

# A national survey of oral and maxillofacial surgeons' attitudes towards the treatment and dental rehabilitation of oral cancer patients

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## IN BRIEF

- There has been an increase in the number of oral and maxillofacial surgeons using implants for rehabilitation.
- There has been an increase in the number of microvascular tissue grafts used to reconstruct maxillectomy defects over the last 15 years.
- The involvement of a consultant in restorative dentistry in the multidisciplinary cancer team is still limited at 30%.

**Aims** To investigate the attitudes of maxillofacial surgeons in the treatment and dental rehabilitation of oral cancer patients in the UK. **Material and methods** The survey was conducted by postal questionnaires with 17 close-ended questions. A total of 229 questionnaires were sent to members of the British Association of Oral and Maxillofacial Surgeons over a one week period. A follow-up was sent if a reply was not received within 12 weeks. These results were compared to a similar study that was carried out approximately 15 years ago. **Results** The response rate was 65.5% (150/229). Overall 62% of respondents (92/150) carried out maxillary resections, which represents a decline of 23% on the previous study. There has been an increase in surgeons reconstructing the maxillary defect from 38% in the 1995 study to 91% in the present study. Ninety-eight percent of respondents had their patients seen in a multidisciplinary team (MDT) clinic, but in only 30% of the cases was a restorative dentist present on these clinics. There has been an improvement in the accessibility of a restorative dentist for this patient cohort, from 65% to 90%. The use of implants for dental rehabilitation post-cancer surgery has increased from 43% to 93%. **Conclusion** This study highlights the changes in the dental and oral rehabilitation of patients undergoing resective surgery for oral cancer and especially those undergoing a maxillectomy procedure. It illustrates the increased use of implants for post-surgery rehabilitation and shows the different trends in which these implants are placed. An important aspect of this study is the input of the dental team. Current national guidelines state that a consultant restorative dentist needs to be a member of the MDT; this survey shows that this was the case in only 30% of responses.

## INTRODUCTION

The resection of malignant tumours from the palate and maxillary sinus can result in acquired palatal defects. The extent of the defect is dependent on the size, location and behaviour of the tumour.<sup>1</sup> Post-resection management of the defect can be either primary surgical closure or prosthetic rehabilitation with an obturator. The decision in choosing one of these two treatment modalities is multi-

factorial and requires a multidisciplinary team approach.<sup>2-4</sup>

The relative advantages and disadvantages of one treatment modality over the other have been discussed.<sup>5</sup> The main advantages of reconstruction include an immediate closure of the defect with minimal post-operative supervision and the avoidance of nasal reflux that may result from a poorly fitting obturator.<sup>6</sup> Disadvantages of reconstruction include the difficulty in fabricating a retentive prosthesis over the reconstruction and the difficulties in detecting a tumour recurrence in the resected area.<sup>6</sup> In contrast, the relative advantages of an obturating prosthesis include the ability to examine the resected site by direct vision, the provision of appropriate lip and cheek support and superior prosthesis retention when utilizing the defect undercuts. However, obturators may need frequent adjustments or in many cases, the need for a new obturator

soon after initial surgery.<sup>6</sup> On a psychological level the residual defect may be an uncomfortable reminder of the cancer.<sup>7</sup>

There have been numerous studies measuring the quality of life outcomes of these two treatment modalities. One study found that a well functioning obturator significantly contributed to quality of life post-maxillectomy.<sup>8</sup> This is in contrast to a later study which found that patients with palatomaxillary reconstruction had superior quality of life in comparison to those prosthetically rehabilitated.<sup>9</sup> A more recent study found that between the two treatments, no statistically significant difference in quality of life was found.<sup>10</sup> There seems to be a lack of consensus on how best to rehabilitate this patient cohort.

The need to assess and treat head and neck cancer patients in conjunction with a multidisciplinary team (MDT) has long been cited by Ali *et al.*<sup>6</sup> This national survey of maxillofacial surgeons revealed

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that only 65% had access to a restorative dentist. Interestingly, access to a restorative dentist influenced a maxillofacial surgeon's decision on whether to surgically reconstruct or obturate patients undergoing a maxillectomy procedure.<sup>6</sup> Since this study there have been numerous national clinical guidelines that outline the need for a restorative dentist to be part of multidisciplinary teams in the management of patients with head and neck cancer.<sup>11,12</sup>

Osseointegrated implants are now a routine consideration when restoring complete and partially edentulous patients.<sup>13–15</sup> Their use in prosthetically rehabilitating maxillectomy patients is well established.<sup>16–18</sup> National clinical guidelines have identified those patients undergoing major jaw resection as a priority group for the provision of implants both for intra-oral and extra-oral prostheses.<sup>19</sup> Irrespective of whether the placement of implants for dental rehabilitation in these cases is performed by the restorative dentist or the maxillofacial surgeon, the need for thorough case evaluation and detailed treatment planning is paramount.<sup>4</sup>

When the extent of resection is such that the residual alveolus is insufficient to provide adequate bone for dental implant placement, the use of zygomatic implants can be considered.<sup>20,21</sup> The original technique was first described by Brånemark in 1998, who published a follow-up over 10 years of 164 implants anchored in zygomatic bone with a success rate of 97%.<sup>22</sup> Of note, the patient cohort that was examined in this study did not include oncology patients. Zygomatic implants are considered advantageous in providing an alternative to bone augmentation procedures and so potentially these patients may be fitted with a prosthesis sooner.<sup>23</sup> A notable disadvantage is that patients with zygomatic implants may be at a higher risk of infections that could result in chronic sinusitis. When this occurs it may be necessary to surgically restore ventilation to the sinuses.<sup>24</sup> A recent systematic review could not identify any suitable studies comparing zygomatic implants and conventional dental implants in augmented bone for severely resorbed maxillae.<sup>25</sup>

