

# Development of patient-centric eating advice for complete denture wearers

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## Abstract

**Background:** Edentulous people eat less healthily, and wearing dentures impairs eating function and enjoyment.

**Objective:** To apply a sequential approach to integrate scientific evidence, and patient and professional experience to co-develop intervention to support better eating with dentures.

**Methods:** Focus groups, two with purposive samples of patients and two with dental professionals, explored experiences and opinions about advice on eating with complete dentures. Findings were distilled with evidence from the literature to underpinned concepts for eating interventions. User engagement informed prioritisation of ideas and led to the development of a leaflet on eating with dentures.

**Results:** Patients receive no advice on what they can realistically expect when eating with dentures, and professionals lacked confidence to provide eating advice. Patients did not think dentists a credible provider of eating advice, feeling peer support more appropriate and offering numerous strategies for eating with dentures. Concepts for eating intervention included a patient leaflet, Web-based eating interventions, patient support blogs, waiting room videos and improved nutrition training for dental professionals. User feedback informed prioritisation of ideas, leading to the development of a leaflet on eating with dentures. Justified by the data, the leaflet focused on patient-generated tips for overcoming the functional limitations of eating with dentures, and unobtrusive healthier eating advice. Face validity with users confirmed acceptability.

**Conclusion:** A systematic and rigorous integration of scientific evidence, expert experience and patient input has developed a patient-centric, evidence-based approach to a patient leaflet on eating with dentures that, based on initial face validity, is likely to be well received.

## KEYWORDS

mastication, nutrition, prosthodontics, tooth loss

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## 1 | INTRODUCTION

A wealth of evidence shows edentulism and even subsequent rehabilitation with complete dentures are associated with problems in biting and chewing foods and continued consumption of a less healthy diet that is lower in fruits, vegetables and fibre.<sup>1-4</sup> Despite significantly improving chewing function, most evidence indicates that prosthetic rehabilitation, in the absence of dietary intervention, does not result in consumption of a healthier diet.<sup>5-7</sup> Moreover, several studies have shown that eating with dentures has a negative impact on eating-related quality of life through loss of enjoyment eating, and loss of social interaction with others, caused by self-consciousness or embarrassment while eating with dentures.<sup>8,9</sup> A recent narrative evidence synthesis of interventions to promote dietary advice delivered concurrently with dental prosthetic restoration identified eight studies that reported at least one positive outcome regarding healthier eating, thus supporting the positive impact of dietary intervention coupled with oral rehabilitation.<sup>10</sup> However, these studies focused on promoting healthier eating in general, and did not specifically address the eating problems identified by patients. Moreover, none of the interventions employed were designed with input from patients. It is likely that people who wear dentures would benefit from support to overcome the issues they experience with eating, and current evidence suggests that such support would benefit from being patient centric.<sup>11</sup> Support with eating is also likely to be more successful when its delivery mode is appropriate and acceptable to the target group.

Internationally, many authoritative bodies advocate the integration of stakeholder involvement in the development of health interventions.<sup>11-13</sup> Patient and professional input into the development of dietary intervention is important to ensure that the intervention is relevant and useful for both patients and practitioners and to maximise the acceptability and potential effectiveness of the dietary intervention. Increasingly, design-orientated approaches are being applied to innovation in health care.<sup>14-16</sup> Involving patients and practitioners as co-designers of dietary intervention for dental practice allows them to help define the problems faced by patients, in eating, and practitioners, in supporting patients to eat better with their dentures. This approach helps identify preferred solutions, generates new ideas for dietary intervention and facilitates prioritisation of solutions.<sup>17-20</sup> O'Brien et al<sup>21</sup> highlighted that information from user perspectives alone is not sufficient for effective intervention development. Rather, this should also be guided by the best available evidence from the peer-reviewed literature and in-depth enquiry of the needs, attitudes, behaviour and contextual factors of the specific population and health topic under investigation through qualitative investigation. They provided a methodological framework on how to integrate evidence from the literature, qualitative enquiry and stakeholder needs and preferences and to apply these integrated elements to the development of health intervention.

The aim of this paper was to describe the application of this system to support better eating for people who wear complete dentures. The objective was to apply an iterative co-development process to

integrate scientific evidence from the literature, qualitative evidence from users (patients, dentists and dental care professionals (DCPs)) and ongoing user feedback to inform eating intervention for denture wearers and its mode of delivery.

## 2 | METHODS

A positive ethical opinion from the National Research Ethics Services Committee London-Westminster (approval number 15/LO/1299) and a relevant Research and Development approval from Newcastle upon Tyne Hospitals (NHS Foundation Trust, number 7515, September 2015) were obtained. Written informed consent was obtained from all participants.

An iterative co-development process based on that described by a previous study<sup>21</sup> was followed (see Figure 1). This involved the following: engaging with stakeholders (including patients and professionals) through focus groups and discussion; integrating the evidence identified from the focus groups and from the published literature to generate ideas for intervention around eating; prioritising ideas; building a prototype intervention; and validating the intervention to ultimately produce a dietary intervention for people who wear dentures. This process involved a series of stages (each of which is described in more detail below) and in which each stage in the process resulted in output(s) to inform the design of the intervention. After each stage, the research team discussed and analysed the output(s) and critically reflected on the process. Outputs from each stage were used subsequently as inputs to the next stage of development. Figure 1 displays an overview of the methods employed and outputs derived at each stage.

### 2.1 | Compiling the evidence base through focus groups and literature review (Stage 1)

In the first stage of the development of the dietary intervention, evidence pertaining to eating with dentures was collated through focus groups and literature review.

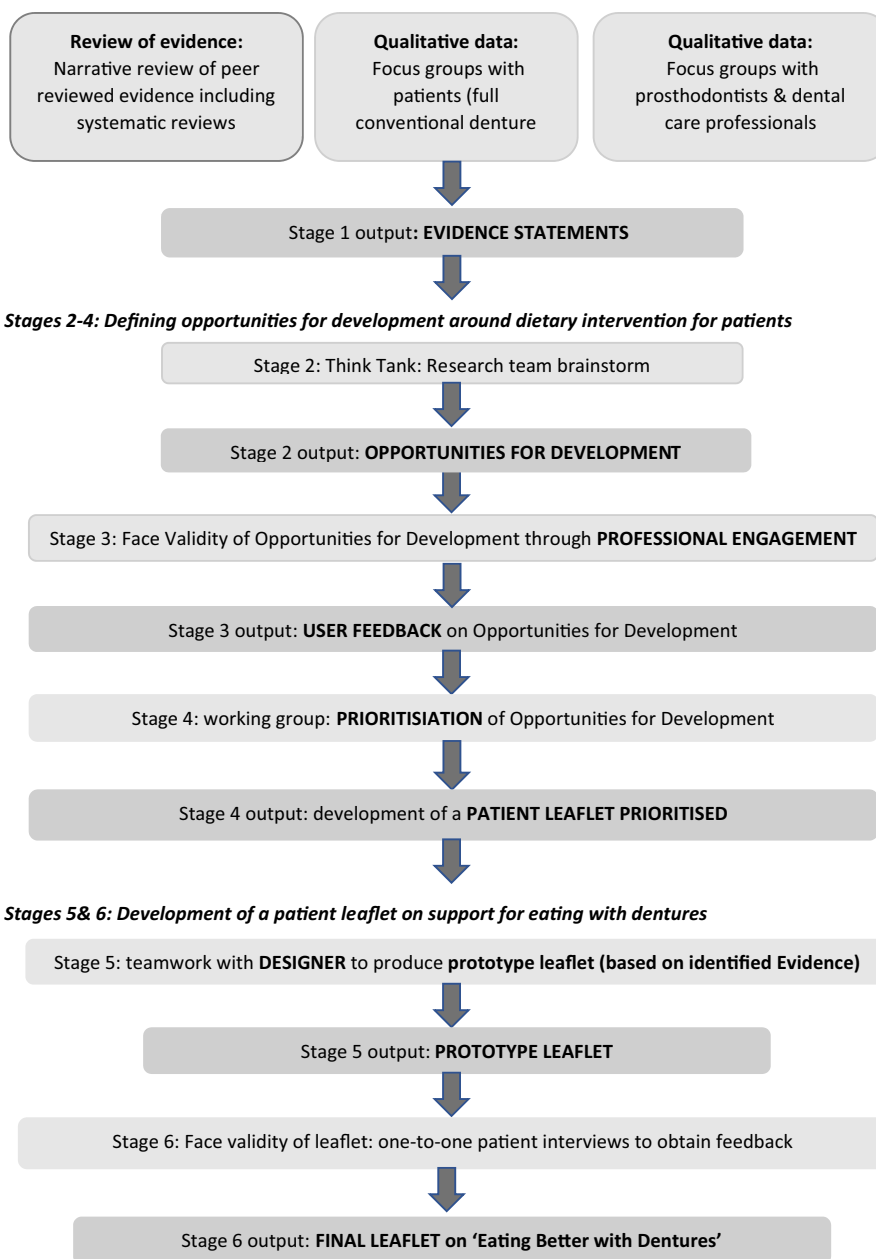
#### 2.1.1 | Focus groups

Focus groups, two with patients and two with dentists and DCPs, were conducted to explore their experience and opinions about advice on eating with complete dentures. Focus groups took place between February and June 2016, in a seminar room of the School of Dental Sciences.

