

Development and assessment of reliable patient-based hypodontia website

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Background: The aim of the study was to develop a high-quality valid patient information website with regard to hypodontia and its management, and to test its effectiveness in delivering this information.

Methods: A patient-based hypodontia website was created and placed on the Trust's website. It was then validated using five website assessment tools: Flesch reading ease score, LIDA, DISCERN, Journal of American Medical Association and Health on the Net seal. A cross-sectional prospective design was adopted using a 15-item questionnaire to assess the effectiveness of the newly created hypodontia website in helping participants understand their management. New patients attending their first hypodontia clinic consultation appointment were invited to complete the questionnaire both before and after visiting the website.

Results: The newly created hypodontia website scored well with the website validation tools in comparison with previously assessed hypodontia websites. Forty participants (25 female) took part in the questionnaire study, with a mean age of 15.3 (SD 6.1) years. After visiting the website, 85% of participants felt the website was helpful in understanding hypodontia, with an observed improvement in all domains of the questionnaire, reaching statistical significance ($p < 0.05$ – 0.001) in 10 of the 15 items.

Conclusion: This study found that patients felt that a hypodontia website was effective in improving their perceived knowledge of hypodontia.

Keywords: hypodontia, website, patient information

Introduction

Hypodontia is the congenital developmental absence of a tooth, excluding the third permanent molar.¹ It is the most common dental developmental abnormality affecting 6% of the European population.² Managing patients with hypodontia can be both clinically complex and lengthy, not only due to the absence of teeth but also due to frequent association of dental abnormalities with this condition.^{3–5} In addition, the negative psychosocial impact of hypodontia can impact both the patient and their parents.^{6,7}

Patients with hypodontia are frequently diagnosed at young age and may undertake multidisciplinary treatment that can span several years. As with any treatment, it is important that patients and parents are fully informed of the treatment options. These can be divided into: space opening with prosthetic replacement of the missing teeth; and space closure with orthodontic camouflage of the missing teeth.

There are a multitude of considerations that are taken into account in order to determine the best outcome for patients and to assist patients in this otherwise difficult decision process, patients are seen in a multidisciplinary clinic environment, with all the relevant specialists involved in managing hypodontia present to give advice and

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support.^{8,9} This not only allows pooling of clinical expertise but also gives patients the opportunity to meet the clinicians who will lead different aspects of the patient care.

Patients must be well informed regarding their treatment in order to provide consent and to help ensure they have realistic expectations of care. When patient expectations are met, they are more likely to be satisfied with treatment.^{10,11} Primarily information is relayed to patients in the clinical consultation, which can then be supplemented with letters and leaflets.¹² However, the Internet is increasingly becoming a source of information with the fifth most common Internet activity to seek health-related information; this has increased by threefold since 2007.¹³ In the UK, the majority of adults access the Internet daily and increasingly on mobile devices, which highlights the importance of clinicians engaging with the Internet as a source to accurately inform patients.¹³

Many clinicians are likely to have experienced the “Internet research” patient who has believed false inaccurate information regarding treatment. The time then taken to correctly inform patients has been felt to be a burden for the clinician.¹⁴ The use of an Internet prescription has been suggested to overcome this where clinicians direct patients to specific websites.^{15,16} However, in order for this to work websites that are both high quality and contain reliable information must be available. Several website assessment tools have been developed to assess this,^{17–21} yet when applied to existing hypodontia websites it was found that no one website scored highly across all the tools.²²

The aim of the current study was to develop a high-quality valid patient information website with regard to hypodontia and its management, and to test its effectiveness in delivering this information.

Methods

Website development and validation

The content for the new website was created using Microsoft Word 2013 (Redmond, WA, USA), which was then converted into a webpage with the assistance of hospital communication team and incorporated into the Trust’s website. Ethical approval and informed consent were not required as the study was designed and undertaken with the registration of the Clinical Effectiveness Team of Barts Health NHS Trust (ID: 5177 07.2015). The content was arranged in a question-and-answer format over two webpages. The first webpage provided information on the description, causes and prevalence of hypodontia, while the second webpage discussed the management of hypodontia, including treatment options available. The aim was to give the reader a basic but comprehensive understanding of hypodontia, and it was designed to increase

the ease with which patients can navigate the website. The questions not only acted as a contents page but also were hyper-linked to enable quick access to information. The website was then validated against a number of existing website assessment tools that covered a number of domains including readability, reliability, usability and accessibility, as seen in Table 1.