In oncology patients who require dental implants, hyperbaric oxygen (HBO) has been advocated by some authors as a prophylactic measure to prevent osteoradionecrosis

and improve osseointegration of dental implants.<sup>26</sup> HBO treatment involves the delivery of 100% oxygen at high pressure.<sup>27</sup> It is generally felt that there is a need for better quality of evidence to truly evaluate the benefit of HBO.<sup>28,29</sup> One randomised trial compared HBO and penicillin in the prevention of osteoradionecrosis (ORN) after dental extractions. The results showed that HBO was more beneficial, with the incidence of ORN in the HBO group markedly less (5.4%) in comparison to the antibiotic group (29.9%).<sup>30</sup> However, more recent studies have questioned HBO's benefit. In a randomised double-blind trial of patients with ORN treated with either HBO or a placebo, no benefit was seen in the group undergoing hyperbaric oxygenation.<sup>31</sup> Further to this, oral implant rehabilitation of irradiated patients has been shown to be successful without adjunctive hyperbaric oxygen.<sup>32</sup>

## METHODS

In light of the different options in the treatment of these patients, a questionnaire survey was designed to assess the current practices of consultants in oral and maxillofacial surgery in the UK for patients requiring a maxillectomy procedure (Appendix 1). The main aim was to evaluate the changes in attitudes to the treatment of these patients since this was last charted in a previous study.<sup>6</sup> In the time that has elapsed since this study there have been numerous clinical guidelines published to outline optimum strategies in the treatment of this patient cohort.<sup>11,12,33</sup> By repeating the survey, the effect of these publications and guidelines can be estimated.

Names were taken from the list of Fellows of the British Association of Oral and Maxillofacial Surgeons and the questionnaires circulated over a one-week period. A follow-up was sent if no reply was received within 12 weeks.

## RESULTS

A total of 229 questionnaires were sent and 150 were returned, a response rate of 65.5%. Of the 150 questionnaires returned, 61% (92) of respondents carried out maxillary resections (Table 1). This represents a drop of approximately 20% from the previous study<sup>6</sup> in which over 80% of respondents performed maxillectomies (Fig. 1).

The majority of respondents treated between one and five cases a year (55%), with approximately one third treating between six and ten (33%) and the remaining more than ten cases (11%). In the previous study 77% treated between one and five cases and 19% of respondents performed between six and ten cases (Table 1, Fig. 2).<sup>6</sup>

Respondents who consistently reconstructed the defect (24%) were considerably greater in number than those who did not (8.6%), with the vast majority performing reconstruction sometimes (67%). In comparison to the previous study, there has been a marked increase in the number of individuals undertaking surgical reconstruction: a rise from 38% to 91% (Table 1, Fig. 3).<sup>6</sup> Further evidence for this is illustrated by the finding that 65% of respondents reconstructed the defect in 50% of cases (Table 1, Fig. 4) while in the previous study, 40% were reconstructing defects in only 10% of cases.<sup>6</sup>

The most popular type of flap for reconstruction was based on the deep circumflex iliac artery (39%). This was followed by radial forearm flap (28%) and then temporalis (16%). In comparison to the previous study there has been a marked change in the category of flaps used for reconstruction.<sup>6</sup> The results show that a greater number of respondents are now favouring microvascular flaps (80%) whereas in the previous study rotational flap reconstruction was more popular (64%) (Table 1, Figs 5 and 6).<sup>5</sup>

Responses to the question on specialties other than maxillofacial surgery performing maxillectomies showed that 27% of respondents had colleagues in ENT performing this procedure in their trusts, with none from plastic surgery or general surgery (Table 1, Fig. 7).

Responses also showed that while the vast majority (97%) of respondents had their patients seen by dedicated multidisciplinary teams, the composition of clinicians on these teams was varied (Table 1, Fig. 8). The vast majority of teams had consultants from ENT (99%), radiology (91%), oncology (97%) and pathology (84%). Other members who commonly attended the MDT were head and neck specialist nurses (93%) speech and language therapists (92%) and dieticians (84%). In contrast, consultants from restorative

Table1 Responses to the study questionnaire						
	Yes			No		
Do you carry out maxillary resections?	61.3% (92/150)			38.7% (58/150)		
	Between 1–5		Between 6–10		Over 10	
How many cases do you treat a year?	55.4% (51/92)		32.6% (30/92)		11.9% (11/92)	
	Yes		Sometimes		Never	
Do you carry out surgical reconstruction of the maxillary defect?	23.9% (22/92)		67.3% (62/92)		8.6% (8/92)	
	0–25%	25–50%		50–75%	75–100%	
What percentage of cases are surgically reconstructed?	35.8% (33/92)	29.3% (27/92)		18.4% (17/92)	16.3% (15/92)	
	Radial forearm graft	Temporalis	Deep circumflex iliac artery	Scapula	Fibula	Others
What type of flap do you use to reconstruct the surgical defect?	28% (26/92)	16% (15/92)	39% (36/92)	9% (8/92)	4% (4/92)	4% (3/92)
	No		ENT	Plastics		General surgery
Do consultants in specialities other than maxillofacial surgery perform maxillectomies regularly in your Trust?	73% (71/97)		26.8% (26/97)	0% (0/97)		0% (0/97)
	Yes		No		Sometimes	
Are all your oncology patients seen on a multidisciplinary team clinic?	97.8% (90/92)		2.2% (2/92)		0% (0/92)	
	Yes, always		Yes, sometimes		No, never	
Do you have access to the services of a restorative dentist to assist with prosthetic rehabilitation?	73.9% (68/92)		16.3% (15/92)		9.7% (9/92)	
	Consultant restorative dentist	Associate specialist	Staff grade	Clinical assistant	SHO	Other
If yes, what grade of dentist do you have in your team?	73% (60/83)	11% (9/83)	8% (7/83)	5% (4/83)	2% (2/83)	1% (1/83)
	Yes, always		Yes, sometimes		No, never	
Following surgical reconstruction, are the patients dentally rehabilitated?	32.6% (30/92)		64.1% (59/92)		3.2% (3/92)	
	Yes, always		Yes, sometimes		No, never	
Do you use dental implants to reconstruct patients' dentition?	1% (1/92)		92.3% (85/92)		6.5% (6/92)	
	Nobel Biocare	Astra	3i	Straumann	Others	
What design of dental implants do you routinely use for prosthetic reconstruction?	50% (45/92)	16% (15/92)	4% (4/92)	26% (24/92)	4% (4/92)	
	Maxillofacial surgeon		Restorative dentist		Depends	Not applicable
Are the implants placed by the surgeon or the restorative dentist?	70% (64/92)		16% (15/92)		24% (12/92)	
	Yes, always		Yes, sometimes		No	
Are dental implants placed at the time of primary surgery?	1% (1/92)		32.6% (30/92)		66.3% (61/92)	
	Yes			No		
Do you use zygomatic implants for maxillary prosthetic reconstruction?	29% (27/92)			70.6% (65/92)		
	Yes			No		
Do you have access to hyperbaric oxygen therapy (HBO) for patients with osteoradionecrosis or requiring dental implants?	90% (83/92)			9.7% (9/92)		
	Yes			No		
Do you routinely use HBO for patients who have undergone radiotherapy who are scheduled for dental implants?	51% (47/92)			49% (45/92)		

dentistry (32%), palliative care (41%) and dental hygienists (23%) were less common (Fig. 9).