For the patient focus group, edentulous patients ( $n = 77$ ) wearing complete dentures, aged 52-85 years, who had been recruited into a cohort study of patients receiving replacement complete dentures,<sup>22</sup> were invited to participate in a focus group approximately 2 months following insertion of replacement dentures. The inclusion criteria for the wider cohort study were patients attending Newcastle

**FIGURE 1** Overview of the systematic, sequential approach to intervention co-design and development

**Stage 1: compiling the evidence base through focus groups and literature review**



Dental Hospital, Newcastle upon Tyne, UK, from September 2015 to June 2016 who were edentulous with existing dentures and requiring new complete dentures regardless of the complexity of the case and the technique used. Participants had to be able to give verbal and written consent and be fluent in the English language. Exclusion criteria included patients who did not understand verbal and written English, patients with implant-supported overdentures and tooth-supported overdentures, or dentate patients. Patients with a history of temporomandibular disorders (TMDs) or jaw clenching were also excluded. The target sample size for each focus group was 5-8 participants.

For the professional focus groups, purposive samples of 5-8 dentists and DCPs were recruited from the prosthodontic clinic in Newcastle Dental Hospital and stratified by gender and occupation.

Topic guides (see Appendix S1) were developed by the research team, which included a prosthodontist, nutritionist and experienced qualitative researcher. Focus groups, led by a moderator (HA) with an assistant moderator (MB) taking notes, followed an inductive and iterative approach allowing topics to evolve. Prompts were used for transition between topics, and probes were used for exploring in-depth information. Focus group discussions were audio-recorded using a digital voice recorder (Olympus WS-832), and recordings were transcribed verbatim. Principles of constant comparative techniques, based on collecting and analysing the data over the same period,<sup>23</sup> were broadly used during data collection until data saturation was reached. Data underwent framework analysis<sup>24,25</sup> led by one researcher (HA) and were and independently reviewed by two other members of the research

team (PM and JF). At each stage, the data were also sent to a third independent reviewer (an experienced qualitative researcher) to assess and triangulate the emergent themes. The independent researcher has been acknowledged. Verbatim quotes are presented with gender and age (patients) or profession (dentist or DCPs) along with participant number.

### 2.1.2 | Literature review

A narrative review of the peer-reviewed published literature was conducted employing MEDLINE, Web of Science and Scopus to identify evidence pertaining to the impact of wearing complete dentures (compared with being dentate) on diet and patient-centric issues pertaining to eating and eating-related quality of life. Included were peer-reviewed original articles containing quantitative or qualitative data pertaining to eating with dentures. Key search terms are provided in the Appendix S1.

The evidence from the literature and focus groups was summarised by the principal researcher (HA) and reviewed by the research team (PM, JF) to distil the integrated findings into a number of “Evidence Statements.”

## 2.2 | Defining opportunities for development around dietary intervention for patients who wear complete dentures (Stages 2-4)

A brainstorming “think tank” exercise was conducted by the research team to define a broad range of “Opportunities for Development” around provision of dietary intervention for people who wear complete denture based on the identified *Evidence Statements* (Stage 2).

Next, feedback to face validate the identified *Opportunities for Development* was elicited from a diversity of dental health professionals (Stage 3). Participants in this stage were delegates at a national (UK) conference attended by dentists, specialist and dental care professionals working in restorative dentistry (Restorative Dentistry UK, and Specialty Registrar Restorative Dentistry Group Annual Conference). A presentation during the welcome session of the conference was used to verbally invite conference delegates to engage in the research. Delegates were invited to visit a visual display depicting the *Evidence Statements* and the *Opportunities for Development* and were invited to provide their feedback on the *Opportunities for Development*, including exploring any additional innovative ideas. Bespoke feedback cards were provided for this purpose, which could be handed to the researcher or posted anonymously in a receptacle at the display. During the conference exhibit, the researcher made notes of points raised by participants verbally, to supplement written comments provided on the feedback cards.

The feedback from engagement with conference delegates was reviewed by the research team in a second working group (Stage 4). A key aim of this stage was to prioritise concepts and ideas for

further development by consideration of the relative importance of the ideas and the practicalities of taking the identified *Opportunities for Development* forward. At this stage, development of a patient leaflet was prioritised (see results for the process underpinning this decision).

### 2.3 | Development of a patient leaflet on support for eating with dentures (Stage 5)

The content for the leaflet was drafted, focusing on the issues with eating identified from the previous stages. The resulting prototype leaflet underwent further validation with users (face validity; Stage 6) to derive a final intervention product.

### 2.4 | Face validity of the prototype leaflet (Stage 6)

Patients attending student clinics who wore complete dentures were identified by the prosthodontists and asked whether they would be willing to speak to a researcher (MB) about the study. Attendees at these clinics are generally people who have worn dentures for a long time and who are experiencing difficulties with the fit of their prostheses. If willing, the patient was given a brief explanation of the study and what it would involve and if provisionally interested in participating, they were provided with a participant information sheet and asked whether they would be willing to provide their contact details and be contacted by phone in a few days' time. Potential participants were contacted by phone and given the opportunity to ask questions; if still willing to take part, an interview was arranged either face to face or over the phone, depending on participant preference. Prior to the interview, written consent was obtained, brief demographic details were collected, and participants were provided with the prototype leaflet. A short topic guide was used to explore general impressions and all aspects of the presentation and content of the leaflet, as well as any suggested improvements and thoughts on the provision of this leaflet to people who wear dentures (see Appendix S1). Interviews were audio-recorded and transcribed. Given the brief nature of the data, a framework approach was used to organise data and NVivo software (QSR), a tool for organising and managing qualitative data, was used to manage this process.

## 3 | RESULTS

The results of each of the six stages described in Figure 1 are presented sequentially below including the following: compiling the evidence base through focus groups and literature (Stage 1); defining Opportunities for Development around dietary intervention for patients who wear complete dentures (Stages 2-4); development of a patient leaflet for support with eating with dentures (Stage 5); and face validity of the prototype leaflet (Stage 6).

### 3.1 | Compiling the evidence base through focus groups and literature review (Stage 1)

#### 3.1.1 | Focus groups

Of the 77 patients invited to participate in the focus groups, 27% volunteered ( $n = 21$ ), from which a purposive sample of ten people who dentures (four females and six males, mean age 69.4 year) participated in two focus groups with five participants per group. Focus groups lasted approximately 1 hour. Data saturation was reached with two focus groups, and therefore, further groups were not deemed necessary.

Four overarching themes emerged: (i) advice received about eating with dentures; (ii) recommendations from denture wearers; (iii) denture fit and stability; and (iv) preferred format of eating advice; these are discussed below, and illustrative quotes associated with identified themes are presented in Table 1.

Most participants had received no advice about eating with dentures from the dentists or the dental team. If received, the advice was very simple and not related to the enjoyment of eating or eating more healthily. Participants mentioned different reasons for not receiving eating advice from the dental team. Several had never considered that dentist could give them advice on eating with dentures, and therefore, they have never asked their dentist for advice related to eating. Some participants were not keen to receive eating advice from dentists because of a perceived inability of the dentist to empathise with the patient's experience of eating with dentures due to lack of personal experience. Others thought that providing advice related to eating was outside the professional remit of a dentist. Many believed that people who wear dentures, through experience and knowledge of what kinds of foods they can eat and enjoy with dentures (regardless of whether these foods are healthy or not), were better placed to give eating advice than dentists. Such findings indicate that peer advice on eating with dentures is likely to be appropriate and well received.

