (OT) will train under the registered title of DCP. Their role is to assist in the provision of orthodontic treatment to a given population. The General Dental Council (<http://www.gdc-uk.org>) have outlined the role of OT as being able to assist dentists in carrying out orthodontic treatment and provide some aspects of the treatment themselves. Orthodontic therapists will also be able to carry out treatments to assist patients in an emergency by relieving pain or making appliances safe. The wording of this statement is significant. This is because it stipulates some of the limitations of the OT indicating that the OT will be involved in the treatment of a patient as opposed to diagnosis and treatment planning. Despite this, the OT will be expected to have a basic knowledge of the features and classification of malocclusion including its aetiology in terms of skeletal, soft tissue and local factors<sup>2</sup>. The role of diagnosis and treatment plan will, therefore, continue to be under the control of the 'dentist'. The statement doesn't state specialist orthodontist, consultant orthodontist or GDP with a specialist interest (DWSI).

The development of the OT role at a time of significant changes in the provision of NHS dental services may also prove significant. Within the United Kingdom the provision of orthodontic treatment has traditionally been provided by specialist orthodontic practitioners, orthodontic consultants and DWSI. With the implementation of the new Dental Contract in April 2006 came an alteration in the funding of NHS dentistry, including orthodontic treatment. Prior to April 2006 a practitioner had an 'open ended' arrangement with the NHS and provided they had the capacity to treat an eligible patient they could do so. The present arrangement is a direct purchaser / provider contract with the local Primary Care Trust (PCT). This contract stipulates the volume of treatment episodes that may be provided (funded) within a given financial year. This places the funding of orthodontics in competition

with funding for other health services, including general dentistry. This capping of orthodontic services has in some regions compounded the difficulties for specialists to create new practices in regions that have a shortfall in orthodontic provision. These funding difficulties may potentially leave the PCT with difficulties providing orthodontic services. To manage this PCTs' are assessing methods of utilising salaried dental services. The scenario of a qualified specialist orthodontist being employed and running a multi-chair clinic assisted by an OT may soon become a reality. The 'catch 22' situation is that it may also lead to difficulties in the training of OT, as the potential for the expansion of specialist practices within the NHS may be limited, resulting in fewer training locations.

This survey assessed the opinions of orthodontic providers on the remit, training and utilisation of OT. The survey was carried out in the form of a questionnaire posted to individuals on the orthodontic specialist list, held at the GDC. Respondents were asked their views on differing aspects of OT training and given the opportunity to comment specifically on any given question. The comments were, in the most part, positive towards OT. Specific concerns were repeated by a number of respondents which will be discussed in a later section. The foundation of the questionnaire reflects the findings of a pilot project<sup>3</sup> carried out in Bristol in 1995. The project 'Orthodontic auxiliaries – a pilot project<sup>3</sup> identified the advantages of orthodontic therapists as follows:-

1. Increase in treatment standards, productivity and efficiency.
2. Reduced clinical workload for the orthodontist allowing more time for treatment planning and the finishing stages of treatment, which may improve treatment standards.
3. Reduced costs in training the orthodontic workforce. It currently takes postgraduates three years to complete their full time speciality training; orthodontic auxiliaries could be trained to perform simple, reversible practical procedures within a greatly reduced time span.
4. The present uneven distribution of British orthodontic services could be addressed by initially focusing auxiliary employment in areas of under provision.

The foundations of training and the specific duties that OT would be able to, and are competent to undertake, are however open to interpretation. The important factor is that they provide treatment and are not responsible for diagnosis or treatment planning. In this survey the majority view appeared to be that the OT should perform the more routine clinical duties, particularly those they may not require the clinical skills and knowledge of a qualified orthodontist per se. For example, a strong YES response was received for utilising OT to perform oral photography (95%), taking impressions (94%), fixed appliance removal (89%), orthodontic emergency care (82%), and in the delivery of a comprehensive oral care plan (71%). Clinicians were less in favour of OT performing removable appliance placement (66%), casting and trimming models (63%) and cephalometric analysis (61%). Interestingly, cephalometrics is considered a valuable tool in the orthodontic diagnosis and planning. This survey didn't distinguish whether this was identifying specific cephalometric landmarks or the interpretation of radiographic findings. From comments received, however, the indication is that OT should not be expected to analyse the radiographs and that their role should be limited to the tracing of the radiographs.

The accurate placement of bonded attachments is one of the cornerstones of fixed appliance treatment and is generally considered the domain of the orthodontist. This view was reflected in the survey where clinicians were against the

placement of fixed appliances and the fitting of headgear, with 50% and 44% NO responses respectively. A limitation of the study was the failure to include a category 'adjustment of fixed appliances'. This may have led to some confusion when completing the form and may have affected the recorded scores. The OT could be seen as having a role in the adjustment and removal of these appliances. This does not however, indicate that OT should not be trained in the placement of brackets and bands as one of the preferred duties of OT is in the provision of emergency care, where the ability to accurately replace brackets and bands would be essential. The fitting of headgear recorded an even split of 44% in favour or against (12% no response). Though this a reasonably straight forward task the potential health and safety implications must be considered and was expressed by many respondents. As a minimum, if the OT were to fit the headgear it must be the clinician's responsibility to check this before the patient leaves the clinic.

The identification of career escalator has been promoted within the dental community. This is reflected with the publication of the GDC document -Developing the Dental Team<sup>2</sup>, which encourages DCP's to develop professionally, and diversify. The principle is, assuming the individual fulfils the minimum entry requirements; they may be able to proceed from dental nurse to hygienist, hygienist to therapist, or nurse to therapist. There is also the possibility to progress from a dental technician into a more clinical role. Clearly, the training requirements of each individual would therefore differ according to their background knowledge. To assist this there may be the possibility of accreditations of prior learning (APL) to be allocated and incorporated into any training programme<sup>2</sup>.

There was general agreement that trained dental nurses, hygienists and dental therapists should form the core of trainees. This may reflect concerns relating to the differing background knowledge of the DCP professions. Of note, there were a number of comments made suggesting minimum levels of experience potential trainees should have before being able to progress as OT. This reflects the GDC suggestion that trainees should have at least 1 year of full time, or equivalent, post qualification experience prior to starting OT training. With recent changes to the Employment Equality (Age) Regulations 2006<sup>4</sup> restrictions such as these cannot be placed. However, the control of applications could be controlled by stating the requirement for further professional training prior to any application e.g. obtaining a recognised post qualification for dental nurses in orthodontics.

Orthodontic auxiliaries are already employed in parts of Europe as well as Canada and the United States, working efficiently and effectively. Within these countries, the training requirements differ. For example the length of the training varies from one week to 2 years<sup>2</sup>. The GDC guidance is that DCP students seeking to qualify as OT should study for a period not less than 45 weeks (1 year) - full time study, or part time equivalent<sup>2</sup>. In contrast to these guidelines most individuals surveyed thought the overall length of training should be greater than 1 year. The majority of orthodontists thought that the theoretical component should in itself be either 6 months or 1 year. There was a greater variation in responses regarding the practice setting, with the most popular length being 1 year. The setting of the course is not dictated though there must be a balance of academic knowledge and clinical experience. Training, therefore, does not need to be restricted to a dental hospital setting and may occur within a practice or

district hospital. In this survey clinicians were asked if they would be willing to provide the clinical based component within their practice or hospital department. Encouragingly, more than 70% suggested they would, in theory, be willing to provide this training. This opens the possibility to arrange a course on a 'distance learning' basis. The academic component could be provided to cover all aspects of the syllabus as stipulated by the GDC<sup>2</sup> as a combination of lectures, demonstrations and phantom head teaching combined with e-learning. This could be interspersed between blocks of practice / clinic based experience.

Interestingly, the two areas that generated most heated and greatest number of comments related to the funding of any training and where OT's should work following qualification. The concerns with funding relate to the retention of a trainee following qualification i.e. following training the individual may move to another job. A potential way forward may be for the trainee to fully or partly fund their own training and for there to be an agreement with the training practice that this will be reimbursed over a set period of time. The second major area of concern is the ability for the OT to be employed and supervised by a general dental practitioner. At present there is no legislation dictating where an OT may work, or indeed a limit on the number of OT that may work under one dentist. The scenario that must be avoided is a GDP employing OT's as essentially orthodontists and leaving them unsupervised.

The survey findings are clear that OT should only be able to work where they would be supervised, and in the presence of, a qualified orthodontist.

## CONCLUSION

This survey indicates that there is positive support for the training and development of the orthodontic therapist role within the orthodontic community. The OT would be able to carry out specific duties in the treatment, though not diagnosis, of an orthodontic patient. However, linked to this support are concerns as to the funding and potential supervision and workplace of OT following qualification.