Nearly three quarters of respondents had access to a restorative dentist (74%) with considerably less having access sometimes (16%) and never (9%) (Table 1). In total 90% had access to a restorative dentist, which has increased from 65% in the previous study (Fig. 10).<sup>6</sup> When access to a restorative dentist was available the grade of the clinician varied. The majority were consultants (73%), with associate specialists (11%) staff grades (8%), clinical assistants (5%) and senior house officers (2%) comprising the group of other dental professionals inputting into the planning process (Table 1, Fig. 11). Following reconstruction, the responses on dental rehabilitation post-surgery varied. Thirty-three percent indicated that patients always underwent dental rehabilitation and 64% indicated this sometimes occurred, while the proportion indicating patients were never rehabilitated was small (3%) (Table 1, Fig. 12).

The use of implants in dental rehabilitation was performed always by 1% of respondents and sometimes by 92%, with the remaining 6.5% not using implants for this purpose (Table 1, Fig. 13). This is a marked increase on the previous study where 43% of respondents were using implants for rehabilitation. The types of implants used included Nobel Biocare (Zurich, Switzerland) (50%) and Straumann (Basel, Switzerland) (26%) (Table 1, Fig. 14). The different types of implants used have changed from the previous study. Previously 30% of respondents were using 'Bonelit' implants (product line of Straumann implants in 1995) and 39% were using 'Brånemark' implants (Nobel Biocare Implants) (Fig. 15). Astra Tech implants (Mölnådal, Sweden) have also increased in their usage from 12% to 16% and there has been an emergence of newer implant systems such as Biomet 3i (Palm Beach Gardens, Florida), with 3% of respondents using this implant system in this study and no significant recordings in 1995.

The placement of the implants for the purpose of oral rehabilitation was most commonly performed by the maxillo-facial surgeon (70%) or the restorative dentist (16%) and in 24% of responses

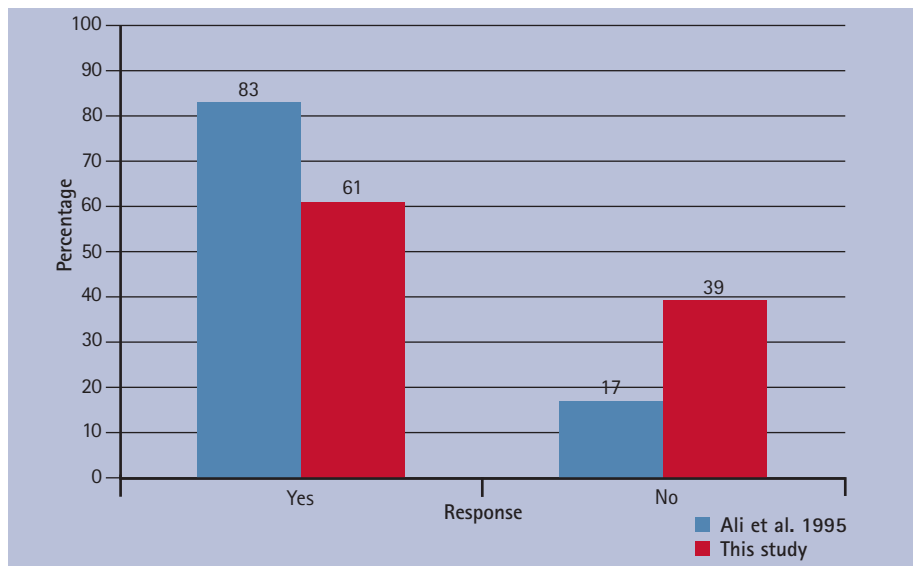


Fig. 1 The percentage of respondents carrying out maxillary resections. Comparison between the present study and a previous study<sup>6</sup>

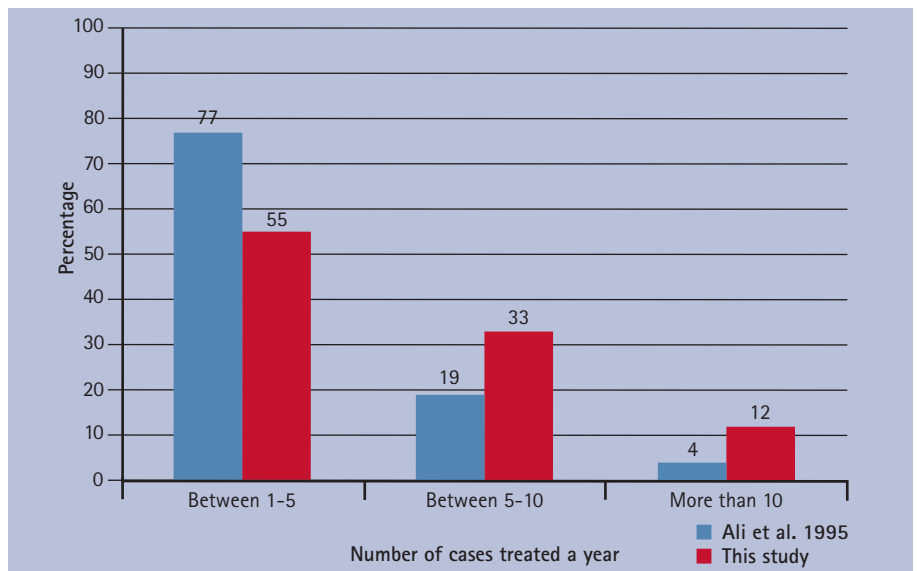


Fig. 2 Number of cases treated a year in the previous study<sup>6</sup> and the present study