Advice recommended by participants included the descriptions of the different ways through which they could enjoy foods or eating. Participants emphasised the importance of perseverance in adapting to new dentures in terms of eating, especially in the first 2 weeks. Eating and preparing food "differently" was suggested to overcome functional difficulty and enjoy eating by several participants, for example cutting up hard fruits such as apples, cutting bread into small finger-like portions and using slow cooking techniques to tenderise meat. Despite the difficulty eating healthier foods such as fruits and vegetables in general, participants emphasised the importance of overcoming functional difficulties (ie chewing and biting difficulties) in the beginning of their accommodation to new dentures and gradually adopting a healthier eating style when eating with dentures became easier. Similarly, several participants discussed swapping dietary items for foods suitable for eating with dentures, especially when eating in public (e.g., swapping steak for casserole).

Many participants highlighted the use of denture fixatives during eating though perspectives on this seemed highly individual. As

movement of dentures during eating was identified as a problem, some participants found using denture fixative made dentures more stable during eating. Others avoided fixative due to adverse side effects on food flavour. One participant who regularly used fixative offered specific advice (see Table 1).

Several participants discussed the concept of denture fit and stability in relation to eating. They described their experience of pain on eating when adapting to new dentures and how denture adjustment was important in relieving this pain and discomfort.

With regard to the preferred format of eating advice, an important idea that emerged was the need for a patient leaflet, to provide advice on eating with dentures for the people who wear dentures. Participants suggested that this should include information about potential eating problems with dentures and general advice about how these can be overcome. Some participants suggested that such a leaflet could link to a website or an "app" for further information about eating with dentures. However, providing information online was not favoured by all participants; some suggested that for older people or those, who have no access to the Internet or are not "tech savvy," the preferable format was the patient leaflet. Participants did not like the idea of a support group, which had been suggested from within the focus groups of dentists and DCPs. Patients/participants simply did not feel comfortable in sharing with strangers personal details about how dentures have affected their life.

Eight dentists and four DCPs (two dental hygienists and two dental nurses) participated in the professional focus groups. The groups were purposively selected based on job role, and each mixed group was made up of six participants. Most dentists were specialist prosthodontists and, therefore, directly involved in the management of the denture wearers. Data saturation was reached after holding two focus groups. The emergent and recurrent themes focused on: (i) advice given about eating with dentures; (ii) barriers against giving eating advice; and (iii) strategies suggested by participants. These themes are discussed below, and illustrative quotes associated with identified themes are presented in Table 2.

Most participants reported being involved in giving patients who wore complete dentures general advice on eating with dentures, but the level of advice varied. For example, informing patients of potential eating difficulties associated with wearing complete dentures, and advising patients to initially select "soft" foods, which are easy to chew and to gradually progress to eating harder foods.

This basic advice given by the denture providers was reiterated in a general advice sheet available for patients receiving new dentures within this clinical environment. Participants suggested that this simple advice could be expanded to include more detailed information, new meal ideas and recipes on eating with dentures based on patients' experience. Many prosthodontists only provided advice when prompted by patients. Bespoke advice to address specific problems was then provided. When participants were asked whether they gave advice on healthier eating to patients who were edentulous, almost all prosthodontists said they did not. However, one offered patients practical advice including adding meat and vegetables to homemade soup and eating fish and eggs, which are

TABLE 1 Key themes identified from patient focus groups along with supporting quotations

Subtheme	Example supportive quote
<b>Key Theme: Advice received about eating with dentures</b>	
Simplicity or lack of advice	<p>"The only advice I've ever been given is, 'Just use paste'. that's the only advice I was ever given, 'Just use paste to keep them in place'" (P03, F65)</p> <p>"Nobody told me what you had to do, how you had to eat. We didn't get anything like that, none whatsoever" (P08, M75)</p>
Reasons for not receiving eating advice	<p>"I cannot see how a dentist can give you advice on your eating habits, when they're not on this side of your teeth, you know what I mean? I don't think they really could give you a lot. You know. [they] could tell you what, as I said before, tell you what foods to eat or enjoy, which is good for [you], but whether you could cope with that, whether your denture stays, is another matter" (P04, M69)</p> <p>"I really didn't expect any. I thought, 'Well, you've lost your teeth, it's up to you...' he's [dentist] a busy man, he's an expert, it's what he's doing. Erm, I didn't think that [dietary advice] was open so I couldn't ask because I would think I was asking too much" (P10, F82)</p>
<b>Key theme: Recommendations from denture wearers</b>	
Eating food differently	<p>...you can still eat the same foods, but you tend to eat them differently, whereas I would pick up an [apple] and I now I peel it and I slice it and I still eat it, still enjoy an [apple] but you eat it in different ways (P07, M59)</p> <p>"But what I found, I can't eat- Well, I don't eat steak now, I don't think I could. So, I've got about three slow cookers and I get good quality beef and just put it in there with the seasoning and I enjoy that as much" (P10, F82)</p> <p>"And when I'm not in work I have ham and eggs, scrambled eggs on your toast makes- You still get the texture of the toast, but the scrambled eggs make the toast softer" (P07, M59)</p>
Trial, error and perseverance	<p>...you've got to persevere that little bit...it's a case of, when you first get dentures, erm, don't think that what you're like in the first week or two is going to affect you long term (P02, M65)</p> <p>"...first couple of weeks is where you'll be eating but you'll not (be) eating what you want..., you've got a couple of weeks period where your food isn't going to be the same as in a few weeks' time, you know. You can't go straight down and get your steaks and your apples, you know. You know, you, you've got to let your gums settle down and harden up for a couple of weeks" (P02, M65)</p>
Using denture fixative	<p>"Can't eat without it" (P07, M59)</p> <p>"I've never used any artificial means of me teeth, I don't believe in it, because as you see it tastes awful" (P04, M69)</p> <p>"I certainly can't eat, I've got to wear the paste still. If I don't, I cannot chew anything. ...Erm, I eat a lot of fruit, and I find when I put the paste on, I can manage to eat some foods, but you know the one's that acidic because it just takes the paste straight off. So halfway through an orange the teeth are moving all over the place again... I still haven't found a paste that's really good" (P03, F65)</p> <p>"Well, a little tip ... so you fix [denture] with [fixative]—you get up in the morning, you fix your dentures in. You wait 10 min for them to settle down, get all, like you say, get all the other crap out of your mouth like the overspill, ... And that denture will stay in place reasonably well 'til dinner time. So, you put a towel- what I do is I put a towel in my mouth, and I bite on it. So, it's completely dry or as dry as possible and then, obviously, I've got my dentures sitting waiting with the [fixative] on and then the towel comes out and [the denture] goes straight in. I find that that is much, much better. And it gets a better fix. .... The bottom ones- I'm having to fix them preferably just before I go for a meal, cause then I'm confident that they're going to be okay for the meal" (P07, M59)</p>
<b>Key theme: denture fit and stability</b>	
Denture fit and stability and comfort eating	<p>"The problems I have are denture moves and sticks to foods and stuff gets underneath the, the palate and- When, when I get erm, jam or, you know, if you got a little seed underneath, oh, the agony. It feels as though you've got a boulder underneath." (P08, M75)</p> <p>I must admit since I've had the new ones here, they're an excellent fit on the bottom and the top. Erm, I, I don't have a problem with anything, I've one more adjustment to do at the top for the front teeth, apart from that I can eat anything again. Apart from harder stuff, I've got to get that sorted but, the teeth themselves stopping, and stopping them from moving, it makes it easier for me to eat anything more or less that I choose without any functional difficulty" (P02, M65)</p>
Importance of denture adjustment	<p>"Since they've done that little adjustment, I can eat anywhere in the mouth now so, that determines the type of food I can eat now, I'm back to, eating anything that I want. Just keep trying them but do get them adjusted if they're not fitting properly. But things will get better, but they'll not be an instant fix" (P02, M65)</p>
<b>Key theme: preferred format of eating advice</b>	



TABLE 1 (Continued)

Subtheme	Example supportive quote
Patient leaflet and Web-based information	<p>“So, it’s a list of, ‘This is what you eat now, when you get dentures, you will find that you struggle with this’. ‘And eat the same foods but, instead of doing that, do this’, you know? And it gives you that, sort of, advice, and you’re prepared for it then. Because it [leaflet] gives you the suggestion, or at least the confidence to, well, they say I [can’t], so I’ll try. ...[the dentist] can’t do personal plans for everybody, But it would be just general advice about how to function with dentures” (P07, M59)</p> <p>“I would say a leaflet and have something on the internet, because most people are on the internet nowadays” (P09, F66)</p> <p>“And erm, as I say you talk about handing leaflets out, most oldish people are not computer literate, so they couldn’t get advice in that respect” (P04, M69)</p> <p>“Yeah, but you would also, you would also need a leaflet form for people who don’t use the internet. That’s what I’m saying, not everybody uses the internet, and they’re not all computer-savvy. I’ve got mates that are in their 60s that don’t even have mobile phones. They don’t want anything to do with modern technology” (P07, M59)</p>

softer sources of protein. Some DCPs mentioned giving “informal” healthier eating advice if requested.