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# OUTCOMES OF CLEFT LIP AND PALATE PATIENTS AFTER ORTHOGNATHIC SURGERY

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Keywords: Cleft lip and palate, orthognathic surgery, outcome, cephalometrics

## INTRODUCTION

The Clinical Standards Advisory Group's (CSAG) evaluation of cleft care in the United Kingdom<sup>1</sup> revealed disappointing outcomes. Scarring from primary surgery is seen as a major aetiological factor for adverse maxillary growth<sup>2</sup>. As a result orthognathic surgery may be an important part of treatment for a number of patients with cleft palate. In line with CSAG recommendations it is important to evaluate the outcomes of orthognathic surgery so that the success of the technique and informed consent can be obtained. The process of determining the outcome of the orthognathic surgery in this group is not well documented and there is an absence of standards against which to audit results. The Aarhus Cleft Team has identified "good" unilateral cleft lip and palate cephalometric values based on their patient sample. These results were based on the

assessment of 132 patients in a two-centre study to determine the effects on midfacial growth after delayed hard palate repair compared to conventional surgery.<sup>3</sup> The patients in the oldest age group (15.1 to 16.5 years-old) were evaluated using a five-point scale with respect to their midface and profile (Table 1).

## AIMS

- To evaluate the overall outcome of orthognathic surgery for cleft patients in our region, prior to implementation of the post CSAG service.
- To evaluate cephalometric changes pre and post orthognathic surgery.
- To compare post orthognathic cephalometric values with good cleft values.

## MATERIALS AND METHODS

A retrospective audit was carried out on all cleft patients who had undergone joint orthognathic treatment between Newcastle General Hospital and Newcastle Dental Hospital (1995-2006). Computerised cephalometric tracings were produced from pre-orthodontic and post-surgical lateral cephalograms using Opal (version 1.3) software. The tracings were used to analyse the skeletal and soft tissue appearances of the patients. Values recorded were taken from the standard Eastman analysis with the addition of the Holdaway angle (the angle soft tissue Nasion – soft tissue Pogonion – Labrale Superius) and cranial base to mandibular plane angle, for comparison with other researchers' work in this field. Information was collected on a standard data collection sheet and analysed by a single clinician.

The information collected was stored on a departmental

Classification	Definition
1	Harmonious skeletal and soft tissue profiles.
2	Harmonious skeletal profile with some imbalance between lips.
3	Slightly concave skeletal profile and also some midfacial soft tissue retrusion.
4	More pronounced maxillary horizontal and vertical deficiency, still possible to achieve acceptable occlusion, but soft tissue profile reflects relative mandibular prognathism and orthognathic surgery should be considered.
5	Definitely in need of orthognathic surgical correction.

Table 1. Classification of midface and profile

computer. Patient identity was kept anonymous by modification of the hospital number.

The project was overseen by Mr Jan Ledvinka (Senior Registrar Orthodontics) and Dr C Rye Mattick (Lead Orthodontist, Northern and Yorkshire Cleft Lip and Palate Service).

## RESULTS

Records indicated 23 cleft patients who had undergone joint orthognathic/ orthodontic management between Newcastle General Hospital and Newcastle Dental Hospital. The sample demographics revealed proportionately more males (n=16), and an increased incidence of left side unilateral clefts. Patients' surgical dates ranged from May 1995 to April 2006. Complete records were only available for 9 patients including 8 boys and 1 girls (Table 2).

Gender		
Boys	Girls	
8	1	
Left unilateral cleft	Right unilateral cleft	Bilateral cleft
4	2	3

**Table 2. Gender and cleft type of cases with complete records**

Table 3 illustrates the mean changes in values for all the patients involved. Mean ANB increased from -5° (pre-treatment) to -1° (post-treatment), largely due to a decrease in SNB. Mean overjet changed from -6.5mm to 0mm. Maxillary incisor and mandibular incisor inclinations improved from 104° and 80° pre-treatment to 108.5° and 86° post-treatment, respectively. A soft tissue improvement was noted with a mean change of +7° in the Holdaway angle.

	Pre-orthodontic Mean	Post-Surgical Mean	Mean Change
SNA	72	73	1
SNB	77.5	74	-3.5
ANB	-5	-1	4
NSL/ML	36.5	39	2.5
IIs/NL	104	108.5	4.5
Iii/ML	80	86	6
LFH %	57.5	58	0.5
OJ	-6.5	0	6.5
OB	0.5	0	-0.5
Holdaway	-0.5	6.5	7

**Table 3. Mean cephalometric values and changes**

Table 4 shows a comparison between post surgical figures for non-cleft patients, patients treated at Aarhus (Denmark – Enemark) and at Newcastle (Pre CSAG).

	Non-cleft	Aarhus	Newcastle
SNA	81	74.5	73
SNB	78	73	74
ANB	3	1.5	-1
NSL/ML	32	35	39
IIs/NL	109	95	108.5
Iii/ML	93	86	86

**Table 4. Comparison between centres**

## DISCUSSION

Previous research by Enemark<sup>3</sup> has provided us with cephalometric values to compare our cleft sample with. It was felt this was a more reasonable comparison than with a non-cleft group alone. In Aarhus, surgical closure of the cleft is performed before the age of two at the same stage as soft palate closure, as it is in Newcastle. The Aarhus group was also rated amongst the best for maxillary growth in the Eurocleft multicenter study (1992).<sup>4</sup>

A reduction in SNB was noticed post-treatment despite most patients exhibiting a retrusive maxilla pre-treatment. This was a result of bimaxillary surgery i.e. maxillary advancement and mandibular setback to tackle the class III discrepancy. Not all cases can be managed by maxillary surgery alone, if the maxilla is advanced too far, there can be problems with stability and speech (velopharyngeal insufficiency) and so mandibular setback may be required.

In our sample, 6 of the patients exhibited a mild Class III incisal relationship post surgery, however dental and soft tissue improvements were observed throughout the sample. There are still improvements to make to match other published data. Another important finding was the quality of the records particularly in relation to radiographs. Although radiographs had been taken, there was no evidence of documentation of the findings in the event that the film itself was missing. Incomplete records were therefore not included in this evaluation, as they provided no objective way to measure the outcome of surgery. Many of the cases with incomplete records had not been treated within the hospitals for at least eight years. As a result the records and radiographs had been placed on CD-ROM for storage and hard copies destroyed.

## CONCLUSION

While dental and soft tissue improvements were seen, improvements in record keeping need to be made. The post CSAG cleft service may result in favourable changes in the future.

## RECOMMENDATIONS

- Better record keeping in line with CSAG recommendations.
- Re-audit of the post CSAG service

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# ARE ECTOPIC CANINES REFERRED APPROPRIATELY?

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Keywords: Ectopic canines, referral timing, radiographs

## INTRODUCTION

The aetiology of palatal canine ectopia has been suggested as being polygenic and multifactorial.<sup>1,2</sup> The prevalence is about 1.5% and ectopic canines are twice as likely to be located palatally than buccally.<sup>3</sup> The management of the condition requires co-ordination between primary and secondary services and hospital departments. Ericson and Kuroi<sup>4</sup> provide some evidence that the interceptive extraction of primary canines can result in the normalisation of the ectopic canine if carried out before the age of 13 years, which may negate the need for surgical intervention. Late referrals remove this option and can be costly in terms of clinical time and the possible development of root resorption of permanent incisors in 12-48% of cases.<sup>3,5</sup> Anecdotal evidence from experienced orthodontists suggests that ectopic canines may present later than ideal following referral from the primary sector.

## AIMS

To investigate:

- the age at which patients with ectopic canines were referred to the Department of Orthodontics,
- the time between referral and the patients' initial assessment,
- the need for immediate treatment,
- the use of radiographs in the assessment and referral of ectopic canines.

During this process we would highlight any areas of shortfall and make recommendations to improve the quality of service offered to patients.

## STANDARDS

Guidelines are currently set by the Royal College of Surgeons of England (RCS Eng) and are available electronically on their website.<sup>6</sup>

Inspection and palpation in the canine region is recommended annually from the age of 8 years. It is hoped that early diagnosis and treatment of ectopic canine eruption will reduce the possible need for surgical intervention at a later stage. If they cannot be palpated by 10 years or if, from palpation, palatal ectopia is suspected appropriate radiographs will be needed to confirm the diagnosis and to check for possible pathology. Onward referral to a specialist orthodontist for advice on management is appropriate, if any abnormality is detected or suspected.

Patients with unerupted palatal maxillary canines should be referred by the age of 12 years<sup>4</sup> and seen within a 13 week target set by the Department of Health (DoH).

## METHOD

A prospective study to investigate the timing of referrals involving ectopic canines was carried out, commencing May 2005. It included all new patient referrals to the Department of Orthodontics involving ectopic canines or retained primary canines. At the initial assessment clinicians were asked to keep a copy of the patient's details to allow review of the notes during data collection. Based on an audit in "Methodologies for clinical audit" by the Royal College of Surgeons of England,<sup>7</sup> the quality and timing of the referrals were assessed. Information was collected on a standardised data collection sheet and was only used in the hospital for the purposes of the audit (Table 1).

