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Evaluation on the effectiveness of a peer led video on oral hygiene education in young children

Abstract

This study evaluated the effectiveness of a peer-led oral hygiene education video in improving oral hygiene knowledge and behaviour in year two (six to seven-year-old) and year three (seven to eight-year-old) children. A novel peer-led oral hygiene education video was created, in which a group of six to ten-year-old children delivered key oral hygiene messages. The video was then shown to children of the same age group, whom oral hygiene knowledge and behaviours were assessed before and after the video. Results found that the video was an effective method of improving overall oral hygiene knowledge. It was effective in improving specific aspects of oral hygiene such as knowledge of the frequency of brushing and toothpaste amount, and in the behaviour of using the toothbrush in a circular motion. It was not an effective method in improving the overall oral hygiene knowledge and behaviour of *Year Two* children, demonstrating children may develop significantly in just 1 year.

Keywords

Oral health education, Peer-led education, Educational video, Children's oral hygiene

Declarations

Conflict of interest

All authors declare they have no conflicts of interest.

Ethical approval

Ethical approval for this study was granted by the University of Leeds Dental Student Research Ethics Committee (Reference number: FYP2018DRWYB).

Introduction

The prevalence, severity and extent of caries and periodontal disease in children remain high, drastically affecting their quality of life, and incurring high financial and emotional treatment costs (WHO, 2017). According to the Child Dental Health Survey 2013, 31% of five-year-olds and 46% of eight-year-olds have 'obvious decay experience', and 22% of five-year-olds and 46% of eight-year-olds have experienced gingival inflammation (HSCIC, 2015). Intervening between such ages may therefore bring benefit (Robertson, et al., 2011). In the United Kingdom (UK), approximately "80% of caries is found in 20% of children" (PHE, 2017). Children from lower socioeconomic families and ethnic minorities are more likely to be affected (HSCIC, 2015), making these diseases of social inequality.

The maintenance of excellent oral hygiene is critical in preventing these diseases (*ibid*) and remains a much-needed research area (Cooper et al., 2013). Methods to motivate oral hygiene can be universal or targeted towards high-risk children (Gray-Burrows et al., 2016). When working with children in this modern age, methods should also be attractive and adopt communication tools that children are familiar with, such as electronic devices e.g. iPads. Such devices are accessible by ~86% of children in the UK (Statistica, 2017), and most of which are capable of streaming videos from familiar channels such as YouTube, etc.

Videos are an entertaining, accessible and cost-effective channel for educating groups and individuals. They offer a fixed standard of teaching that can be repeated based on the viewer's needs, and have been extensively used in healthcare education e.g. for nutrition, asthma and diabetes. Professionally made videos starring trained adult teachers has been qualitatively evaluated as an acceptable method for oral health education in children with special needs (Palin-Palokas et al., 1997). A randomized trial further supported the effectiveness of such videos in improving the oral hygiene of autistic children (Popple et al., 2016), but faced a high dropout rate. Indeed, a more rigorous systematic review by Kay and Locker, 1998 has noted that the effectiveness of media usage in oral healthcare is yet to be conclusive due to questionability of the methodologies used. The use of a peer-led oral hygiene education video has yet to be investigated.

Peer-led education involves the delivery of an educational programme by peers of a similar or slightly older age than the students receiving it. Its effectiveness is supported by social learning theories (Bandura, 1976), which advocate that sensitive information is more easily shared between peers of a similar age. There is no strong evidence supporting this method of education due to the inability and unethicality of controlling many of the confounding factors. However, a review by Mellanby et al., 2000 has suggested that peer leaders for children were at least as or more effective than adult leaders. A randomised clinical trial has also demonstrated the effectiveness of video modelling in reducing children's anxiety towards dental treatment under Inhalation Sedation (Al-Namankany et al., 2015). Therefore, by integrating the benefits of both methods, there is potential for a peer-led oral hygiene education video to be effective.

There has not been clear consensus drawn on what developmental stage is the best time to motivate oral hygiene in children (Silvia et al., 2016), some suggest it should begin prenatally by parental orientation (Brook et al., 1996), whereas others recommend the school age, where children develop many of their beliefs, attitudes and skills, and may be more receptive (Rodrigues et al., 2003). A systematic review of longitudinal studies by Müller and Minger,

2013 has noted that susceptibility to peer influence starts increasing from middle childhood (six to eight-years old) and peaks in early adolescence (eleven to thirteen-years-old). Children in their middle childhood years also start developing more logical and concrete reasoning, become less egocentric (Piaget, 1964), and gain more independence in undertaking daily tasks such as toothbrushing (CDCP, 2017), therefore a peer-led oral hygiene education video may be effective during this age.

Materials and methods

The objectives were to assess the video's effectiveness in improving:

i. Oral hygiene knowledge
ii. Oral hygiene behaviour

in Year Two and Year Three children.