Most participants, in particular prosthodontists, described focusing on the technical aspects of denture construction and adjustment, as opposed to advising patients on eating with dentures. They felt their role was to make and fit a good set of dentures and adjust them as necessary as opposed to giving eating advice. Nonetheless, the focus on adjusting dentures is itself likely to improve function and thereby indirectly improve enjoyment of eating but will not necessarily support healthier eating.

Barriers to providing advice on eating with dentures included the following: perceived value of the advice; perceived behavioural and socio-economic barriers; lack of knowledge and training; not feeling responsible for giving dietary advice; and time and financial barriers.

Several participants were sceptical about the effectiveness of individual dietary advice (particularly healthier eating advice). Several participants mentioned the limitations of “one off” advice and emphasised the importance of monitoring and review of advice—which is not always feasible. Some participants were reticent to provide advice to patients who had worn dentures long-term who had first had experience of eating with dentures. Others questioned whether providing dietary advice to patients who had lost their teeth should be the priority and that efforts should focus on patients who are dentate. Some participants reported that providing the patients with a new set of dentures and asking them to eat healthier foods simultaneously were difficult and impractical. Others highlighted a dilemma between helping patients to functionally eat vs encouraging healthier eating.

Several participants commented that those who lose their teeth earlier tend to come from low socio-economic backgrounds, and assumed their socio-economic status meant that they had a poor diet. Several participants also commented that it was difficult to change the dietary behaviour of patients who wear dentures because many have limited budgets—thus assuming that healthier eating was more expensive, and that patients would choose processed foods (assuming them less expensive).

Most participants, particularly prosthodontists, felt unprepared and lacking in knowledge to provide dietary advice to patients that wear dentures. Though some DCPs expressed confidence to provide specific dietary support to patients who wear dentures, most participants felt that they had only received adequate training to advise on sugar reduction; some participants suggested giving more training about eating with dentures at the undergraduate level.

Several participants thought patients should get healthier eating advice elsewhere, for example from a dietitian, and not rely on dentists. Conversely, several participants (dentists and DCPs) were enthusiastic that trained DCPs would be the best individuals to give eating advice to the patients.

Most participants, particularly prosthodontists, attributed their inability to provide advice, particularly healthier eating advice on eating with dentures to inadequacy of time and financial supports within the constraints of the UK public health care system in which they worked. Within this system, some participants were uncertain about the value of spending time on improving nutrition as a means of improving overall quality of life, and whether that could ever be reflected in fee payments for making dentures.

Participants discussed potential strategies, which they believed would help people overcome eating problems with dentures and support healthier eating and eating-related quality of life.

Several participants suggested an Internet forum where people who wear dentures can post and get advice and recipes from their peers (in preference to receiving information from dental professionals). However, others thought a digital approach might not be suited to this patient group. Several participants suggested that a leaflet was an inexpensive tool and a straightforward way to give information on eating with dentures and that patients could be involved in its development.

The idea of holding support groups in which ‘denture wearing champions’ might be able to give advice to the other people who wear dentures with eating difficulties was suggested by one participant and supported by some participants in these focus groups. In contrast, several participants indicated that people might not be

TABLE 2 Key themes identified from focus groups with dentists and dental care professionals, along with supporting quotations

Subthemes	Example supportive quote
Key theme: Advice given about eating with dentures	
General eating advice	<p>"I think we do give fairly general advice... but to a very limited degree" (P03, M, dentist)</p> <p>"I usually just say, you know, to start, I think like everyone said, when you have a new pair of dentures is a bit like a new pair of shoes, to wear them in slowly and start with softer foods and sort of work into more difficult things really. But it's just very general advice and not a lot" (P05, M, dentist)</p> <p>"My advice was usually to try and get people to understand that they could not eat the same foods, probably, that they could when they had their own teeth" (P01, M, dentist)</p> <p>"I got the advice sheets when I knew I was coming here to see what we actually have written down.... And it says that the patient should cut their food up small and eat, eat on both sides and there will be some dietary adjustments. That's what's written down, you know, that we give out to the patients. There were two lines that just says, again, "Try and chew on both sides, cut your food up small and expect adjustments" (P02, F, dental nurse)</p> <p>"I was employed as a dental health educator in practice, plenty of children and plenty of diet advice there, and even adults, but never for denture wearers. It was something that was never addressed unless the patient directly approached a member of the team" (P10, F, dental nurse)</p>
Specific eating advice for patients with denture-related problems	<p>"... you will get some patients who will come back and report that they have difficulty eating. And then you can sort of focus on, "What is it you're having difficulty eating?" and try to, to give them some advice on how they may either manage those foods or find alternatives. So, it, it's, it's very variable. And I wouldn't say that I had a particularly general approach, it was very much bespoke to each individual patient" (P03, M, dentist)</p> <p>"But going back to what X said about patients who've lost their dentures, we get the general hospital, ringing us where patients have lost dentures wanting urgently to have new dentures made. And I work with X and the advice she gives them is that they, you know, they can get the nutrients from the various, the substances, the, the meal replacements" (P02, F, dental nurse)</p> <p>"So, some of the patients attend feeling that they can't have a healthy diet because they have difficulty actually incising some of the, what we would regard as, healthy foods and so as a result feel that they have to have a softer diet as a result of that. Some patients do have concerns that it affects their diet and nutrition as a result of the fact that they don't feel that they can actually function as well with the dentures. I guess that's one of the things that we try to focus on but I'm not sure that we really reflect on it at the end of the process. Certainly, if patients are having difficulties with their dentures and they feel that that's affecting their nutrition, and when they discuss that in consultation, sometimes I would often give them suggestions of things that they could have which would potentially help in the process whilst we're waiting to make new dentures for them" (P11, F, dentist)</p>
Adjusting dentures rather than adjusting eating	<p>"I think, from a personal point of view, we're quite bad at doing this (eating advice) because the focus tends to be on comfort and fit, and by default we assume then that if they're comfortable with it, for example the prosthesis is not rubbing, then we might assume that they're then able to function with them. Yes, it wouldn't be part of your standard review process. If you did make a review for a patient, and that's a big if, if you did make a review for a patient then the expectations would be that you would be making adjustments to try and improve comfort rather than to try and enhance the social aspects of denture wearing and interaction with other people" (P07, M, dentist)</p> <p>"You know, we try to design dentures in such a way that they will be able to function well with them and then obviously we deliver them and review them, check that they're comfortable and they're able to eat, but it's rare that we actually review people frequently enough to ensure that they're completely able to manage the full range of foods that they might choose to eat. Probably yes, because if the patients attend complaining that they have difficulty eating certain foods then we're looking technically at the dentures to see what we could do to improve upon them to make them function better, or what we believe will function better with the dentures. But we probably don't actually assess the outcome of that formally at the end of the process" (P11, F, dentist)</p>
Key theme: Barriers to giving eating advice	
Perceived value of the advice	<p>"The people that listen to you are the people who don't need to listen to you. The people that need help are the ones that have, perhaps, not got the educational background and the motivation to do so" (P01, M, dentist)</p> <p>"... these bits of additional advice are the sort of the embellishments and the aspirational elements of patient care and management for denture wearers rather than the essential aspects of care which go back to the points which X made about functionality and comfort. As a result of that the focus [for dietary advice] is on edentate patients to keep and not edentate patients because they've already lost them (teeth)" (P07, M, dentist)</p> <p>"And, and I think, you know, we perhaps do need to be more mindful of the fact that we need to give our patients advice. But it, it's, on the other side of that we often have very experienced denture wearers, sometimes who are more experienced than the clinicians who are providing the dentures for them" (P03, M, dentist)</p> <p>"I think the healthy side of something is, like you said, the World Health Organisation push that and that's great, but, like we've said a few times, if they didn't eat that before what do you do in trying to re-educate on that level as well as about what they can eat? Or should you be focusing on, "We'll try and keep you to the diet you already had" which is not, from a healthcare perspective, not right because you should be encouraging them to have a healthy diet. It's very complex as to where you start with it" (P10, F, dental nurse)</p>