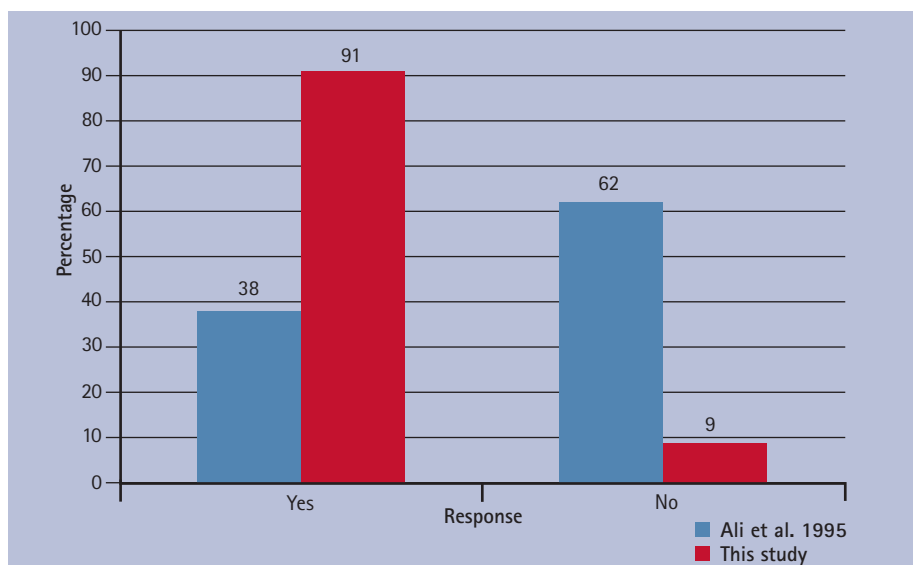


Fig. 3 Respondents carrying out surgical reconstruction of the defect in the previous study<sup>6</sup> and the present study

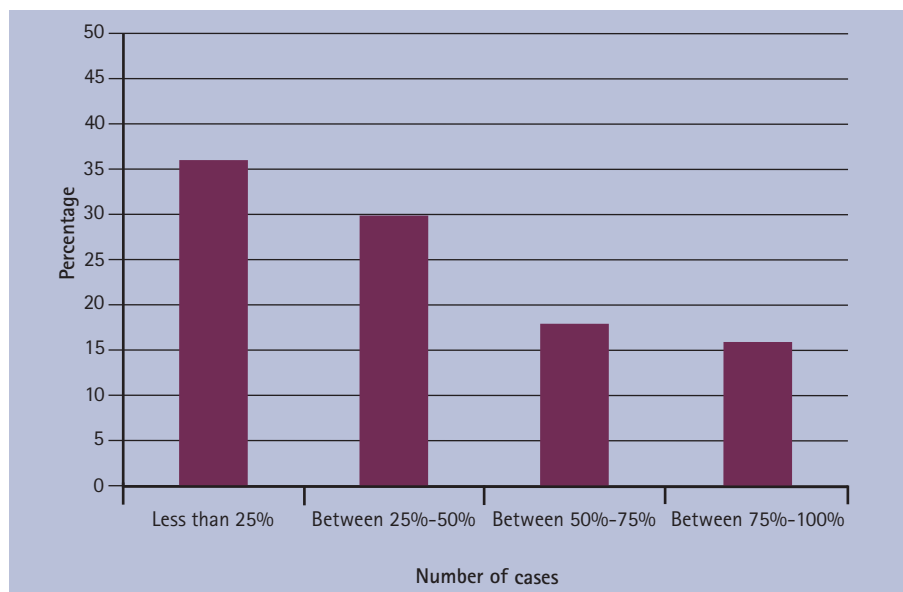


Fig. 4 Column graph of surgical reconstruction

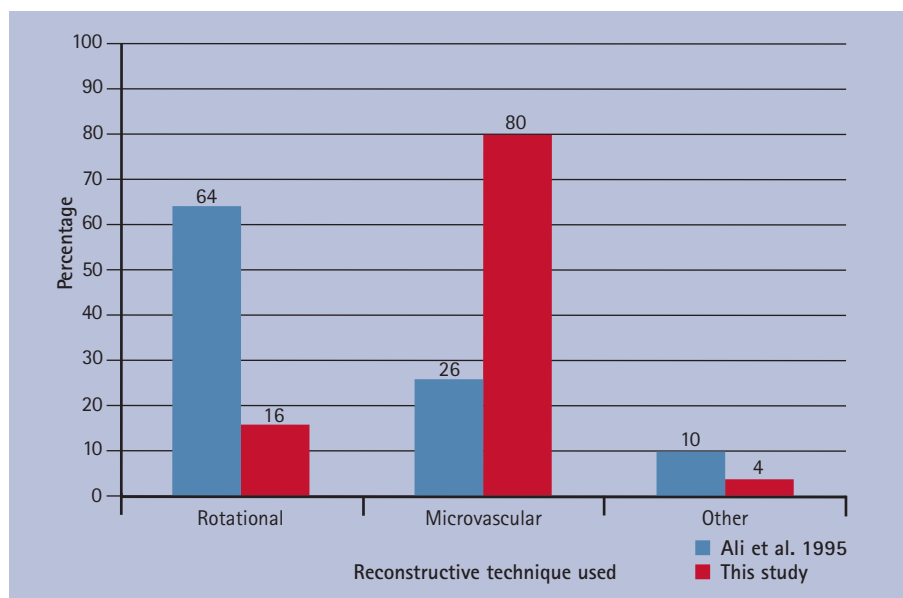


Fig. 6 Column graph comparing the differences in categories of flap designs (rotational, microvascular or other) between the previous study<sup>6</sup> and the present study

the decision depended on the type of case (Table 1, Fig. 16). Implant placement at time of ablative surgery occurred sometimes in 33% of responses and not at all in 66%, with 1% performing this always (Table 1, Fig. 17). Twenty-nine percent of respondents placed zygomatic implants for maxillary prosthetic reconstruction, while the majority (71%) did not (Table 1, Fig. 18).