Patient Details	Name Date of birth Hospital number Regular attendee with GDP
Referral letter	Referring dentist Date of referral Age at referral Reason for referral Special tests Treatment provided at GDP
Newcastle Dental Hospital	Initial appointment Special tests Diagnosis Treatment planned

Table 1. Information included on data collection sheet

## RESULTS

- Fifty complete records were collected between May 2005 and September 2006.
- There was a 2:1 female to male split in the patients seen who all had at least one unerupted maxillary canine.
- In most cases it was not obvious if patients were regular attendees at their general dental practitioner (GDP), but 81% were referred to the Orthodontic department by a named GDP. The remaining 19% were either referred from another hospital department or via the Community Dental Service (CDS).
- The average age at referral was 14.3 years, with 70% being over the recommended age of 12. Of the patients who attended their GDP regularly only 44% were referred by the recommended age.
- Radiographs were taken by 66% of GDP's before referring, and were included in 74% of the referrals. Further radiographs were taken at Newcastle Dental Hospital (NDH) for 81% of patients, with 8% of GDP films repeated.
- GDP's had removed retained deciduous canines in 4% of the patients referred prior to specialist assessment.
- Immediate treatment was organised for 68% of patients referred.
- The average wait for an appointment was 12.6 weeks. However 32% of patients were seen after the 13-week deadline for their initial appointment (Fig 2).

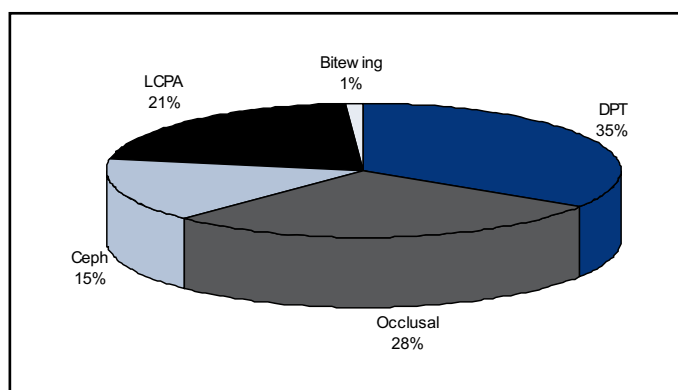
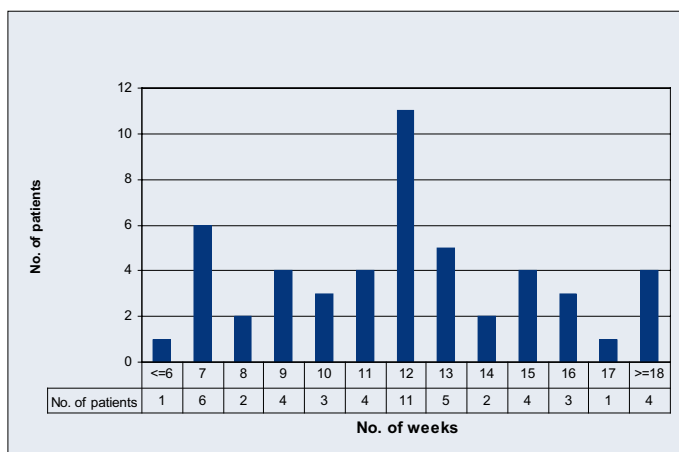


Figure 1. Radiographs taken by the department.



**Figure 2. Time to initial assessment.**

## DISCUSSION

The new General Dental Service contract was introduced on the 1st April 2006; therefore the results of this audit are split over this time period. No differences were noted in referral trends in this audit between the two contracts but as the timeframes were not equal and the numbers within audit small, it is difficult to draw any significant conclusions regarding the new contract's effect.

The demographic distribution of the patients in terms of sex (2:1 female to male) is comparable with other publications on the topic.<sup>1,8</sup> Regular monitoring of the developing dentition is the most reliable way to diagnose potential problems and the results show that patients who were regularly seen by a GDP were more likely to be referred by the recommended age. Despite this, 56% of the patients were still referred after the age of 12 and therefore missed the opportunity to have interceptive orthodontics and could already exhibit incisor root resorption. This would indicate that there are other difficulties in keeping to the guidelines.

The late age of referral can influence the management of the ectopic canine. At the initial assessment it was decided that 68% of the patients required some sort of immediate treatment to be initiated by the Orthodontic Department (extraction of deciduous canines or exposure/ extraction of ectopic permanent canine). It is likely actual treatment times for problems deemed needing "immediate treatment" by the Orthodontic Department were variable depending on the facilitator of the treatment (GDP, Oral Surgery Department). Of the other 32%, patients were referred to tertiary services (e.g. Hypodontia Clinic), some discharged with no further active treatment and others reviewed to allow the dentition to develop.

GDP's took radiographs in 66% of the cases, but did not always include them with the referral, delaying the treatment of the ectopic canine in 26% of cases. Even when included, 81% of the cases required further films. Films were only repeated if they did not provide sufficient diagnostic information or were considered out of date. Other radiographs carried out at the initial visit were used for the purposes of treatment planning or caries diagnosis (Fig 1). The benefit of radiographs taken by the GDP is difficult to establish, especially if repeat films are necessary.

The extraction of deciduous canines by GDP's prior to referral is low. It may indicate unfamiliarity with the management, or an awareness of the need for a full assessment prior to extraction. Interestingly, a prospective controlled study concluded that the extraction of deciduous canines alone did not increase the rate of normal eruption,<sup>9</sup> further influencing the management of this condition.

Waiting times for assessment in the Department on average were under the 13-week time frame. Delays in assessment were due to cancellation of appointment by patients, a shortage of clinical staff especially over the summer months and inappropriate referrals to other departments (e.g. Oral Surgery). Possible solutions may include targeting extra clinics at specific times of year when annual leave is anticipated therefore reducing any backlog. With DoH targets changing, ultimately more clinicians will be required.

The results of the audit suggest that future education targeted at primary care practitioners to increase awareness of the established clinical guidelines may be appropriate. In particular, advising specific referring practitioners has been recommended.<sup>8</sup> There should also be mention of which Department to refer to as treatment may be delayed by referrals to other hospital departments which would then require an Orthodontic opinion prior to any treatment planning.

## CONCLUSION

The average age of patients referred to the hospital with ectopic canines was 14.3 years with an average waiting time of 12.6 weeks. Some form of immediate treatment was required in 68% of the patients following orthodontic assessment. Further guidance is required for primary care practitioners in the management and referral of canine ectopia.

## RECOMMENDATIONS

- Children should be under the care of a dentist to allow the monitoring of developing canines.
- Reinforce referral guidelines with primary care practitioners especially relating to ectopic maxillary canines.
- Publication of "Orthodontic Referral Guidelines" on Trust Internet site.
- Guidelines to primary care practitioners regarding radiographs for canines and inclusion with referral.
- More staff required to assess referred patients.
- Re-audit 6 months after dissemination of information to practitioners.

## FUTURE AUDIT

Investigation into the diagnostic value of radiographs submitted as part of referrals to the Department of Orthodontics.

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# A RETROSPECTIVE AUDIT OF ORTHODONTIC CLINICAL PHOTOGRAPHY UNDERTAKEN BY MEDICAL ILLUSTRATION PHOTOGRAPHERS: CLOSING THE AUDIT LOOP

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2. Norfolk and Norwich University Hospital

Keywords: Clinical photography, standards

## INTRODUCTION

Clinical photographs taken before, during and after orthodontic treatment form an essential part of the patient's records.

Photographic inaccuracies may lead to misrepresentation and misdiagnosis of the patient's malocclusion, treatment status or presence of pathology<sup>1</sup>. It has been stated that nine pre-treatment and nine post-treatment images per patient (Four extra-oral and five intra-oral) should constitute the minimum data set for an orthodontic patient undergoing treatment<sup>2</sup>.

It is common practice for the orthodontist to take their own clinical photographs. In a recent European survey it was found that 60% of orthodontists took their own photographs and only 5% utilised the services of a professional photographer<sup>3</sup>. However, many NHS Hospital Orthodontic Departments refer their patient's to their Department of Medical Illustration to help minimise chair-side time and improve departmental efficiency.

During a candidates preparation for the Membership in Orthodontics it was noted that there was a high incidence of errors in clinical photographs taken by Department of Medical Illustration at the Norfolk and Norwich University Hospital rendering many cases unsuitable for examination purposes.

## AIMS

1. To audit the standard of clinical orthodontic photographs taken by the Department of Medical Illustration at the Norfolk and Norwich University Hospital.
2. To identify the errors present.
3. To provide advice and training to aid improvement in the quality of photography with the Medical Illustration department.
4. To re-audit and close the audit loop.

## STANDARDS

The photographic standards for this audit were based on the recommendations set out by McKeown et al., (2005) and included standards set during a con-current audit carried out in the Eastern Deanery by Ipswich General Hospital<sup>1,4</sup>. It was decided locally by peer consensus that 95% of clinical photographs taken should be above the standard set out below. The agreed photographic standards were:

Extra-oral, frontal:

- No Glasses or jewellery
- Head fills whole photograph
- Hair behind ears
- Pupils parallel to the horizontal (Not tilted)

Smiling:

- No Glasses or jewellery
- Head fills whole photograph
- Hair behind ears
- Pupils parallel to the horizontal plane (not tilted)
- Smiling with teeth in occlusion

<sup>3</sup>/<sub>4</sub> view:

- Head rotated with pupils horizontal.
- Tip of nose in line with outer margin of cheek.
- No glasses or jewellery
- Hair behind ears

Profile:

- Right profile photograph with the Frankfort plane horizontal
- Hair behind ears
- No glasses or jewellery

Intra-oral, anterior:

- Anterior photograph showing buccal corridors and labial segment parallel to the occlusal plane.
- Teeth in occlusion.