TABLE 2 (Continued)

Subthemes	Example supportive quote
Behavioural, lifestyle, and socio-economic barriers	<p>“... a lot of the people who tend to lose their teeth earlier came from disadvantaged background who already had questionable diet before they ever were introduced to complete dentures.... Erm, so I think the transition to dentures for some of them is probably, while a bit of a shock in one way they probably weren't eating their lightly cooked broccoli and stuff beforehand. Again, it's a socio-economic skew on it, the, the people from poorer backgrounds were already eating, lots of processed food, things that they just found easy, convenient, and which is easier to market to a certain section of the population” (P01, M, dentist)</p> <p>“I think you go back to the economics as well, er, you know, how well off your patients are. Erm, can they afford to buy all this fresh fruit, nuts and, you know, erm, foods or is it easier to buy the more processed things, erm, which maybe are softer, and they can eat with dentures, so therefore they've never had the problem, never seen having dentures as a problem” (P02, F, dental nurse)</p>
A lack of knowledge and training	<p>“I think we could possibly do with more knowledge” (P12, F, dental hygienist)</p> <p>“The more I think about it the more I think I feel untrained and that I would not have the skills to answer the questions you might quickly face about vegetarianism, certain religious based diets which you might unwittingly stray into without wanting to offend a patient. I think there would be quite a bit of training required actually. It is bizarre actually that we spend our whole life dealing with the mouth, but I can't think of a single lecture, certainly as an undergraduate, from a dietetics person. It's actually a bit humbling to realise that we don't actually have much to do with this and we probably should” (P08, M, dentist)</p> <p>“I would say that I don't feel comfortable or knowledgeable enough about that subject to provide that advice so I would steer away from it” (P09, M, dentist)</p> <p>“And then the dentists have a limiting factor. I think, I think I would find it difficult. I think most dentists would agree me that I find it hard to give somebody a new set of dentures they then go and say, ‘Go and buy some raw carrot” (P04, M, dentist)</p> <p>“Yeah, we do. On our department we do really, if a patient rings up and they're having problems we'll give advice, we wouldn't ask, go away and ask the clinician, we'd, you know, have enough experience to be able to, to help and, and advise as best we can” (P02, F, dental nurse)</p> <p>“I think the only thing that I feel moderately adequately trained to give advice on is the sugar content of the diet because that's something that we were taught in dental school ... So certainly, in relation to the prevention of tooth decay that's something that we feel relatively comfortable giving advice about, but not always in relation to a general healthy diet” (P11, F, dentist)</p> <p>“I think at an undergraduate level we're quite poor at communicating [in impact of dentures on diet] to our students. .... How you would change that and how you would modify that would mean starting very much from the beginning again, looking at the undergraduate curriculum and trying to deliver an intervention there” (P07, M, dentist)</p>
Giving eating advice is the responsibility of persons other than a dentist	<p>“I think patients might find it a little bit difficult to stomach [eating advice] coming from, a dentist rather than, you know, perhaps from a dietitian or someone with a nutritional background” (P03, M, dentist)</p> <p>“Perhaps there may be other avenues available if you feel that somebody's really struggling with managing any diet at all, then it may be a referral through a general medical practitioner to a dietitian” (P08, M, dentist)</p> <p>“In reality it wouldn't be the dentist, it'd have to be trained dental nurses who are trained in dietary giving” (P05, M, dentist)</p> <p>“I am sure there are plenty of nurses out there who would be happy to go through a short course, or something like that, for extended duties on anything, as long as you know you've got the correct information and direction at the time” (P10, F, dental nurse)</p> <p>“Erm, I think that I think it would be a great thing for dental nurses and dental hygienists, I think they'd love to be involved in stuff like this. I don't know how realistic it is that practices would have, as X has said, the space and the time to allow people to. But I think they'd love to expand their role and take on something like that” (P06, F, dental hygienist)</p>
Time and financial barriers	<p>“I worked out what my timescale was to be able to complete dentures within the restrictions of the [public dental health care system] and I had to do it, from start to finish, all stages, in 20 min. So, I have not got time to talk to people about how to cook their broccoli and stuff” (P01, M, dentist)</p> <p>“... You'd need to delegate that work and you'd have to have an infrastructure within the practice to get, you know, other salaried people doing it because it's just so expensive if it's the dentist's time. To have a sort of, 20-min chat with someone about their diet it, you know, incredibly expensive in, in practice for that” (P05, M, dentist)</p> <p>“But again, it's not having that specific member of staff who has the time to do that. And I think that's, that's just in, there's so many good initiatives in health but they need the, a dedicated person who has the time to spend with the person” (P06, F, dental hygienist)</p> <p>“What it touches on, I suppose, is whether in the bigger picture there is value to the healthcare system investing time to improve the overall wellbeing via nutrition and whether that could ever be reflected in fee payments for making dentures, and whether you'd have to focus it on certain types of patients?” (P08, M, dentist)</p>

(Continues)

TABLE 2 (Continued)

Subthemes	Example supportive quote
Key theme: Strategies suggested for delivering dietary support	
Web-based information	<p>"If there was some really nice information, a nice website or a nice leaflet, I would definitely utilise it" (P09, M, dentist)</p> <p>"But as far as educational sort of styles or, or methods are concerned leaflets are one but there could be a website which might be another, just referring to a website. Cause some people like more interactive, erm, things, you know" (P06, F, dental hygienist)</p> <p>"I imagine the best place to get advice would be off others with that condition. And I don't know, I mean the, I think now the best would be something quite anonymous like an internet forum. Clearly not appropriate for the group, well not clearly, but possibly not appropriate for the group that we're looking at" (P05, M, dentist)</p> <p>"I think the technology is fantastic but I'm in my 50s and I come across in my age group who are not tech savvy at all, depending on what sort of job they've had. .... So, I think it might be a while before those types of technology can be used. I think definitely in the future but not at the moment" (P10, F, dental nurse)</p>
A patient leaflet with verbal explanation	<p>"If the patients have said that they would like a leaflet that seems like a really good indication that they would like a leaflet, and do a leaflet, you know what I mean? That sounds brilliant. I think it's, it's, economically it's, by a million ways, the, the easiest for us. And I imagine that would be very powerful because that's how I get the best results when I'm teaching people to clean, you know? But, you know, as I think about it that probably would be a good thing to have a selection of foods ... and show people how to with a, with a nurse there, you know, it would be, it would be good. cause a leaflet, all of those things it's not the same as, quite, sitting and doing it with people" (P05, M, dentist)</p> <p>"I think the thing with a leaflet is its good if somebody sits with you and goes through the leaflet. I think it'd mean more to people. Erm, I think that taking a nutritional leaflet to a patient user group of people who wear dentures and seeing them pick it apart and put things in there that are really relevant and make a really nice leaflet would be an amazing thing to do" (P06, F, dental hygienist)</p> <p>"... we all know some patients can go out and eat anything others can eat nothing but they're perfect dentures, most people are somewhere within the middle of that spectrum...And that is the problem, there isn't a simple leaflet that will apply to everybody" (P01, M, dentist)</p>
Holding support groups	<p>"And the other, the other idea I have is maybe, erm, like denture wearing champions who wear dentures, they've lived through it, and they might be able to have some advice you could call, have an advice line or could give advice. Some- someone who wears them and is supportive of other people. 'cause I know that works incredibly well with other, erm, disabilities if you have, it's usually a really good support to people who, say, have lost a limb is other people who've lost a limb who, you know, who, who give them support in the early days. And we, that just as an idea could be something we could do with denture wearers, you know" (P05, M, dentist)</p> <p>"But X idea of getting them into support groups, I mean that's worked really well in oncology. They- They've found that survivability in oncology's big factor of patients feeling good support" (P01, M, dentist)</p> <p>"I think that would have to be a very particular kind of patient, first of all, to volunteer the fact that they're a denture wearer. There are quite a few patients who are very embarrassed about the fact that they have dentures... I think that would reach quite a small group of patients" (P08, M, dentist)</p>

comfortable to take part in the support groups or embarrassed to speak about the impact of dentures in front of strangers.