Effectiveness of the website to deliver information

A prospective cross-sectional study design was used to evaluate the effectiveness of the website in helping patients understand hypodontia. Patients who were attending the hypodontia multidisciplinary team (MDT) clinic for the first time were invited to take part in the study. Bart’s and The London Research and Design Services advised that no formal consent was judged necessary by the research ethics committee in view of the study design. Parents and children were approached and invited to take part. They agreed by verbal consent to completing the project. A total of 40 participants took part in the study as this was both a practical and achievable number without disrupting the clinic. The inclusion criteria for the study were: a confirmed diagnosis of hypodontia, attending the hypodontia MDT clinic for the first time, aged ≥ 10 years, any sex and fluent in English. The exclusion criteria for the study were: participants with craniofacial deformities who had previously attended the hypodontia MDT clinic and patients undergoing treatment for hypodontia.

A 15-item questionnaire was developed to assess a range of domains including participants’ understanding of hypodontia, orthodontic and restorative management of the condition and allow participant feedback of the newly created hypodontia website. Prior to use, the questionnaire was piloted by the authors’ own patients with hypodontia. The answers were provided on a dichotomous scale or utilized a visual analog scale (VAS). The questionnaire was completed by participants at two time points, prior to their appointment in the hypodontia MDT clinic (T0). The first questionnaire provided baseline

Table 1 Summary of website assessment tools

Website assessment tool	Domain accessed	Evaluation method
Flesch reading ease score (FRES)	Ease of reading text	Online FRES calculator
LIDA	Usability, reliability and accessibility	Questionnaire
DISCERN	Reliability and information on treatment choices	Questionnaire
JAMA benchmarks	Authorship, attribution, disclosure and website currency	Questionnaire

Abbreviation: JAMA, Journal of American Medical Association.

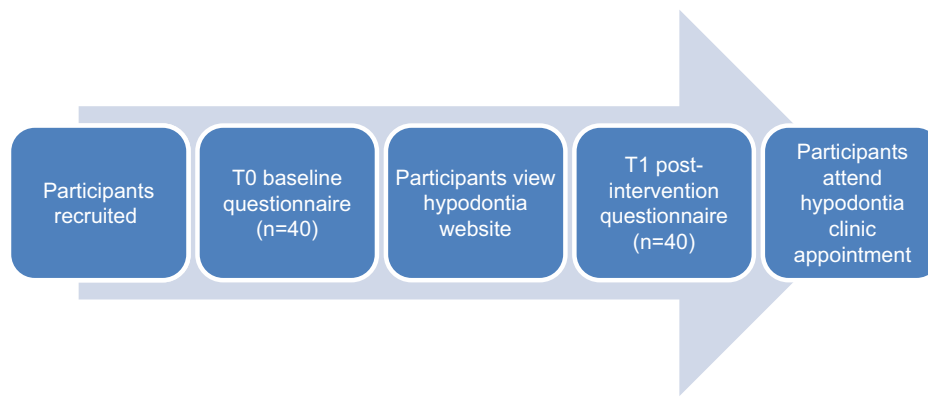


Figure 1 Summary of participant pathway.

information on the participants' knowledge of hypodontia. The participant was then given the opportunity to view the hypodontia website and again invited to complete the questionnaire (T1). Both these time points were prior to the participants' MDT appointment to remove bias. The answers to the paired groups were then evaluated to assess the relative effectiveness of the website. This has been summarized in Figure 1.

Data analysis

All questionnaires were checked for completeness. Descriptive statistics was carried out on Microsoft Excel 2013 with means and standard deviations reported. Data analysis was performed using IBM Statistical Package for the Social Sciences (Version 23, 2015; New York, NY, USA) with statistical significance determined at $p < 0.05$. Where the questionnaire responses were dichotomized variables, McNemar test was used. For the questionnaire responses based on the VAS, Wilcoxon signed-rank test was used.

Results

Website validation

The newly created hypodontia website was validated against the website assessment tools; the results are shown in

Table 2. The second column reports the average score in relation to all worldwide hypodontia websites achieved using each tool, as reported by Kukadia.²² The third column, on the other hand, shows the single highest score found per assessment tool, but importantly these websites did not score highly across all the tools. The Flesch reading ease score (FRES) score of 77.8 for the newly developed website indicates that the readability of the website was good; this score was much greater than the average FRES score reported by Kukadia,²² but just lower than the highest scoring website. As with FRES, the results from the LIDA instrument and Journal of American Medical Association (JAMA) benchmark for the new hypodontia website were more than the average score found by Kukadia,²² but not as high as the highest single scoring website. The DISCERN score for the hypodontia website was greater than both the average and highest scores of the websites assessed by Kukadia.²²

Effectiveness of the website to deliver information

Of the participants, 25 (62%) were females. The majority of the participants were between the ages of 10 and 18 years, with a mean age of 15.3 (SD 6.1) years. There were two outliers at ages 33 and 46 years, as seen in Figure 2.