Buccal (Right and left):

- Occlusal plane horizontal
- Whole of first molar must be visible in occlusion.
- At right angles to teeth desirable.
- Teeth in occlusion.

Upper and lower occlusal:

- Arch must be square in centre of the photograph.
- First molars must be visible as a whole.
- No mirror misting.
- No cheeks or lips obscuring teeth.

## METHODS

This was a retrospective audit of the clinical photographs of patients (n=75) commencing treatment between the 6th April 2005 to the 30th June 2005. They were randomly selected from the Medical Illustration database.

The photographs taken were assessed against the Gold standards by an independent evaluator.

The audit process was repeated again for records (n=75) taken between 1st January 2006 to the 31st March 2006, following the evaluation and subsequent re-training that was provided to the photographers after the first audit cycle.

## RESULTS

1st Audit cycle

In total 160 photographs out of 675 (24%) fell below the standard set out above (Figure 1). It was established that the photographs pertaining to these patients were taken by 5 different professional photographers (Figure 2). Each error identified was logged for every photograph in order to identify specific problem areas.

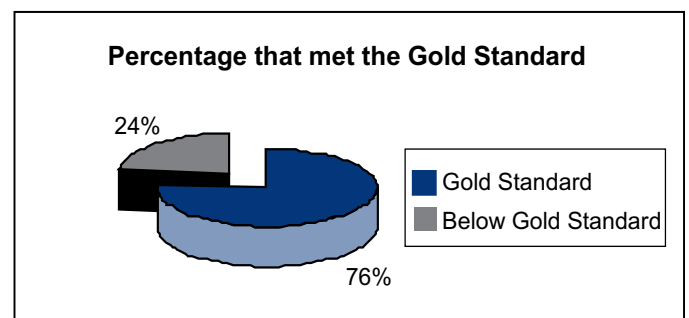


Figure 1. Overall photographic success rate.

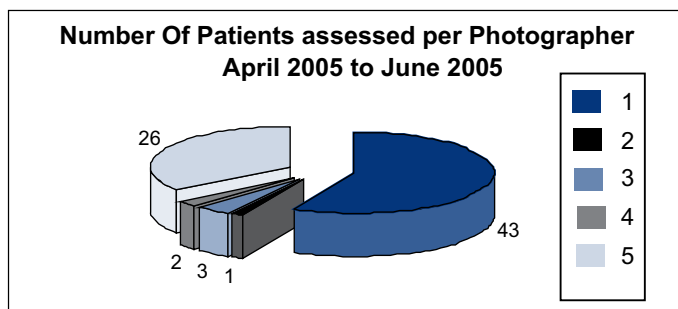


Figure 2. Number of cases photographed per photographer

### 2nd audit cycle

2 photographers took the photographs during the second assessment period.

119 photographs out of a possible 675 (18%) fell below the standard (Figure 3).

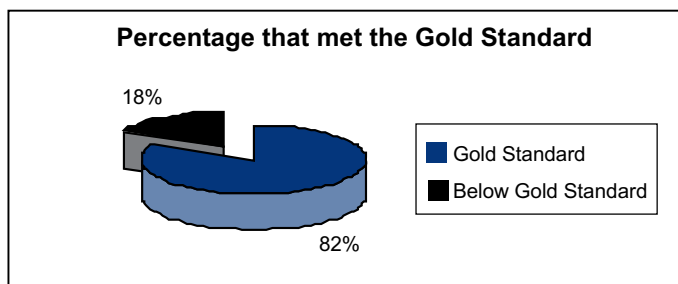


Figure 3. Overall success rate of the 2nd cycle.

EXTRA-ORAL	1 <sup>st</sup> audit cycle % Below Standard	2 <sup>nd</sup> audit cycle % Below Standard	% Improvement
FRONTAL	21	11	10%
FRONTAL(Smiling)	27	13	14%
3 QUARTER	32	12	20%
RIGHT PROFILE	9	7	2%

INTRA-ORAL	1 <sup>st</sup> audit cycle % Below Standard	2 <sup>nd</sup> audit cycle % Below Standard	% Improvement
FRONTAL	9	4	5%
R BUCCAL	27	29	-2%
L BUCCAL	13	17	-4%
UPPER OCCLUSAL	43	43	0%
LOWER OCCLUSAL	32	23	9%

TABLE 1. A comparison of the first and second audit cycle showing the percentage of improvement made in each of the 9 photographs taken.

### DISCUSSION

The number of photographs falling below the set standards was deemed unsatisfactory after both audit cycles. There was a 6% overall improvement following the first audit cycle, but the achieved success rate was well below the 95% standard.

The results are extremely pertinent in a unit where Specialist Registrars are dependent on the photographers for potential examination records.

Initially five different photographers, of varying experience, were involved with orthodontic photography which contributed greater variation in the results achieved.

During the first audit cycle the lateral profile shots proved to be the photographs with the fewest number of errors. Significant errors in the upper occlusal shots were experienced, the most common problem being the exclusion of the first molars. The second most common error occlusally was the evidence of fingers being in view, indicating a lack of use of appropriate retractors. In 3% of cases there was an incomplete set of 9 photographs with the occlusal shots being excluded.

The upper occlusal photographs showed an identical standard achieved after the second cycle but the issue of fingers in the shots was not evident.

The results of the first audit cycle were presented to the Department of Medical Illustration and appropriate recommendations and training were given to the photographic team. Examples of examination standard photographs were provided as a guide to aid the photographers. Further recommendations included the appropriate use of soft-tissue retractors and the extent of cheek retraction required to obtain buccal shots. In addition long handled mirrors were recommended to aid occlusal shots to avoid fingers in the photograph and to include the first molars. The number of photographers allocated to orthodontic record taking was reduced to two to limit inconsistencies.

Although there was an overall 6% improvement in the standard of the photographs after the second audit cycle there was a reduction in the quality of the right and left buccal shots. The most common reason for this was an inability to retract the buccal mucosa to allow full visualization of the first molar and therefore the molar relationship. In addition many buccal photographs were taken too anteriorly and not perpendicular to the buccal surfaces of the teeth. This led to misrepresentation of the true molar relationships.

One reason given by the photographers for the difficulty they experienced in taking intra-oral photographs was the absence of a headrest for the patient. They had been taking intra-oral photographs with patients sitting in a backless chair. This would make soft tissue retraction very difficult and the patient's posture and head position unstable. In addition they noted that they did not have the help of an assistant to retract the soft tissues and were using the patients to hold the retractors.

The presence of copious saliva and air bubbles was also a problem which was difficult to address due to the lack of a 3:1 air supply in the Department of Medical Illustration.

The extra-oral shots showed the greatest level of improvement in quality.

### CONCLUSION

After both audit cycles, 18% of photographs falling below the Gold Standard was deemed unacceptable with regards to the preparation of examination case presentations. Further training of photographers is required especially for intra-oral photography. This would include the use of a chair with a headrest for the patient, to make soft tissue retraction and head position more stable and predictable. Ideally orthodontic photographs should be taken at the clinical chair-side to make use of the headrests, air supply and assistants to achieve the best possible results. This would necessitate the photographers visiting the department every time a set of photos were required which may be logistically problematic.

In an effort to produce better occlusal shots it has been recommended that mirrors with handles should be used in addition to further training in the use of soft tissue retractors.

Ongoing training for Medical Photographers should include Orthodontic Photography and the clinicians must check all photographs after they have been taken to ensure that the achieved result is acceptable for examination purposes. In addition orthodontic photography should be limited to one or two specially trained photographers to maintain consistent standard.

It is intended to re-audit the photographic process again to ensure that further improvement is achieved in this important aspect of clinical record keeping.

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# FIXED APPLIANCE BREAKAGES – THE ONGOING AUDIT CYCLE.

E. Thickett, S Power, The Wessex Regional Audit Group.

Keywords: Fixed appliance breakages, contributory factors

## INTRODUCTION

Breakages to fixed appliances during treatment cause significant delay in treatment progress. Repair of appliances is time consuming, often necessitating extra visits with associated extra costs in time and materials.

Over the last five years there has been a significant increase in the money spent on fixed appliance breakages (Dental Practice Board). With the introduction of the new contract this figure is built into the UOA value.

Several factors may be involved in appliance breakages including the patient, the operator, and the materials.

It was felt that determining the current level of complication rate for individual clinicians would be useful. An expected gold standard was set based on previous work carried out on fixed and removable appliances (Wong and Power 2000) and Tyrell (1998) and on the views of the Wessex Audit Group. Individuals could then compare their results with those of the group and also to the gold standard.

The type of complication was recorded so that clinicians could analyse their results in comparison to their peers. If areas of increased complication were noted by individuals then investigation of technique or process could be carried out.

Should any results prove significantly better than the average then the practices of these operators could be looked at.