Access to hyperbaric oxygen was available to 90% of respondents (Table 1, Fig. 19). Fifty-one percent routinely used this for patients undergoing radiotherapy and requiring implants (Table 1, Fig. 20).

## DISCUSSION

The decision to either surgically or prosthodontically rehabilitate a maxillary defect seems to be dependent on numerous factors, including the surgeons own preference.<sup>6</sup> The present study illustrates the changes in the provision of treatment for this patient cohort since a previous study first charted how these cases were managed in the UK.<sup>6</sup> The previous study showed that 20% more surgeons were doing maxillary tumour resections than the present study.<sup>6</sup> The number of surgeons treating less than five cases has dropped from 77% to 55%.<sup>6</sup> This coincided with an increase in surgeons doing more than ten cases

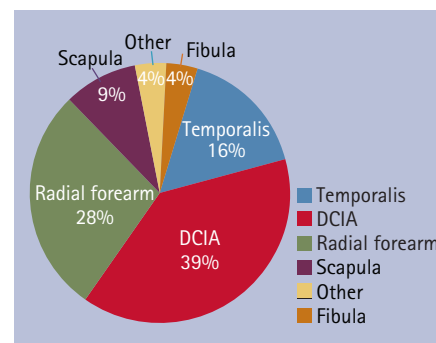


Fig. 5 Pie chart representing the choice of flaps chosen by the respondents for surgical reconstruction

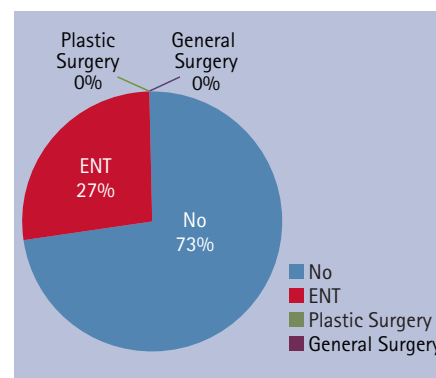


Fig. 7 A pie chart representing the proportions of other specialties performing maxillectomies

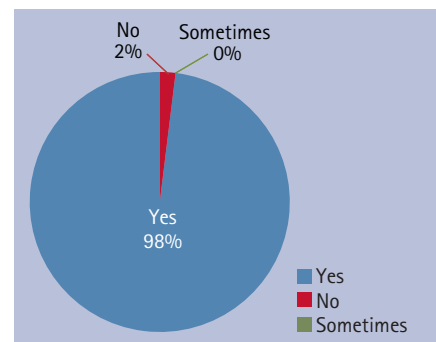


Fig. 8 Pie chart representing access to multidisciplinary clinics

a year, from 30% to 11%.<sup>6</sup> These results may signify the development of niche skills by individuals within the specialty, with the development of surgeons whose work is primarily dedicated to a cancer multidisciplinary team.

This concept is supported by 98% of respondents working in such a team (Fig. 8). This high percentage is probably a reflection of the Calman and Hine report<sup>33</sup> and the more recent SIGN and NICE guidelines identifying the need for MDTs in the management of head and neck cancer.<sup>11,12</sup> More specifically these guidelines outline the need for a restorative dentistry consultant to be part of the MDT. Our results

show that there has been an increase in respondents' access to restorative dentists from 65%<sup>6</sup> rising to 90% in the present study, although the grade of clinician varied from senior house officers to consultant (Fig. 11). In spite of this improvement, the perceived ideal of a fully integrated consultant in restorative dentistry present on the multidisciplinary team was recorded in only 30% of responses.

In the present study 24% of respondents always carried out surgical reconstruction of the defect, with the majority carrying out reconstruction 'sometimes' (67%). This is in contrast to the previous study where 38% of cases were reconstructed. These observations could signify a paradigm shift in the management of patients requiring maxillary resection. A recent retrospective study of maxillary reconstructions between 1992 and 2001 showed that 84% of cases were reconstructed surgically with 16% being rehabilitated with an obturator prosthesis.<sup>34</sup> The increased popularity of microsurgical techniques and the increased use of implants for prosthetic rehabilitation in post-surgical reconstruction could coincide with a decrease in the need for traditional prosthetic obturator provision.<sup>34,35</sup>

Of the flaps used to reconstruct maxillary defects, the temporalis flap was the most common (53%) in the 1995 study, while in the present study this has dropped to 19%. This has coincided with a marked increase in the use of microvascular techniques (from 26% to 80%) and a decrease in rotational flaps (from 64% to 16%) in post-resective surgical reconstruction (Fig. 6). This large variation in techniques could reflect the different extent of maxillary resections, with certain techniques being only suitable for smaller defects.<sup>1</sup>

The use of implants in the reconstructive phase of treatment was undertaken by over 90% of the respondents, in comparison to the previous study where there were 43%. The increase in implant usage for rehabilitation is probably due to the increased availability and training in implant provision for maxillofacial surgery and restorative dentistry trainees and the increased involvement of restorative dentists in the MDT. Other factors include guidelines identifying patients with major jaw resections as priority groups for implant rehabilitation.<sup>19,36,37</sup> Previous studies have