### 3.1.2 | Evidence identified from the literature search

In the narrative literature search, 21 papers were identified that had data pertaining to the impact of wearing dentures, compared with dentate, on dietary intake ( $n = 4$ ), dietary advice in dental practice for eating with dentures ( $n = 7$ ), patient perceived difficulty chewing food ( $n = 4$ ) and qualitative data on experience of eating with dentures ( $n = 7$ ). Table 3 summarises the key issues pertaining to diet and eating with complete dentures identified from these studies.

The *Evidence Statements* (Stage 1 output) derived from distilling the findings of the qualitative focus groups and literature are presented in Table 4.

### 3.2 | Defining opportunities for development around dietary intervention for patients who wear complete removable dentures (Stages 2-4)

The *Opportunities for Development* arising from the team Think Tank Workshop are presented in Table 5 (*Stage 2 output*). Feedback on these was obtained from a total of 30 conference delegates, of which 26 were qualified dental health professionals (dentists, specialists and DCPs working in restorative dentistry) and 4 were dental undergraduates. A total number of 40 comments were received. No additional ideas emerged through discussion with delegates. The feedback received on the *Opportunities for Development* is also presented in Table 5 (*Stage 3 output*). Overall, there was support for all of the *Opportunities for Development* including the following: training in dietary advice in the undergraduate curriculum and through continuing professional development; inclusion of dietary advice for people who wear dentures in guidance from authoritative bodies; and providing dietary advice that focused on the specific needs of

denture wearers (as opposed to specifically promoting healthier eating), to manage expectations, and to include patient-specific healthier eating tips. The use of a patient leaflet to deliver such support with eating was broadly accepted. Web-based approaches (including

patient blogs and talking-head videos) were also supported, though some concern existed about universal access to information delivered in this format.

Following review of the feedback by the research team (Stage 4), the concepts identified for further consideration included the following: (i) producing a patient leaflet; (ii) developing a Web-based eating intervention; (iii) developing online support group/blog for people who wear dentures on eating better, and (iv) developing videos on eating coping strategies to display in patient waiting rooms and/or online. Other concepts such as training dental professionals (through undergraduate curricular and CPD) to be competent in providing dietary advice to patients who wear dentures and including advice on eating with denture in resources of authoritative bodies (eg Public Health England), though important, were not seen as researcher-led activities or direct patient intervention and were therefore not considered further as part of this research. Due to available resources, and concerns regarding patient access to and IT literacy, the final priority (Stage 4 output) identified was to develop a patient leaflet on eating with dentures, as the first output of this research. Other options will be considered in the future.

**TABLE 3** Summary of evidence pertaining to eating with dentures identified from the literature

Problem identified in people who wear dentures (compared with being dentate)	Supporting references
Low intake of fruits and vegetables	[26,27]
Low intake of fibre	[26,28,29]
Low intake of protein	[29,30]
Delivering advice in dental practice improves the diet of denture wearers	[27,31-36]
Need to adapt food preparation, for example mashing	[8,37]
Pain on eating (especially in early days while adjusting to new dentures)	[8,9,37-41]
Dentures moving causing eating difficulty	[9,22,37-39]
Food sticks to dentures	[8,9,22,37-39]
Change in taste perception	[37,42]
Reduced ability to chew foods	[29,37,43-45]
Wearing dentures leads to loss of enjoyment of eating (but optimising dentures improves this)	[8,9,22]
Wearing dentures negatively impacts on eating-related socialising (but optimising dentures improves this)	[9,22,38]
Denture fixative is useful for eating-related socialising	[22]

### 3.3 | Development of a patient leaflet for support with eating with dentures (Stage 5)

Based on feedback from the patient participants, the leaflet focused on overcoming functional limitations when eating with dentures. However, in order to address the nutritional needs of patients, which

**TABLE 4** Evidence Statements derived from distilling the evidence from Stage 1

Evidence statement	Source
Wearing dentures leads to loss of enjoyment of eating	Literature Focus groups (patient)
Wearing dentures has a negative impact on eating-relating socialising	Literature Focus groups (patient)
Patient concerns were around the functional limitations and social and emotional impacts on eating of wearing dentures	Focus groups (patient) Literature
People who wear dentures may consume a less healthy diet (with respect to fruits and vegetables, fibre and some macronutrients)	Literature
Optimising dentures/ replacing dentures improves eating-related quality of Life (ERQoL)	Literature
Dentists adjust the denture rather than adjusting the diet to overcome problems with eating	Focus groups (patient/dentists/DCP)
Patients received no advice on what they can realistically expect (with regard ability to eat) following the provision of dentures	Focus groups (patient)
Authoritative groups advocate dentists, and dental care professionals should support patients to change dietary behaviour; however, dentists and dental care professionals feel they have not had adequate training with respect to this	Focus groups (dentists/DCP)
Patients do not see dentists as a credible source of advice on eating as dentists do not have first-hand experience of eating with dentures. Dentists feel established. People who wear dentures are a more credible source of information	Focus groups (patient/dentists/DCP)
Dietary advice through the dental practice improves the diet of denture wearers	Literature
A physical (hard copy) leaflet was the preferred mode for providing support with eating (Web-based materials were also viewed favourably, especially as technology use increases)	Focus groups (patient/dentists/DCP)

**TABLE 5** Opportunities for development of dietary intervention for people who wear dentures including feedback from professional engagement

	Opportunities for development	Feedback or comment
1.	Develop eating advice for denture wearers that focuses on overcoming functional problems with eating (as indirect opportunity to provide healthier eating advice)	<p>Whenever possible eating advice should be tailored to specific problems of patient rather than general dietary information</p> <p>Provide information on specific problems, which clinicians and their patients can select on the basis of individual need</p> <p>Focusing on coping strategies: this is very important, particularly for compromised patients</p> <p>Focusing on the psychological component of advice: if the patient is willing to accept the advice, eating behaviour can be changed even with poorly fitting dentures</p> <p>Changing the way of eating: suggest foods that the patients can cope with (not just “soft diet”). Give example of diet plans to help the patients eat better</p> <p>Integrate eating intervention with denture delivering appointment</p> <p>Managing patient expectations when giving denture as a treatment option</p>
2	Inclusion of eating advice for people who wear dentures in updates of existing toolkits for oral health practitioners, for example Public Health England's “Delivering Better Oral Health Professionals”	<p>Ensuring oral health toolkits for dentists include information on eating with dentures.</p> <p>Delivering Better Oral Health Toolkit (Public Health England) is used by many dentists, and it is potentially the best method to make a change in the clinical practice</p>
3	Train dentists and DCP to be competent to provide patients advice and support on eating with dentures through the undergraduate curriculum	<p>It is useful and essential for dental students to learn about giving diet advice (tailored to denture wearers), which helps them improve the acceptance of complete dentures</p> <p>Dentists explained that they received training on what constitutes healthy eating and diet recommendations but not specific to denture wearers, felt with no first-hand experience of wearing dentures they had little knowledge on what is difficult/easy to eat</p> <p>Dietary intervention should consider appropriate behaviour change techniques</p> <p>Students should make effort to learn directly from their patients about the experience of eating with dentures</p> <p>Expert patients could be involved in talking to the students about their experience in support or focus groups</p> <p>Holding seminars to practice giving advice and to learn how to tailor the advice to certain patients</p>
4	Develop an online support group/blog for people who wear dentures relating to eating better with dentures	<p>Support groups/blogs could enhance social support and feeling of confidence</p> <p>The Internet is a good way to provide information on eating with dentures</p> <p>Delivery by the Internet would enable eating intervention to be tailored</p> <p>Some participants noted some patients have no access to the Internet or are not interested in the use of technology, which could lead to inequities in provision of advice</p> <p>Use of the Internet to provide support should be in conjunction with other more traditional sources of information (eg leaflets)</p>
5	Create videos on eating coping strategies to show in the prosthodontics waiting room and online forums	<p>A good tool for increasing knowledge, particularly for those too embarrassed to ask for help/advice when they are having eating problems</p> <p>Video presentations in isolation may not change eating behaviour and could make some of the patients anxious while they are waiting</p> <p>Use short, sharp, and effective videos, and probably based on real patient stories</p> <p>If posted online, the link to the video should be placed on a leaflet given to all patients, who receive new dentures</p>
6	Produce a patient leaflet on eating well with dentures	<p>A good way to provide information on eating with dentures for patients to absorb and digest the information at their own pace</p> <p>Those useful for practical advice to overcome eating problems, leaflets are a poor method for promoting healthier eating behaviour change</p> <p>Combining the information in the leaflet with pictures to become more effective</p> <p>Keeping it as short as possible</p> <p>The dental team can talk through a leaflet, and it could include a link to appropriate online forum/website as advice coming from peers/other denture wearers</p> <p>Could be available in few different languages</p> <p>Should include healthy nutritional tips</p>