## AIMS

To determine the level of complication rate (anything necessitating an extra visit or repair at a routine visit) of fixed appliances

To identify operator and techniques which reduced the complication rate.

## THE GOLD STANDARD

The gold standard was set at 12% for breakages as a percentage of the total number of visits.

## MATERIALS AND METHOD

Clinicians (hospital consultants, FTTA's, and specialist practitioners) selected a continuous 6 week period (i.e. no holidays) which would reflect their normal practice. The clinicians were circulated with forms (see appendix 1) and a meeting was held to confirm that everyone understood the criteria for classification of breakage and method of recording.

All fixed appliance breakages were recorded during this period. Failures relating to bonded retainers were not recorded. Extra oral traction breakages were excluded.

The number of fixed appliance visits during the period was recorded so that breakages as a percentage of treatment visits could be determined.

Operators recorded clinical procedures for fixed appliance placement on the data sheet

The results for operators were collated and submitted to the convenor for analysis.

A meeting was held to discuss the results and to look in detail at the findings. The audit was carried out twice; Time 1, and again 12 months later; Time 2.

## RESULTS

At Time 1, 31 clinicians participated, whereas at Time 2 only 19 of the original 31 participated. There was one retirement, and 2 had moved away. At Time 2 there were five additional clinicians, therefore a total of 24 forms to analyse. The return rate for Time 1 was 86% and 77% for Time 2.

The number of fixed appliance visits per operator varied widely. This reflects full time or part time practice and case mix of clinicians.

At Time 1, self assessment of current performance and discussion amongst peers took place regarding alternative techniques to reduce complication rates. It was left to individual clinicians to alter practice in the light of the results and discussion.

	Time 1	Time 2
Range	1-30%	3- 25 %
Group average	14 %	15 %

Table 1. Number of breakage visits as a percentage of total visits

	Time 1	Time 2
Range	0.3 — 26%	2-19%
Group average	10%	10 %

Table 2. Percentage patients with Brackets off for individual operator

	Time 1	Time 2
Range	0-14%	0-7%
Group average	3%	1%

Table 3. Percentage patients with bands off for individual operator

	Time 1	Time 2
Range	0-9	0-10
Group average	2	2

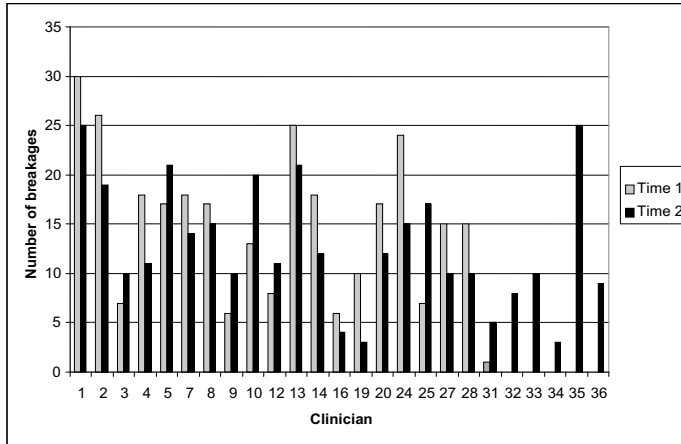
Table 4. Number of wire fractures

	Average Number of brackets off
Time 1	2.36
Time 2	2.29

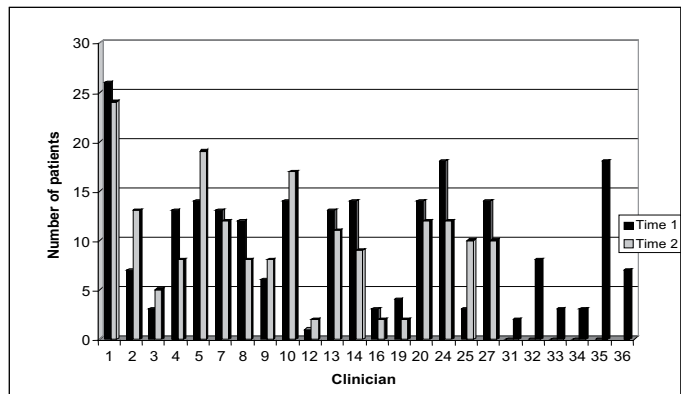
Table 5. Average no of Brackets off per patient over 20 month course treatment (Extrapolated from average number of brackets off in a six week period. Assumes patient seen once every 6 weeks)

Time 1		Time 2	
12	5.5%	15	6.1%
25	5.9%	25	6.6%
35	7.3%	12	7.2%
45	7.9%	35	7.9%

**Table 6. Which brackets fail most commonly?**



**Figure 1. Clinician comparison of breakage visits as a percentage of total visits**



**Figure 2. Clinician comparison of patients with brackets off as a percentage of the total number of patients**

## DISCUSSION

Clinicians can compare their total for each of the breakages with other group members and with the average for the group.

The Practice of the four clinicians with the least number of breakages was looked at by the convenor. No common features were found. Different techniques, bracket systems and cements were used. No obvious common denominator was found.

Three operators as a result of this audit discovered a fault with their bonding sticks. This was reported to the company supplying them for investigation.

## CONCLUSIONS

Seven operators had a complication rate on or below the 12% gold standard at Time 1. Fifteen operators had complication rates on or below the Gold Standard at Time 2.

On discussion it was felt that 12% was probably the correct level to set as the gold standard. Individual clinicians are now going to look at their current practice and attempt to reduce their figure.

The lower number of band failures may reflect the fact that fewer bands are now being used.

## FURTHER RECOMMENDATIONS

Further investigation into molar tube failure rates, the effect of changing to precoated brackets, the use of prophylaxis and tungsten carbide burs prior to either etch or self etch primer.

## References

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# AUDIT TO ASSESS THE QUALITY OF IMPRESSIONS TAKEN FOR VACUUM FORMED RETAINERS

*Amish Patel, James Dickson Cheltenham General and Gloucestershire Royal Hospitals*

Keywords: Quality of impressions, retainers

## INTRODUCTION

Vacuum formed orthodontic retainers are used to keep the teeth in their new functional position post orthodontic treatment and to prevent relapse. Advantages of vacuum formed retainers are that they are removable, comfortable, do not affect speech and are aesthetically pleasing<sup>1</sup>. They are also relatively quick and inexpensive to produce<sup>1,2</sup>.

A common type of vacuum formed retainer is an Essix retainer which is produced from copolyesters and poly-propylenes with derivatives. The original Essix retainer was invented by Dr. John Sheridan in America, and was first used in December 1992. Since then the retainer has been developed and improved. Essix retainers are the type of vacuum formed retainers used within the department (currently the department uses Essix ACE™ from Raintree Essix®). It has been noted that on regular occasions Essix retainers have not fitted the patient, or the impression was not of an adequate standard to make an Essix retainer. This results in a waste of hospital

resources, in terms of laboratory time, clinic time and material costs. The retainer may have to be remade by the laboratory, or a more expensive alternative provided. It may also cause inconvenience for the patient.

For an Essix retainer to fit well, it is imperative that a good impression is taken, providing adequate detail of the teeth and the gingival margin. The production of Essix retainers allow very little leeway for inaccuracies in the impression.

## AIMS

1. To ascertain the prevalence, how many of the Essix retainers that are requested are then successfully fitted.
2. To assess the quality of clinical procedures in making the retainers i.e. the quality of the impressions.
3. To make recommendations for improvement of the quality of clinical procedures (if required).

## STANDARDS

Criteria	Target	Exceptions	Strength of Evidence
Patients details filled out clearly and correctly on the laboratory card	100%	Nil	Recommended good practice (local consensus)
Clear instructions on laboratory card	100%	Nil	Recommended good practice (local consensus)
Alginate impressions are poured within the hour	100%	Nil	Recommended good practice (local consensus)
Models are of sufficient quality for Essix retainers	100%	Nil	Recommended good practice (local consensus)
An Essix retainer should be made and fit the patient	100%	Nil	Recommended good practice (local consensus)

**Table 2. Criteria for assessing models**

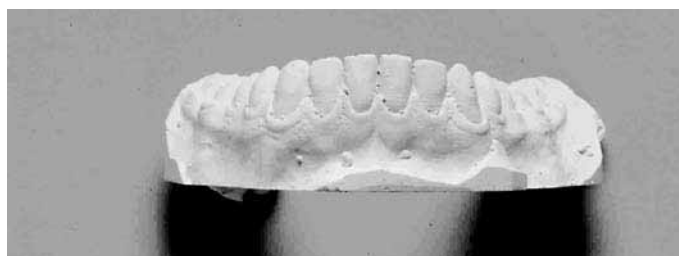
## METHODOLOGY

The sample was selected from patients who had completed a course of orthodontic treatment and had impressions taken for Essix retainers. All of the impressions were taken with Cavex CA37 fast set alginate, using Orthotechnology Duralock Plus disposable impression trays. The models of these impressions were then assessed prospectively, prior to any work being carried out, and scored 1 - 3 based on a set of criteria (Table 2). All defects on the model were recorded, however the worst defect was used to score the model in terms of quality. The "3 point assessment" has been used to score models for crown and bridgework<sup>3</sup>; however in this audit the criteria differed. All the models were assessed by the same person and also independently verified by a senior technician. Please note that the palate was not assessed since it is not required for an Essix retainer.