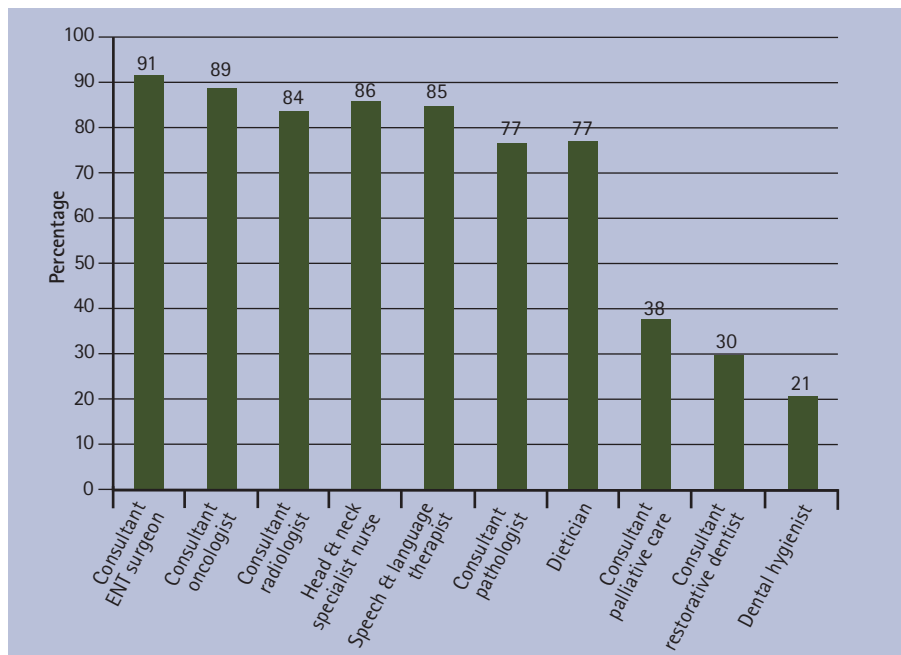


Fig. 9 Graph representing the professional composition of multidisciplinary teams

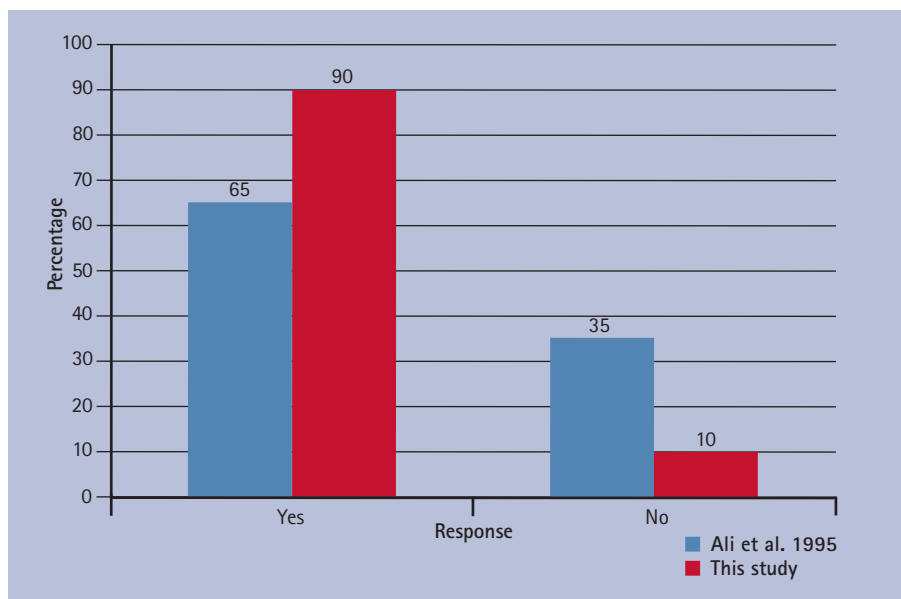


Fig. 10 Graph representing access to a restorative dentist for the purpose of oral rehabilitation

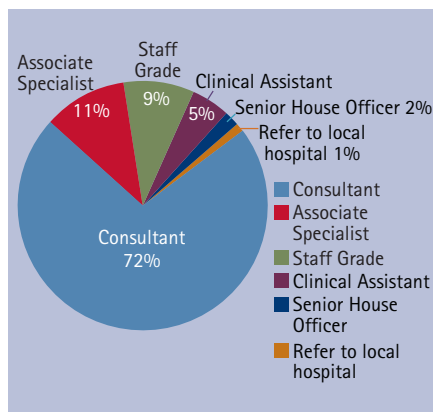


Fig. 11 Pie chart representing proportions of restorative dentist grades

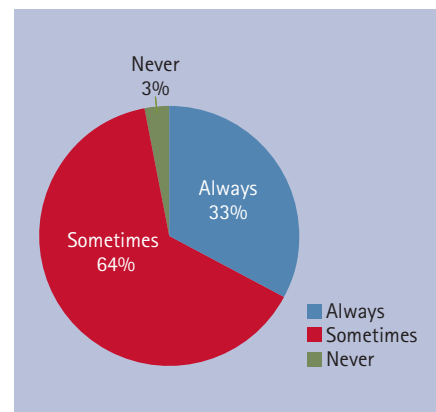


Fig. 12 Pie chart representing responses on the dental rehabilitation of patients

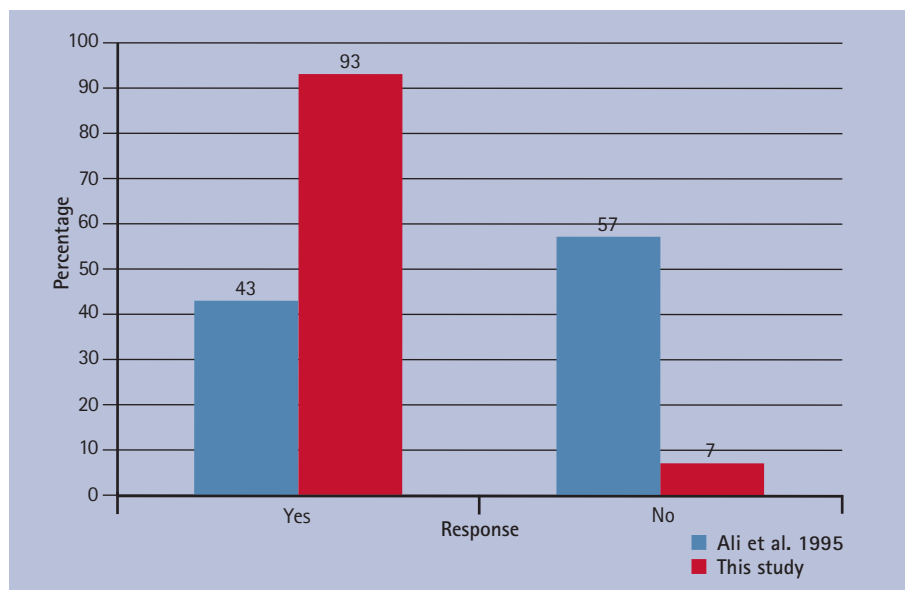


Fig. 13 Block graph representing the use of implants in oral rehabilitation

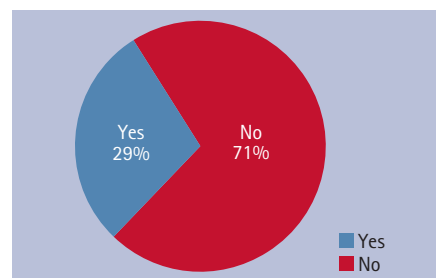


Fig. 18 Pie chart illustrating the use of zygomatic implants for dental rehabilitation