Table 2 Results from website assessment tools for the new hypodontia website

Assessment tool	Newly developed hypodontia website	Average results (Kukadia's study) ²²	Highest scores (Kukadia's study) ²²
Flesch reading ease score	77.8	47.09	83.1
LIDA – usability	81%	51%	92%
LIDA – reliability	62%	28%	73%
DISCERN	86%	40%	72.5%
JAMA	50%	0%	75%

Abbreviation: JAMA, Journal of American Medical Association.

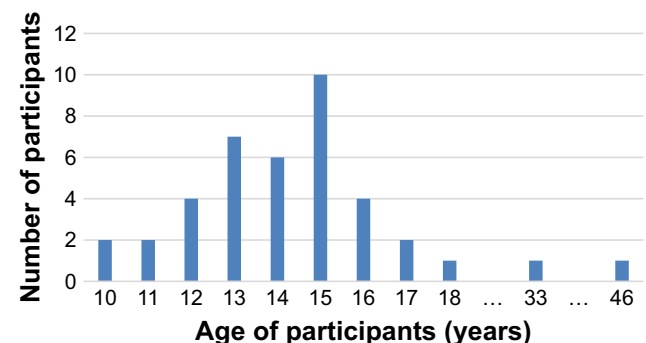


Figure 2 Age distribution of participants.

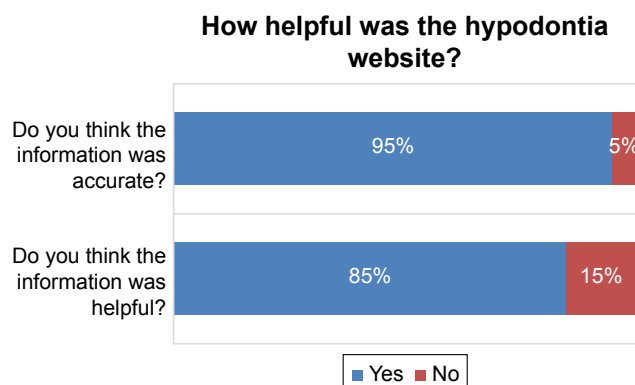


Figure 3 Post-intervention response on how helpful participants found the hypodontia website (n=34).

Participants were asked about how useful they found the new hypodontia website. The majority (85%–95%) of participants found the website helpful and accurate (Figure 3). In relation to the findings from Table 3, participants demonstrated a highly statistically significant increase in knowledge in relation to 10 questions. No improvement in their knowledge was found in five questions, as shown in Table 3, where the p -value was >0.05 .

Discussion

The present study aimed to develop a patient-based hypodontia website offering a high-quality reliable information considering the varying quality of many current hypodontia websites.²² When the present hypodontia website was validated against existing website assessment tools, it

was generally found to score well (Table 2). By assessing the hypodontia website against a range of tools, it was found to cover a broad number of domains, unlike other studies that have assessed websites with no greater than three domains.^{21,23–25} As yet there is no “gold standard” with which to compare healthcare websites against, therefore use of a combination of tools helps overcome the limitations of the individual tools.

Measuring the readability of any patient-targeted healthcare information is important as if the reading level is too complex for the targeted audience, then there will be limited comprehension of the material. The FRES score of the current hypodontia website was 77.8, which is at an educational level of a 12-year-old and is categorized as fairly easy to read. The mean age of participants in the present study was 15.3 (SD 6.1) years, which shows that the website would have been suitable for the majority of participants.

Both LIDA and DISCERN are reliable and validated ways of assessing the website, with useful guidance provided. It has been suggested that a gold standard for the overall LIDA and DISCERN score should be 90%,²⁰ which was met by the new hypodontia website for either of these tools. However, the finding in the current study was very favorable when compared to both the average and highest scoring hypodontia websites reported by Kukadia.²²

The JAMA benchmarks are also prone to the same bias as LIDA and DISCERN. However, unlike LIDA and DISCERN, there is minimal guidance to help answer these questions.

Table 3 Participant responses to questions from questionnaire at T0 and T1

Question	T0 (%)	T1 (%)	p-value
Do you know what the term hypodontia means?	18 (n=7)	93 (n=37)	$p<0.001^*$
Were you aware that some people are born with missing teeth?	63 (n=25)	80 (n=32)	$p=0.065$
Were you aware that missing teeth can sometimes run in families?	53 (n=21)	85 (n=33)	$p<0.001^*$
Do you know that some teeth are more commonly missing than others?	20 (n=8)	60 (n=32)	$p<0.001^*$
What percentage of the population do you think have missing teeth?	23 (n=9)	55 (n=22)	$p<0.001^*$
To what extent do you agree with the statement that having missing teeth may mean that your other teeth might look different?	62	70	$p=0.242$
To what extent do you agree with the statement that baby teeth always fall out when you are a teenager?	37	47	$p=0.063$
Did you know that the hypodontia team consists of dedicated specialists that work together to make joint decisions about your care?	30 (n=12)	55 (n=34)	$p<0.001^*$
To what extent do you agree with the statement that all people with missing teeth need braces?	39	42	$p=0.530$
Were you aware that not all missing teeth need to be replaced?	50 (n=20)	75 (n=30)	$p=0.021^*$
To what extent do you agree with the statement that retainers keep teeth in their new position and are an important part of the brace?	71	76	$p=0.151$
Are you aware of what a denture is?	55 (n=22)	80 (n=32)	$p=0.002^*$
Are you aware of what a bridge is?	35 (n=14)	58 (n=23)	$p=0.004^*$
Are you aware of what an implant is?	63 (n=25)	83 (n=33)	$p=0.008^*$
Do you know from what age patients can have an implant?	23 (n=9)	48 (n=19)	$p=0.002^*$