A sample size of 50 consecutive impressions was selected since it was felt that this would give a representative sample. The models were assigned numbers 1 - 50 in order to anonymise the sample. The notes of these patients were then studied to assess the fit of the retainer. The results were then analysed using an Excel Spreadsheet.

Score		Defects
1. Good model	a.	Good distal extension of model
	b.	No evidence of distortion.
	c.	Good detail of tooth surfaces.
	d.	Good detail of gingival margin
2. Adequate model that appears fit for purpose	a.	Adequate distal extension of the model for provision of an Essix retainer
	b.	Evidence of minimal distortion but still adequate for an Essix retainer
	c.	Minimal defects on tooth surfaces
	d.	Minimal defects on gingival margin
3. Poor model unfit for purpose.	a.	Inadequate distal extension of the model for an Essix retainer
	b.	Evidence of significant distortion
	c.	Significant defects on tooth surfaces
	d.	Significant defects on gingival margin

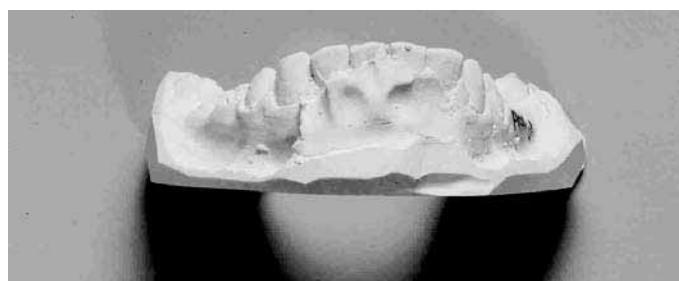
**Table 2. Criteria for assessing models**



**Figure 1. Example of model which scored a 1**



**Figure 2. Example of a model which scored 2. Note the defects of the gingival and labial surfaces of the central incisors.**



**Figure 3. Example of a model which scored a 3. Note the significant defect on the labial and gingival surface of the lower incisors.**

## RESULTS

100% of laboratory cards were clearly labelled and had clear instructions.

None of the impressions taken were poured within 1 hour due to delay in delivery between the clinic and laboratory.

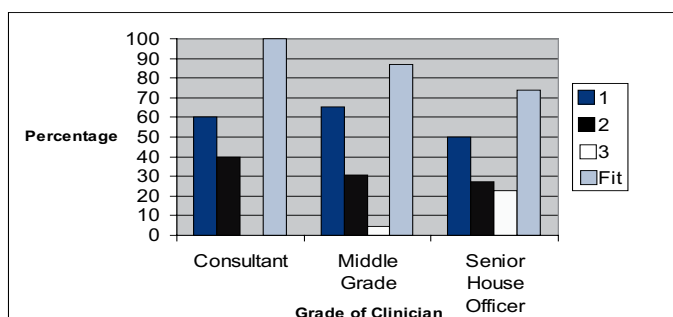
88% of the models taken were deemed to be of the minimum standard or above for provision of an Essix retainer (i.e. Score of 1 (58%) and 2 (30%)) with 12% of models deemed poor quality.

Of the models assessed 54% were of the upper arch and 46% of the lower arch. Significant differences between the arches in terms of quality of models were not noted.

10% of the impressions were taken by the consultants, 46% by the middle grades and 44% by the Senior House Officers (SHOs). Of the consultant impressions 60% scored 1, 40% scored 2 and 0% scored 3. Of the middle grade impressions 65.2% scored 1, 30.4% scored 2 and 4.3% scored 3. Of the

SHO impressions 50% scored 1, 27.3% scored 2, 22.7% scored 3 (figure 4).

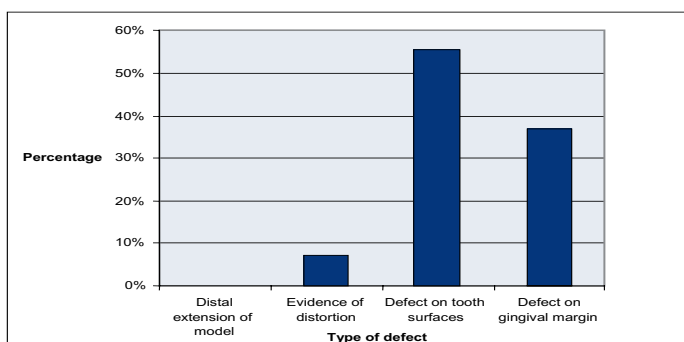
In terms of fit rate, the fit of 4 of the Essix retainers were not recorded in the notes (due to failed appointments or sending the retainers in the post). Discounting these, 17.3% of retainers did not fit or were not made due to the quality of the model. Of the consultant grade 100% fitted, of the middle grade 87% fitted and of the SHOs 73.7% fitted (figure 4).



**Figure 4. Chart to show the percentage scores for the quality of models for each grade, plus the percentage of Essix retainers that were fitted with no problems.**

Overall, the poorest models were produced by the SHOs, who also had the worst “fit rates” (73.7%). The consultant grade was the only grade to meet the standard for quality of impression and fit rate (100%).

The main defects detected on the models were defects on the gingival margin (37% of all defects) and on the tooth surfaces (55.6% of all defects). 7.4% of defects were due to distortions of the impressions. All models had a good distal extension.



**Figure 5. Chart to demonstrate the frequency of the type defects on the models that did not score 1.**

## DISCUSSION

During the audit the quality of the models were assessed. The quality of the models was then extrapolated so an assessment could be made on the quality of the impressions taken. Ideally the impression should be assessed prior to pouring the model, however due to logistics this was not possible. The SHOs performed the worst with regard to the quality of impressions (22.7% of poor quality) and fit rates (73.7%).

The main defects on the models were on the teeth and gingival margins (92.6% collectively). These appeared to be due to air blows, insufficient material in the tray, malpositioning of tray, incorrect tray selection and inadequate debonding of appliance. Distortion of the models (7.4%) may have been due to removing the impression prior to full setting of the impression material or on removal the impression material was pulled away from the tray. Please note the audit did not allow for difficult patients e.g. having a severe gag reflex.

The standards for filling in the laboratory cards were excellent. None of the impressions were poured up within the hour. Laboratory procedures and the skill of the dental nurse were not considered in the audit. However these did not seem significant. If the impression was of adequate quality, the majority of Essix

retainers fit. This suggests that a good quality impression is the main determinant of fitting an Essix retainer.

The method of scoring the models seemed to be quite robust. Only 2 of the models which were deemed adequate was it noted that the Essix did not fit (these were both scored 2). These may have been caused by minor yet significant distortion of the impression which was not easily detected or some other reason e.g. laboratory error, improper processing of impression in clinic.

The department produces around 340 Essix retainers a year compared with 590 Hawley retainers. On the basis of this audit this extrapolates to around 40 unacceptable impressions a year are taken for Essix retainers within the department. The outcome of this will either be new impressions or provision of Hawley retainers, both of which have an element of cost to the department. If new impressions are required then around 15 minutes clinical time has been wasted. Hawley retainers take around an hour of laboratory time to produce, whereas Essix retainers take around half an hour. Over a year this would amount to a significant waste in clinical/laboratory time (minimum of 10 hours a year). Essix retainers are well tolerated by patients and are simple to produce. Emphasis in the future should be placed on the provision of Essix retainers, unless there is a clear indication for Hawley retainers (e.g. hypodontia) since they are cost effective,<sup>1,2</sup> and currently there does not appear to be any reliable evidence to suggest they are less clinically effective than Hawley retainers<sup>1,4</sup>.

## CONCLUSION

It is recommended that all clinicians receive training with regard to impression taking for vacuum formed retainers with particular focus on the SHOs. Highlighting the features of an impression that are required for a vacuum formed retainer should be stressed. The training should be led by a senior clinician. Due to the turnover of SHOs this training should continue to take place on a group basis during the induction period at the beginning of the rotation. The training should allow the SHOs to be critical of their impressions and if they are unsure they should be encouraged to seek advice from a senior colleague. The use of lower trays for upper impressions could be considered for patients with significant gag reflexes. The use of special trays and/or elastomeric impression materials could also be considered for patients with difficult anatomy e.g. marked soft tissue undercuts.

A re-audit should be undertaken in 6 months, once training of staff has been completed. The fit rate standard should be 95% in the new audit.

## ACKNOWLEDGEMENTS

We would like to thank the orthodontic laboratory for their advice and assistance and medical photography for the photographs. In addition we would like to thank Raintree Essix® for providing the background information on the Essix retainer.

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# A SURVEY TO ASSESS PATIENT SATISFACTION WITH ORTHODONTIC TREATMENT

R. Seed, M.R. Walker, J. E. Harrison, C.A. Melrose.

Liverpool University Dental Hospital and Leighton Hospital, Crewe.