TABLE 5 (Continued)

	Opportunities for development	Feedback or comment
7	Develop a website or Web-based information (to include a Web-based intervention, online support group/blog, video and the leaflet) in addition to recipes and healthier eating information	Thought a good idea by all participants. It was recognised most turn to the Web for information and keep up to date This concept would allow progressive development of additional information and updating It would enable customisation to patient Recipes should address vegetarians/vegans' special dietary requirements Should consider behaviour change theory It may include testimonials from the patients on how improving their diet improved their health and eating-related quality of life It could be accessed by wide range of people, for example dietitians, care home staff, community support nursing or carers Main problem is that some older people may not have access to the Internet. (Collaboration with other organisations, which can help older people to access the Internet was suggested)
8	Develop Continuing Professional Development/Education courses on the subject for dentists and DCPs	A good idea to keep all members of the dental team are up to date with current knowledge, resources and guidelines Healthcare systems need to change to support/remunerate such interventions aiming at changing eating and or dietary behaviour It could be integrated with other oral health preventive courses and include dietary advice in general (all patients)

were identified through the literature and through feedback from professionals, healthier eating messages were also included in an unobtrusive way—a “stealth health” approach. The leaflet was therefore structured around key themes based on issues with eating, described by people who wear dentures, identified in our previous research<sup>9,22</sup> and through the literature review (see Table 3). These themes were as follows: (i) problems with biting and chewing foods; (ii) foods sticking to dentures; (iii) dentures moving when biting foods; (iv) pain when eating with dentures, and (v) foods becoming trapped underneath dentures. Healthier eating tips were embedded within these themes. The focus for the leaflet was always on the functional problems identified by those who wear dentures, but unobtrusive healthier eating tips (eg adding vegetables to slow-cooked meat stews to make the vegetables softer, choosing wholemeal (unseeded) bread as it is less sticky than white) were provided as solutions where possible. Verbatim quotations from people who wore dentures were included in the main themes of the leaflet to give an authentic “patient voice.”

A wealth of health education literature aimed at an older demographic was reviewed by the research team with the input from a graphic designer to identify the style and layout of a draft leaflet. The prototype leaflet (*Stage 5 output*) is available in the Appendix S1.

### 3.4 | Face validity of the prototype leaflet (Stage 6)

Six patient who wore complete denture (four men and two women) aged between 57 and 84 took part in interviews to provide feedback on the information leaflet between July and September 2019. Interviews lasted for between 10 and 15 minutes. Illustrative quotes are included below with participants' age and sex.

Feedback on the leaflet was overwhelmingly positive with general impressions that the information was very relevant:

I think it's very comprehensive and it's been well thought out

(Interview 1; Male, 84 years old)

The presentation of the leaflets was felt to be appropriate, and one participant explained how the coloured sections served as a point of reference:

Design wise, it's quite good from my point of view, it's straight forward, you know?

(Interview 5: Male, 57 years old)

I think I quite like it and I think the different colours were good. So, you know, if you want to go back and look at something, you can think, “Oh, yes, that was on the blue one.” So, that's a good idea.

(Interview 2: Female, 71 years old)

Participants reported liking the fact that there was information included, which represented the experience of people who wore dentures:

Interviewer: any final thoughts or recommendations for how it could be improved?

Participant: Erm, no, I don't think so. I'm looking at the leaflet now and I think the main thing is to get people's experiences

(Interview 4: Female, 75 years old)

Yes, it's better if you have somebody who's actually wearing the dentures, so they know what it's like.... Well, he [dentist] may know everything about the

teeth but he doesn't know how it feels to wear them and eat with them. So, it's the people who wear them who know what it's like to eat with them.

(Interview 2: Female, 71 years old)

The types of food that the leaflet focused on were also perceived as relevant, and participants said these foods were typical examples of food that people had difficulty eating:

Lettuce, I just can't eat lettuce; I don't know why? So, yes, all that information, it's all relevant

(Interview 4: Female, 75 years old)

The last page, the tips, "Try removing seeds from foods. Buy seedless grapes etc" which is very good

(Interview 1: Male, 84 years old)

Some participants suggested that the suggestion to use fixatives would only be relevant for some; this was sometimes described as being linked to the length of time that people had used dentures, meaning that the information in the leaflet on use of fixative might not be as effective for the experienced denture as for a new denture wearer:

But, as I say, after 50 years, I've got no gums there anyway so there's just nothing to make them stick, you know?

(Interview 2: Female, 71 years old)

Most people suggested, as long-term wearers of dentures, they did not receive any new information from the leaflet as they had learned this themselves during their time wearing dentures:

It is quite good, I mean I will be honest, because of the amount of years I have been wearing dentures it doesn't really tell me anything new

(Interview 5: Male, 57 years old)

Regarding when this information would be most appropriate, participants were in agreement that this leaflet would be most relevant when people first started wearing dentures:

Yes, it could be given out to people; yes. So, from the beginning

(Interview 3: Female, 73 years old)

Participant: For new denture wearers it's very good

Interviewer: Okay. Is there anything in particular that you think is useful for new denture wearers?

Participant: It advises you what foods to avoid... how to eat certain foods that...making the pieces even

smaller, so you are not getting your teeth in a tangle while you are trying to chew

(Interview 5: Male, 57 years old)

Several people recounted their own experience of having dentures for the first time and how, in the absence of any information or eating advice, their experience of getting used to dentures had been primarily one of trial and error:

The only potentially addition suggested related to fixatives. One participant suggested that there are a wide range of different fixative products available, and it may be useful to highlight this in the leaflet:

on the "tips" I would put something about all these things [fixatives] that are on the market now

(Interview 6: Female, 80 years old)

And linked to this point, another participant suggested that information describing how to clean dentures after using fixatives could be useful:

Participant: Yeah, for first time users it might be nice to have some tips on how to clean them, you know?

Interviewer: Okay. Is that specifically at night-time or after you have eaten something that has got stuck in them?

Participant: Well, if you use a fixative cleaning them after you have eaten something would be a bit difficult

(Interview 5: Male, 57 years old)

Conversely, one participant suggested that the information of fixative might be less relevant if the target audience for this leaflet was people wearing dentures for the first-time, suggesting that fixative might be more appropriate for people who had used dentures for longer, although described how fixatives were not helpful for their personal situation:

So, "some patients found that using it before eating, it helps stop getting food trapped." Well, if you're just getting dentures, they're going to fit really well, hopefully, and that will just keep them in place and it is really helpful. But, as I say, after 50 years, I've got no gums there anyway so there's just nothing to make them stick, you know

(Interview 2: Female, 71 years old)

## 4 | DISCUSSION

This study took a novel approach to understanding how to support patients with complete dentures to eat better, by distilling and



integrating evidence from the published literature, focus groups, and perspectives from service users and providers in a co-development process. The iterative co-development process adopted in this research has led to the development of a patient-centric leaflet to provide support for patients when eating with dentures. The co-development approach used was similar to that of O'Brien et al<sup>21</sup> that combined evidence from the literature and focus groups and involved stakeholders as co-designers of a Web-based lifestyle intervention for people in the retirement transition. The present approach is also comparable to other studies that have successfully engaged users in designing healthcare services to maximise user acceptability and potential effectiveness.<sup>46,47</sup> However, this study is the first to apply co-development to inform eating intervention for those who wear dentures. The study employed methods known to increase the quality and effectiveness of interventions,<sup>48</sup> including seeking to understanding the problem from the user perspective, identifying modifiable causal or contextual factors, deciding on the mechanisms of change (eg a health stealth approach) and clarifying with users the best way to deliver these changes (patient leaflet).