Note: *Difference in results was statistically significant as $p<0.05$.

When compared to other studies, a 100% JAMA score has been found to be present in 45% of other websites.²⁶ The low score for the current hypodontia website may be due to the way the user uses this tool. Unlike LIDA and DISCERN, the question is not answered on a scale reflecting the extent to which the point is met. Instead either a yes=1 or no=0 answer is given. When the research team applied this scoring, unless all parts of the criteria were answered, a score of 0 was given. Therefore, it may be that the new hypodontia website was assessed more harshly than in other studies reflecting the score given. Yet in comparison with the average and highest scores cited by Kukadia,²² the new hypodontia website was found to be very favorable.

The advantage of having the hypodontia webpages as part of the hospital Trust's website is that other information about the services is immediately available to the patient. Other studies have found that patients are expected to find local practical information from hospital websites.¹¹ Therefore, the new hypodontia website would also meet these practical needs.

In the participant evaluation of the website, a questionnaire was applied that was not validated, but was piloted by the authors' own patients. This helped identify areas in the questionnaire that needed improvement prior to being used in this study. The language was kept simple in the questionnaire with the FRES score of the questionnaire being very similar to the website. This ensured consistency between both the questionnaire and the website.

The questions were worded such that participants were frequently asked whether they felt they had an understanding of the topic, as opposed to testing their understanding of the topic. As the intervention was applied to participants in related groups, the changes seen would reflect the participants' opinion of how helpful the website was in improving their understanding of hypodontia. However, the limitations of such questions may be seen to be "leading", which can result in bias if the participant falsely claims understanding. This may have been further compounded by the answer options given as yes or no. Due to a lack of option of "I don't know", the answers may be the result of a false positive.

This prospective study design with related groups is a unique way of assessing the effectiveness of the hypodontia website. Other studies have assessed website effectiveness using questionnaires but with a smaller sample size and sought participants' opinion of the website only after it has been viewed.²⁷ Therefore, it was not possible to carry out a power calculation in order to determine a sample size.

Participants with a confirmed diagnosis of hypodontia were included in this study, with no other information

regarding their malocclusion being recorded. As a result, it is not known whether those with more severe hypodontia were more inclined to participate or took a greater interest in the website. However, it is the authors' opinion that even if only a single tooth is missing, it is still of value for the patient to view such a website in order to be fully informed prior to starting treatment, particularly when the tooth missing is an anterior one.

It was found that participant's overall understanding of hypodontia significantly improved after viewing the website. However, this improvement was seen in questions that were asked for participants' understanding of the topic, with the exception of question 10 that tested participants' knowledge of the prevalence of hypodontia. The questions that used a VAS were found to have an overall increase in median agreement, but this difference was not statistically significant. This may be because participants found these questions harder to interpret. The questionnaire asked participants how much information they had been given by their dentist prior to the hypodontia appointment. Eighteen percent (n=7) reported not having been given any information, which is similar to the findings at the Manchester hypodontia clinic as 17% of patients did not know why they were attending the clinic.²⁸ This suggests that it may be beneficial for referring dental practitioners to be made aware of the hypodontia website so that information can be disseminated to patients as early as possible.

The response to a third of the questions assessing participants understanding of orthodontics, showed a significant improvement in understanding after viewing the website. However, in comparison with participants' understanding of hypodontia and restorative dentistry, the improvement in understanding of orthodontics was less. The third part of the questionnaire asked participants about different aspects of restorative dentistry. After viewing the website, the results in this section revealed a statistically significant difference. These questions focused on the different prosthetic treatment options available to replace missing teeth, which may have reflected the fact that this section of the website was validated by DISCERN. This reflects the benefit of using such tools to help develop websites.

Conclusion

The present study highlights the potential advantages of developing a condition-specific website, with a significant difference observed in a patient's perceived understanding of hypodontia before and after viewing a patient-based hypodontia website.

Disclosure

The authors report no conflicts of interest in this work.

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