## INTRODUCTION

The NHS Plan,<sup>1</sup> published in 2000, outlines a vision of a health service designed around the patient. NHS trusts are now required to collect feedback from service users on a regular and ongoing basis. The information gained from these surveys provides information on patients' perceptions of the health care that they receive which in turn can be used as a measure of patient satisfaction. Additionally, this information can be used to improve both communication and the delivery of orthodontic care.

## AIMS

- To determine the satisfaction of patients, undergoing orthodontic treatment in hospital departments within Mersey Deanery.
- To identify issues which lead to dissatisfaction with the service provided.

## STANDARD

The standard was set at 100% patient satisfaction.<sup>2</sup>

## METHOD

This was a prospective audit comprising of a questionnaire based survey involving patients attending 9 orthodontic departments within the Mersey Deanery. Questionnaires were distributed to 30 consecutive patients undergoing orthodontic treatment or in retention (n=270) in each department and completed anonymously. Three main areas were covered within the questionnaire; welcome received from various staff members within the department, satisfaction of patients undergoing treatment and satisfaction of patients who had completed treatment.

## RESULTS

257 of the 270 questionnaires were returned (95%). 224 (86%) patients were under treatment and 33 (14%) were in retention. The results for individual questions are presented in Tables 1 and 2.

Question	% responding 'excellent/ very good/satisfactory'	% responding 'unsatisfactory/poor'	Audit standard met
Was the welcome you received from the reception staff...	99	1	No
Was the welcome you received from the nursing staff...	100	0	Yes
Was the welcome you received from your orthodontist...	100	0	Yes
How do you feel your treatment is going?	100	0	Yes
What do you think of the result of your treatment?	100	0	Yes

Table 1. Question responses part 1

Question	% responding 'Yes'	% responding 'No'	Audit standard met
Were you satisfied that your orthodontist had been told that you had arrived?	98	2	No
Do you think it was worth having orthodontic treatment?	100	0	Yes
Did you receive any information about what was involved in orthodontic treatment before you had a brace fitted?	100	0	Yes
Did this information adequately prepare you for brace treatment?	97	3	No

Table 2. Question responses part 2

The type of appliance worn by patients undergoing treatment is illustrated in Figure 1.

The 100% standard was not met in 3 areas: welcome received from reception staff, orthodontist told that patient had arrived, and pre-treatment information preparing the patient for the treatment they had received.

The mean satisfaction scores were compared for all of the orthodontic units involved. No statistically significant differences were found between the units.

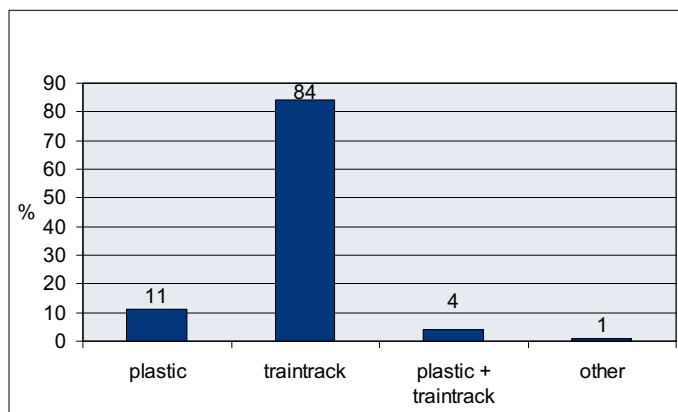


Figure 1. Type of appliance patient wearing (%)

## DISCUSSION

The results of this audit indicate that the patients surveyed were generally satisfied with the orthodontic service provided. The sample however, represents only a small proportion of those currently under treatment in the region. The high level of satisfaction is perhaps a reflection of the rapport built up between patients, parents and the orthodontic team over an extended period of time.

The audit standard was not met in three areas. Two of these reflected a deficiency in communication either from or between members of the orthodontic team but single patient responses were responsible for these results. The other area where the standard was met was related to a perceived shortfall in the information provided prior to the start of orthodontic treatment. Again, a single response was involved.

This is the first time that patient satisfaction with orthodon-

tic treatment has been audited in the region and the results are encouraging. It is essential that this high level of care is maintained and that all members of the orthodontic team strive to make sure that the service provided meets patient's expectations. Additionally, clinicians should ensure patients receive a clear, comprehensive explanation of the treatment process and what to expect along the treatment journey.

## **CONCLUSIONS**

- The level of patient satisfaction with the orthodontic service provided in hospital departments within the Mersey Deanery was high.
- No specific issues were identified as predictors of patient dissatisfaction.

## **ACKNOWLEDGEMENTS**

Many thanks to all the consultants and registrars in the Mersey Deanery who helped in disseminating and collecting the questionnaires. Additionally, we would like to thank Mrs. S. Pender for her help with data entry.

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## COMMON ALLERGIC REACTIONS AND ORTHODONTICS A LITERATURE REVIEW

*Dina Slater, FTTA Newcastle upon Tyne and Middlesbrough*

Keywords: Allergic reactions, orthodontic materials

### INTRODUCTION

There is increasing concern regarding the biocompatibility of dental materials as allergic reactions are becoming more prevalent. This may be due to a true increase in adverse reactions or an increase in awareness. Adverse reactions have been more commonly documented in the general dental literature; however their consideration is important in orthodontics in view of the increasing products and materials available.

### LITERATURE SEARCH STRATEGY

This focussed on publications between 1996-2006 using Medline, Embase and the Cochrane library (2006, issue 3). Both free text and MeSH headings were used such as: allergy, orthodontics, dentistry, latex, nickel, acrylic. The articles identified were limited to those published in English and on humans. Relevant articles and their references were studied.

### REPORTED ADVERSE REACTIONS

A report of adverse reactions in the UK was published by the Adverse Reactions Reporting Project (ARRP). The results suggested that 1.7 adverse reactions occurred per 100 patients annually, of which 12% required emergency treatment<sup>1</sup>. Similar projects in Norway estimated a figure of 3.4 adverse reactions, twice the UK figure despite a much smaller population<sup>2</sup>. These differences may be due to a longer established reporting system in Norway and variation in what is considered an adverse reaction. However, more probable reasons may be the greater tendency of under-reporting in the UK (3.1% response rate) and a lack of awareness of the ARRP. Nevertheless, this systematic monitoring system has been able to provide the first evidence base of adverse reactions to dental materials in General Dental Practice in the UK. The British Orthodontic Society has a Yellow Card Reporting Scheme<sup>3</sup>. This comprehensive report form encourages any systemic, extra oral or intra oral reaction to be reported.

Reported reactions in the literature include: irritant contact dermatitis (ICD), allergic contact dermatitis (ACD) and immediate allergic reactions (Type I hypersensitivity)<sup>4,5</sup>. A survey of Norwegian orthodontists highlighted that intra oral reactions were most often associated with metal components of fixed appliances, monomers, latex gloves and elastics. Extra oral reactions were associated with latex, intra oral appliances and commonly with extra oral appliances with direct skin contact, such as facebows<sup>2</sup>.

### MATERIALS COMMONLY ASSOCIATED WITH ALLERGIC REACTIONS

1. Latex. In 1987 the adoption of universal precautions resulted in the use of gloves for all aspects of patient care<sup>6</sup>. This increased use of latex has been accompanied by an increase in associated adverse reactions primarily affecting clinicians but also patients. The true prevalence of latex sensitivity remains unknown<sup>1</sup>. Safadi et al<sup>7</sup> investigated latex hypersensitivity in dental professionals using questionnaires and skin prick

testing. 12% showed an immediate allergy to latex based on a sample of only 34 subjects. A larger questionnaire study of 1584 healthcare workers, reported that 295 respondents reacted to latex gloves. These subjects agreed to skin prick, patch and glove use tests and RAST (radioallergosorbent test)<sup>8</sup>. 9% had a positive skin prick test to latex glove extract and 10.5% had positive patch tests to accelerators found in latex. Over 90% of reactions were contact dermatitis. Residual protein, ammonia and antioxidant preservatives in latex gloves have also been implicated in allergic reactions<sup>4</sup>. Type I hypersensitivity can result following exposure of latex-sensitised patients to latex gloves. A questionnaire study of 121 Norwegian orthodontists indicated that 2 patients out of 41,000 seen in 2 years developed a type I immediate allergic reaction to latex gloves<sup>2</sup>. Latex exposure to non-intact mucosa can lead more readily to urticaria and anaphylactic reactions. Latex is the commonest cause of anaphylaxis after food, drugs and insect bites<sup>4,8</sup>.

2. Acrylic Monomers. These are found in base plates, bonding materials, composites and glass ionomers. There is very little literature other than case reports regarding their adverse effects. ACD from methacrylates is a well reported reaction affecting clinicians, patients and is the primary source of adverse reactions in technicians<sup>1</sup>. A multicentre retrospective patch test study to dental allergens revealed that 2.8% of 2446 patients tested were allergic to 2-hydroxyethyl methacrylate which seemed to be the best screening substance for methacrylate allergies<sup>9</sup>. Cross reaction between acrylates and methacrylates can result in persistent adverse reactions<sup>10</sup>.