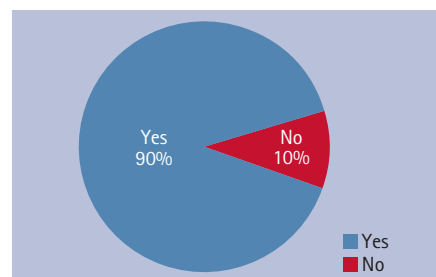


Fig. 19 Access to hyperbaric oxygen for dental rehabilitation or osteoradionecrosis

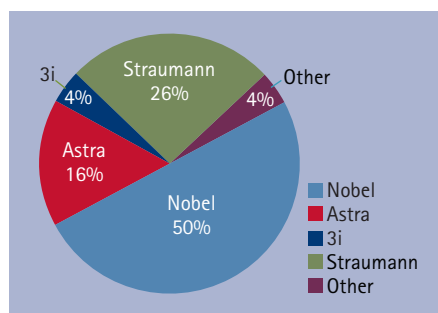


Fig. 14 Pie chart representing the types of implants used by respondents

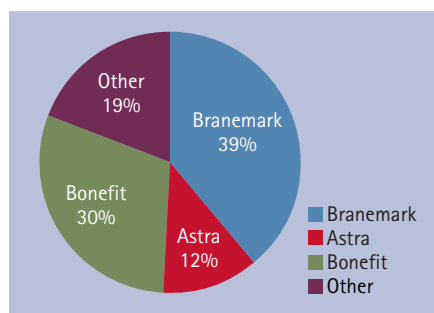


Fig. 15 Design of implants from the previous study<sup>6</sup>

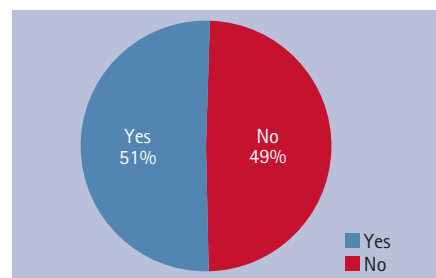


Fig. 20 Routine use of HBO for patients who have undergone radiotherapy who are scheduled for dental implants

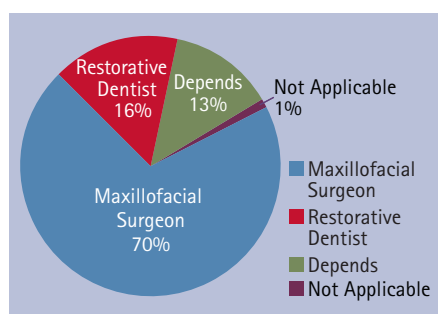


Fig. 16 Clinicians placing the implants in oral rehabilitation

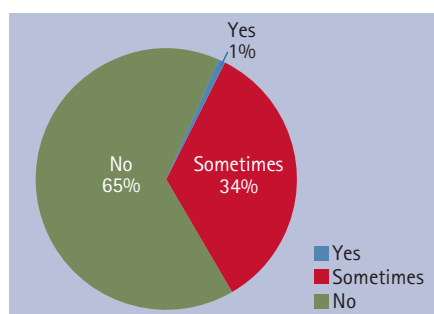


Fig. 17 Placement of implants at the time of surgery

shown that there is a marked variation in the number of patients treated with dental implants within National Health Service hospitals but in most cases this follows the Royal College of Surgeons guidelines of 1997.<sup>38,39</sup>

The increase in the spread of different types of implants in the present study reflects the emergence of numerous companies developing and producing new implant systems since 1995. The most popular system used was Nobel Biocare (49%) followed by Straumann (26%). The most

popular system in the 1995 study was the Brånemark implant (39%) (now branded Nobel Biocare).<sup>6</sup> The use of different types of implants by operators may be irrelevant as a recent systematic review found there is not enough evidence from randomised controlled trials to demonstrate the superiority of any particular type of implant design or implant system over the others.<sup>40</sup> As technology and research into implant coatings progress, the likelihood of popular implant designs at present becoming defunct in the future needs to be appreciated. This is

illustrated by 30% of respondents in the original study using 'Bonefit' implants, which are plasma sprayed. Since then there has been research into implant coatings especially at the 'nanostructural' level.<sup>41</sup> As survival rates for oral cancer continually improve and with the constant turnover and emergence of new implant systems, the provision of implant recognition systems for discontinued as well as new implant systems in the long term management of this patient cohort is important.<sup>42,43</sup>

The placement of the implants yielded interesting results. Sixty-four percent of maxillofacial surgeons placed the implants for the purpose of oral rehabilitation, in comparison to 15% placed by the restorative dentist. The clinician placing the implants depended on the situation in some cases (22%). As the purpose of implants in these cases, where normal oral anatomy has changed sometimes radically, is for the

restoration of oral function and aesthetics, the need for multidisciplinary team interaction in the planning of the position of fixtures is vital.

The apparent discrepancy between patients either being rehabilitated sometimes or never (67%) in comparison to the percentage of surgeons using implants for dental rehabilitation (93%) could be indicative of a gap between what is technically possible but, due to other constraints, unable to be routinely offered. The placement of implants in this cohort ultimately requires the knowledge and skill to provide associated restorations to a specialist level. As our results show that the presence of a restorative dentist on the MDT is still at a minimum (30%), other barriers such as funding and training may also be present. This area requires further investigation.