#### 4.1 | Discussion of the current approach and the underpinning evidence

The qualitative findings from the focus groups and from the published literature in Stage 1 indicated that patients want advice to overcome the physical problems they encountered when eating with complete dentures, and not necessarily healthier eating advice. Dental professionals also perceived conflict between providing advice to overcome functional problems vs providing healthier eating advice. Therefore, rather than adopting an approach that considered behavioural change techniques to promote healthier eating, an approach that focused on practical advice to overcome functional eating problems supplemented with unobtrusive healthier eating tips was used. Moreover, the included practical advice was obtained from those experienced in wearing dentures as opposed to being clinician led. Verbatim quotations from participants that wear dentures were also included in the main themes of the leaflet to give patients' a voice, and to enhance readability of the leaflet.<sup>49</sup> Hence, the unique features of the leaflet were that it was patient-centric, aimed at enhancing enjoyment of eating, and through a "health-by-stealth" approach aimed to have an indirect impact on healthier eating. The success of the leaflet in delivering these aims will be evaluated in further research.

The patient-led approach to the development of the leaflet and its content also addressed an issue identified through the patient/participant focus groups that patients who wear dentures do not feel that dental clinicians are a credible source of information on eating. Moreover, the developed leaflet helps address the issue identified by prosthodontists and DCPs that they did not feel adequately equipped to provide dietary advice. Moreover, the findings suggest that prosthodontists employed within the UK's National Health Service perceive that the provision of healthier eating advice

is outside their remit. Further consideration of the role of providing dietary advice to people who wear dentures is warranted.

The findings from the focus groups, with the professionals, indicated that current support for eating with dentures is generally only provided if requested by a patient and is not a routine part of care. Moreover, the data indicated some misconceptions amongst professional regarding what constitutes appropriate advice for nutrition and healthier eating, for example advising the use nutritional supplements (eg "meal replacements") as a replacement for food (this would only be appropriate under the guidance of a registered dietitian or medical clinician), and describing healthier eating as "eating raw carrot," which demonstrates a narrow understanding of current dietary guidelines.

The focus groups, with dental professionals, highlighted not only misconceptions around what constitutes good nutrition advice but also assumptions around the receptiveness of patients to receiving dietary intervention. For example, although it is true that a higher proportion of the population who are edentulous come from lower socio-economic groups, it is incorrect to assume that because of this dietary intervention will not be effective and to make assumptions about patients' readiness to change based on socio-economic background. When providing support with diet and eating to patients' socio-economic factors should be taken into consideration and not presented as a reason not to intervene.

The perception of some professionals that people who wear dentures would not be receptive to changing dietary behaviour, and that some dental professionals thought that to provide dietary advice simultaneously with prostheses was impractical, is interesting as despite these opinions, the literature shows that providing dietary intervention at the time of prosthetic rehabilitation is effective in promoting positive dietary change.<sup>10</sup> Increasing awareness amongst professionals of the effectiveness of dietary advice at the time of prosthetic rehabilitation, for example through continuing professional development, is therefore warranted.

#### 4.2 | Limitations of the current study

In the current study, the qualitative data that underpinned the approach were obtained from a group of participants that were patients attending the Newcastle Dental Hospital in the north-east of England. Thus, the demographic of the sample may not be representative of the UK. Moreover, most participants were referred to the dental hospital by their general dental practitioner from dental practices and were therefore a patient group that were more likely to have experienced difficulties with their dentures in the past. However, it could be argued that this enabled the worst-case scenario with respect to eating with dentures to be captured.

Involving patients and practitioners in the co-development process provides valuable insights, which helps with real-world implementation,<sup>21</sup> and both were engaged in the current research as previously recommended.<sup>50</sup> However, the professional feedback on the *Opportunities for Development* (Stage 3) was limited to

prosthodontists, dentists and DCPs. Ideally, broader feedback could be obtained from other allied health professions, for example dietitians and speech and language therapists. The professional feedback was also constrained to professionals working within the UK health-care system.

Identification of issues around diet and eating with dentures from the literature was obtained through narrative and not systematic review. However, a recent systematic review<sup>3</sup> on the impact wearing complete dentures on nutritional issues did not identify any additional papers published pre-2017 to those identified in this study, thus indicating that the current approach was comprehensive. Moreover, only one additional recent paper<sup>51</sup> was identified through the systematic review, which did not identify any additional issues around eating with dentures to those already identified in this study.

### 4.3 | Future opportunities for development around dietary intervention for those who wear dentures

Within the scope of this project, only one key concept was taken forward (patient leaflet), which was prioritised based on user feedback and practicalities. The research, however, identified several other concepts (*Opportunities for Development*) that could be taken forward to help address the need to support patients who wear dentures eat better. These included the use of Web-based materials, online support groups/blogs for people who wear dentures, provision of appropriate training to dental care providers, and inclusion of information in guidance from authoritative bodies. All these concepts warrant further consideration, co-development and evaluation.

The future development of a Web-based intervention to supplement the leaflet would enable a personalised approach, which deploys evidence-based behavioural change techniques, and which would provide the opportunity for a confidential blog for people who wear dentures to share experiences. A Web-based approach would also enable the hosting of videos on coping strategies (ways to prepare food differently, food swaps) as suggested by user participants in this study. However, the current research identified both advantages and disadvantages of using the Web as a platform to deliver dietary intervention that would need to be considered further before advancing this idea. Concerns that the target age group for advice for eating with dentures tends to be an older demographic who may not use the Internet are supported by a recent Age UK report, indicating that in the UK, 3.4 million people aged 65+ have never used the Internet and many older people stop with age.<sup>52</sup> Nonetheless, data from the UK Office of National Statistics, on the use of technology by older populations, indicate the use of IT in the 65+ age group is increasing.<sup>53</sup>

Removing barriers to dental health professionals providing eating advice is essential to maximise the opportunity that the dental clinic provides to access patients in need of support to eat better and more healthily. In addition to the current approach (to develop a patient leaflet), improving training in nutrition for dental health

professionals was also identified as an *Opportunity for Development* to address this. There was in general support for the idea of improved training in nutrition for both dentists and DCP. The identified *Opportunities for Development* included nutrition training through both the undergraduate curricula and continuing professional development. This is in line with the recommendations of several authoritative bodies, which recommend that dentist and DCPs should provide dietary advice in line with national guidelines.<sup>54-57</sup> Despite this idea not being prioritised for further development in this current study, there is nonetheless a need for development of training in nutrition for dental professionals beyond advice to reduce sugars for caries prevention.

Although it is not yet known whether the unobtrusive healthier eating elements used in the leaflet are effective in driving positive dietary change, future research will test the impact of the leaflet on the dietary intake, nutritional status and ERQOL of people who wear dentures.

## 5 | CONCLUSION

This study has described a systematic and rigorous integration of scientific evidence, expert experience, and patient input to develop a patient-centric, evidence-based approach to an intervention around eating with dentures. The study has resulted in a patient leaflet on eating with dentures that based on initial face validity is likely to be well received by edentulous people.

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### CONFLICT OF INTEREST

P. Moynihan has conducted consultancy work on the topic of nutrition and wearing dentures for GlaxoSmithKline for which the University of Adelaide received a fee. The other authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

### AUTHOR CONTRIBUTIONS

HF Al-Sultani contributed to the conception, design, data acquisition, and data analysis and interpretation, and helped to draft the manuscript. JC Field contributed to the conception, design, and data analysis and interpretation, and critically revised the manuscript. M Breckons contributed to the data acquisition and data analysis and critically revised the manuscript. JM Thomason contributed to conception and design and critically revised the manuscript. PJ

Moynihan contributed to conception, design and data analysis and drafted the manuscript. All authors gave final approval and agreed to be accountable for all aspects of the work.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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