3. Metals. Nickel, chromium and cobalt are known allergens, of which nickel is the most common<sup>9</sup>. In orthodontics nickel is the primary cause of ACD with intra and extra oral reactions reported. It is found in many materials including brackets, bands, archwires and facebows. The amount of nickel in these appliances ranges from 8% in stainless steel to more than 50% in superelastic wires. A patch test study of 700 adolescents revealed nickel hypersensitivity in 19% which was significantly greater in females (30%) than males (3%). This higher incidence in females may be due to ear piercing, however, orthodontic treatment prior to ear piercing was found to reduce hypersensitivity<sup>11</sup>. Evidence regarding nickel sensitisation due to orthodontics is weak and based on small sample sizes<sup>12</sup>. Larger patch test studies<sup>11,13,14</sup> suggest that appliances do not sensitise patients to nickel. A controlled clinical trial evaluated hypersensitivity to 8 metals used in appliances before and 2 months after bond up, no significant difference in sensitivity pre and post bond up was found<sup>14</sup>. A RCT of orally administered nickel in 30 nickel sensitive females suggested that oral exposure to nickel may lead to systemic ACD in a dose-dependent fashion<sup>15</sup>. Intra oral allergic reactions are related to corrosion resulting in nickel ion release. An in vitro study of epoxy-coated nickel-titanium archwires showed significant corrosive resistance; the clinical effect of loss of the coating was not tested<sup>16</sup>. A study investigating nickel levels of fixed appliances in saliva and serum concluded that measurable amounts were released with values similar to those in healthy individuals<sup>17</sup>.

## MANAGEMENT

A complete medical history and clinical examination are essential noting known allergies, atopy, history of multiple surgery and occupation<sup>8</sup>. Patients with suspicion of symptoms related to a dental allergen may be referred to a dermatologist for further investigation involving patch tests, skin puncture tests and RAST. Adverse reactions should be reported to the ARR<sup>1</sup> as well as the BOS adverse reaction yellow card reporting scheme<sup>3</sup>. Latex-containing orthodontic products include gloves and elastics. Latex allergic patients should be the first patient of the day utilising latex free products such as vinyl, neoprene or polyurethane gloves, non latex elastics and avoiding cross contamination<sup>4</sup>. With regards to monomers, manufacturers are not legally obliged to list the components of acrylates, making the identification and avoidance of allergens difficult due to cross reactivity<sup>5</sup>. The evidence suggests that stainless steel brackets, wires and auxiliaries are safe to use in nickel hypersensitive patients. These patients should be informed of the potential risks of high content nickel-titanium archwires and offered alternatives such as twistflex, TMA or titanium wires<sup>16</sup>.

## CONCLUSIONS

Orthodontic treatment is generally uneventful considering the increasing variety of base metal alloys, light or chemically cured acrylates and natural latex used which all contain known allergens. However, adverse reactions do occur and the identification of potential allergens and recognition of the signs and symptoms of possible adverse reactions is important as these materials can be an occupational health hazard for staff and potentially life threatening for patients.

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# SENSORY NERVE ALTERATION OF THE INFERIOR ALVEOLAR NERVE FOLLOWING BILATERAL SAGITTAL SPLIT OSTEOTOMY - A LITERATURE REVIEW

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Keywords: Orthognathic surgery, sensory nerve alteration

## INTRODUCTION

Orthognathic mandibular surgery can damage the inferior alveolar nerve. This may result in temporary or permanent anaesthesia, paraesthesia or dysaesthesia of the lower lip, chin, teeth and gingivae. The aim of this review is to identify the likelihood of, and possible risk factors for this complication, and so improve patient consent.

## OBJECTIVE

To evaluate the incidence of sensory nerve alteration (SNA) of the inferior alveolar nerve following advancement or setback bilateral sagittal split osteotomy (BSSO) and identify possible risk factors.

## METHODS OF REVIEW

### SEARCH STRATEGY:

Electronic searching was carried out using Embase and Pubmed. Search terms were paraesthesia, anaesthesia, sensory nerve alteration, inferior alveolar nerve, bilateral sagittal split osteotomy and orthognathic surgery. In addition, major orthodontic and maxillofacial journals were hand searched since 1980.

### Search criteria:

All clinical studies reporting objective or subjective assessment of altered nerve sensation of the inferior alveolar nerve following advancement or setback BSSO.

### Description of Studies and Quality of Papers

The search yielded 34 studies, of which 21 were excluded for the following reasons: additional surgical procedures were included,<sup>1-12</sup> a different surgical procedure was being assessed,<sup>13</sup> study was not assessing the topic,<sup>14-17</sup> small sample size,<sup>18-20</sup> short follow up time.<sup>21</sup> Of the 13 included studies, 2 were prospective<sup>22-23</sup> and 11 were retrospective.<sup>24-34</sup> None of these studies had sample size calculations. Comparison between studies was difficult and unreliable due to the different number of surgeons involved and level of experience, type of fixation, follow up interval and the method of testing. Testing was undertaken objectively by the examiner, or subjectively by patient assessment. Some research showed that patients over-report alterations in sensation<sup>27</sup> whereas others found them to under-report.<sup>24</sup> Objective testing methods included light touch sensation, brush stroke determination, two point discrimination, thermal testing and somatosensory evoked potentials (SEPs). SEPs were reported to be sensitive to changes in nerve function which may not have been apparent clinically, and so may be more informative than testing by standard means.<sup>3, 25, 29</sup>

## RESULTS

A summary of the results is presented in table 1. Two studies presented the same data.<sup>31,32</sup> Most subjective methods of testing reported SNA at six months. The percentage of patients with SNA at this time varied from 10%<sup>33</sup> to 34%.<sup>27</sup> Objective testing was generally reported at a later stage. At one year, the percentage of patients with SNA varied from 0%<sup>25</sup> to 41%.<sup>23</sup> Jones<sup>25</sup> reported no alteration in sensation at one year. However this study specifically looked at methods of assessment of SNA. Data were recorded by reporting the percentage of responses within 10% of baseline levels, so the true SNA may be higher than reported. Work by Martis<sup>28</sup> reported a 4%

alteration in sensation in a large sample size. However this was a retrospective study, without specified selection criteria, and the method of fixation was archbars and Gunning splints, which are no longer routine practice. Therefore, the results of this study should be viewed with caution.

Teerijoki<sup>23</sup> describes the best source of evidence using objective testing. This was a prospective study, with specified selection criteria, and a standardised procedure. The reported incidence of SNA was 35-41%, dependent on the BSSO side. However, there were still problems with this study. It did not mention the total number of operators involved, the sample size was small, and the method of fixation was bicortical screws, again, not accepted current practice. In addition, a mixture of objective tests were used, including nerve conduction studies, a complicated procedure, not in routine use.

Some studies<sup>24, 26, 27, 31, 32</sup> combined the results of objective and subjective testing to produce their final results, leading to confusion in evaluation and loss of possible useful data. The studies by Westermark<sup>32,33</sup> are typical of these. They provide some of the largest sample sizes, and give results of 39-41% at two years. However, the usefulness of the data is reduced by merging testing methods.

The following risk factors have been suggested from the data:

### Age

An increased incidence of SNA was reported in patients over thirty years of age.<sup>32, 33</sup>

### Degree of nerve manipulation

A high correlation between the degree of nerve manipulation and the degree of SNA has been reported.<sup>32,33</sup> Westermark<sup>32</sup> reported 33% of cases had some degree of sensory alteration when the nerve was not visualised during surgery. In comparison, where nerve dissection was necessary, 52% of cases showed SNA. Ylikontiola<sup>33</sup> reported greater SNA up to one year after surgery in patients where dissection of the nerve was required compared with when the nerve was not encountered.

### Size of movement

Large mandibular advancements over 7mm have been shown to increase the degree of sensory nerve alteration.<sup>33</sup>

**Biodegradable plates** did not appear to greatly change the risk of altered sensation.<sup>26</sup>

Article ref number	No. pts in study	Testing O= Objective S= Subjective	Percentage nerve alteration		
			6 months	1 year	Other time
22	222	S	25		21 ( 2 yrs)
23	20	O and S		35 -41 (O) 35- 40(S)	
24	19	O and S			S =26 O =66 (2yrs)
25	40	O	10	0	
26	40	O and S		34	
27	25	O and S	34 (S) 8 (O)		
28	258	O		4	
29	20	O		15-35	
30	70	Not mentioned			47 ( 2 yrs)
31/32	274	O and S			39-41 (2 yrs)
33	30	S	10	0	
34	23	O and S	17		15 (1½ yrs)

Table 1. Summary of results

## CONCLUSIONS AND IMPLICATIONS FOR CLINICAL PRACTICE

The reported incidence of sensory nerve alteration ranged from 10-34% (measured subjectively at 6 months) to 0-41% (measured objectively at 12 months).

Factors reported to affect the likelihood of sensory nerve alteration included age, degree of nerve manipulation and size of movement.

Overall, this review highlights the need for further research in this area of a higher and more consistent standard. This would require studies to be designed with sample size calculations, specified inclusion criteria and standardised, objective testing methods.

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e.g.<sup>1</sup>  
1. *Smith J, Brown A (2005) Results of superb treatment. J Orthodont Surg 59: 103-6*