The placement of implants at the time of surgery was not routinely considered in 66% of responses. The relative advantages of immediate implant placement include preventing the need for a second episode of surgery, the possible need for adjunctive HBO therapy and preventing placement of implants in irradiated tissue.<sup>44</sup> The relative disadvantages of placement at the ablative stage include the difficulty in assessing the prognosis of the patient and as such the possible need for more surgery if initial treatment is unsuccessful. A study examining implant survival of 435 implants in 93 patients post-resective surgery showed that the mean survival rate (69%) at ten years was lower than in healthy individuals. This was attributed to the higher mortality rate of the cohort as opposed to failed osseointegration. Of note is the fact that the cumulative survival rate for fixtures in the maxilla was 72% in comparison to 92% in the mandible, and all implants were placed at least six months post-radiotherapy.<sup>45</sup> It seems that the best options in these situations will invariably require a team approach to the time, type and also the position of implant placement.

Over 70% of respondents used zygomatic implants, and their value in preventing the need for bone grafting in rehabilitating naturally atrophic maxillas, patients with severe bone loss secondary to trauma and extensive bilateral maxillectomy procedures, cannot be overestimated.<sup>23</sup> Utilising zygomatic bone for osseointegration in these cases prevents the need

for a wide range of surgical interventions which necessitate morbidity of an extra-oral donor site, patients remaining without a prosthesis during the graft consolidation phase and healing time. Schmidt and co-workers conducted a retrospective study of 28 zygomatic implants in patients with total maxillectomies. Six of the zygomatic implants placed failed (78% success rate).<sup>46</sup> The results of another study yielded similar results in a retrospective study of 28 zygomatic implants placed in patients who previously underwent maxillary resection, with a success rate of 71%.<sup>47</sup> On the evidence of these studies it would seem that the placement of zygomatic implants in post-maxillectomy cases has a lower success rate than in otherwise healthy individuals. This difference in success rate was attributed to the use of radiotherapy in this patient cohort, which may have also included smokers.

Over 90% of respondents had access to hyperbaric oxygen for patients with osteoradionecrosis or those requiring implants. Fifty percent of respondents did not routinely use HBO for patients who underwent radiotherapy and were having implants placed. This may reflect the current uncertainty on the benefit of HBO. A Cochrane review<sup>48</sup> found one suitable randomised controlled trial that compared one group of HBO treated patients with another who received no HBO for implant treatment in radiated patients. In this study patients treated with HBO performed worse in every aspect when compared to patients not subjected to HBO therapy.<sup>49</sup> Eight implants failed in five patients subjected to HBO therapy *versus* three implants in two patients in the control group. Two postoperative complications (one osteoradionecrosis and the other soft tissue complications) developed in two patients subjected to HBO therapy.<sup>49</sup> The conclusion of the systematic review, with consideration to the limited amount of research available, is that hyperbaric oxygen (HBO) therapy in irradiated patients requiring dental implants may not offer any appreciable clinical benefits.<sup>48</sup> As it is difficult to obtain the best quality of evidence in such a patient cohort, research into the relative benefits of HBO will need further investigation as at present there seem to be differing opinions on its benefit. A recent survey of maxillofacial surgeons revealed

that most consider HBO to be part of the management of osteoradionecrosis, but their knowledge about delivery was weak and the protocols used varied.<sup>29</sup>

## CONCLUSION

This survey gives an insight into the changes that have occurred in the treatment of head and neck cancer patients, in particular those undergoing maxillectomy, over the last ten years. The period has coincided with the production of a number of policy documents and guidelines designed to improve the quality of these services.

It highlights a growth in multidisciplinary team working but also shows variation in the utilisation of care team members across trusts and across specialties. In particular there appears to be a significant discrepancy in utilisation of restorative team members and how and at what level they input into the care of head and neck oncology patients.

Over this period there has been a significant growth in the use of more complex microvascular free-flaps for the reconstruction of maxillectomy patients. There appears to be no consensus, however, as to the 'ideal' reconstruction technique. While conventional prosthetic rehabilitation still has an important role to play for oncology patients, there has been a significant increase in the use of dental and zygomatic implants in their rehabilitation.

An area of major contention is the management of these patients and the use of hyperbaric oxygen in aiding osseointegration of dental implants. This highlights the lack of good scientific evidence for or against the treatment modality and therefore the need for more randomised controlled studies.

While overall the results of the study are encouraging, they show the need for further resources to attain the ideal standards across NHS trusts and specialties.

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## Appendix 1

### Questionnaire

#### Do you carry out maxillary resections?

Yes  No

#### How many cases do you treat a year?

Between 1-5   
Between 6-10   
Over 10

#### Do you carry out surgical reconstruction of the maxillary defect?

Yes   
No

#### What percentage of cases are surgically reconstructed?

0-25%   
25-50%   
50-75%   
75-100%

#### What type of flap do you use to reconstruct the surgical defect?

Radial forearm graft   
Temporalis   
DCIA   
Scapula   
Other (Please specify)

#### Do consultants in specialities other than maxillofacial surgery perform maxillectomies regularly in your Trust?

No   
ENT   
Plastics   
General surgery

#### Are all your oncology patients seen on a multidisciplinary team clinic?

Yes   
No

#### Following surgical reconstruction, are the patients dentally rehabilitated?

Yes   
No

#### Do you have access to the services of a restorative dentist to assist with prosthetic rehabilitation?

Yes   
No

#### If yes, what grade of dentist do you have in your team?

Consultant in restorative dentistry   
Associate specialist   
Staff grade   
Senior house officer   
Clinical assistant   
Other

#### Do you use dental implants to reconstruct patients' dentition?

Yes   
No

#### What design of dental implants do you routinely use for prosthetic reconstruction?

Nobel Biocare   
Astra   
3i   
Straumann   
Other

#### Are the implants placed by the surgeon or by the restorative dentist?

Maxillofacial surgeon   
Restorative dentist   
Depends   
Not applicable

#### Are dental implants placed at the time of primary surgery?

Yes, always   
Yes, sometimes   
No

#### Do you use zygomatic implants for maxillary prosthetic reconstruction?

Yes   
No

#### Do you have access to hyperbaric oxygen therapy (HBO) for patients with osteoradionecrosis or requiring dental implants?

Yes   
No

#### Do you routinely use HBO for patients who have undergone radiotherapy who are scheduled for dental implants?

Yes   
No

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