The study commenced with the development of a prototype video starring six to eight-year-old children delivering key oral hygiene messages. Reviews by a focus group of paediatric dentists, orthodontists, dental nurses and dental students from the Leeds School of Dentistry, suggested improvements to its content, which led to the production of an exemplar peer-led oral hygiene education video (Figs. 1.2-5). Within which, the terminology used was fine-tuned, better representation was given to different ethnic groups (Reinhardt et al., 2009) especially ethnic minorities, settings were more creative, and the technical quality was enhanced. The key oral hygiene messages delivered were confluent with the current professional guidelines by Public Health England (PHE), 2017 on the recommended oral hygiene practices for children (Table 1.1). The full video is found on the Leeds School of Dentistry YouTube page entitled 'Don't Rush When You Brush!'.

Participants

Participants were chosen by convenience sampling. Year Two and Three children from Healey Junior, Infant and Nursery School in Batley, West Yorkshire, UK were selected. The key criteria were the school's proximity to the University of Leeds, their high index of multiple deprivation (IMD) (Office for National Statistics, 2015), and that these children have not had any prior school-based oral health intervention. The parents of all Year Two and Year Three children (n = 77) from the school were invited to take part. Following a safety risk assessment, requests for 'opt-in' consent, and losses to follow up, 42 participants were evaluated (n = 42) (Fig 1.6).

Prospective cohort pilot study design

The study adopted a prospective cohort design that comprised of three stages:

i. Collection of baseline data
ii. Delivery of the peer-led oral hygiene education video to all participants
iii. Collection of two-week follow-up data

Outcomes

Oral hygiene knowledge

An oral hygiene knowledge quiz was independently undertaken by each participant. The quiz consisted of six true-or-false questions, each relating to an oral hygiene practice (Table 1.7). Participants could choose to skip any question, although their answer to that particular question will be deemed incorrect.

Oral hygiene behaviour

Each participant was provided with a new children's soft bristled manual toothbrush of identical make, Oral-B 1,450ppm fluoride toothpaste, a cup of water and a bowl, and then instructed to brush their teeth normally as they would at home. Their behaviour on each oral hygiene practice was silently and passively assessed using an observational check sheet (Table 1.8).

Data collection and protection

All data was collected within Healey Junior, Infant and Nursery School. All assessors were briefed on the outcome measures and usage of data collection tools. The data was coded and entered onto a Microsoft Excel spreadsheet, the accuracy of this was cross-checked by an independent observer.

Statistical analysis

All data was analysed using SPSS 22.0 (IBM, 2018).

Quantitative data of mean knowledge and behaviour scores, and percentage of correct answers for the knowledge and behaviour of each oral hygiene practice were presented using descriptive statistics.

Using a 95% confidence level, comparisons were made of all the above variables at baseline against those recorded at two-week follow-up. Further subgroup analyses of the variables were also done of the Year Two and Year Three children individually to add potential value to the research.

The normality of continuous data of mean knowledge and behaviour scores were checked using Kolmogorov-Smirnov and Shapiro-Wilk's tests. Both variables did not follow normal distribution, therefore they were tested using the Wilcoxon sign-rank test.

The sparsity of categorical data of the percentage of correct answers for the knowledge and behaviour of each oral hygiene practice was checked using cross tabulation. Sparse data (≤ 5) was recorded on the knowledge of frequency of brushing, toothpaste amount, circular usage of toothbrush, areas to brush and rinsing, and the behaviour of circular usage of toothbrush and spitting, therefore these were tested using the McNemar's exact test. The remaining variables were tested using the McNemar's test.

Results

i. Year group and Age

33% of the participants were in Year Two, and 67% were in Year Three. The mean age of all the participants was 7.30 years old; that of the Year Two children was 6.54 years old, and that of the Year Three children was 7.68 years old.

ii. Gender

60% of participants were boys and 40% were girls.

iii. Response rate (parental consent)

58% of parents consented to their child participating in the study. No child expressed refusal in participation throughout the study.

iv. Loss-to-follow-up

There was a loss-to-follow-up rate of 5%. No participant withdrew from the study.

Effect on oral hygiene knowledge

The mean knowledge score of all participants improved by 11%; that of the Year Two children improved by 4%, and that of the Year Three children improved by 14%. These improvements were only statistically significant amongst the Year Three children.

In particular, knowledge of the frequency of brushing, toothpaste amount and circular usage of the toothbrush improved by 30%, 20% and 10% respectively. However, knowledge the duration of brushing, areas to brush and rinsing declined by 5% and 10% respectively (Fig 2.2). Only improvements in the knowledge of frequency of brushing and toothpaste amount were statistically significant.

Effect on oral hygiene Behaviour

The mean behaviour score of all participants improved by 2%; that of the Year Two children remained constant, and that of the Year Three children improved by 2%. None of these changes were statistically significant.

Improvements were found in behaviour relating to toothpaste amount, circular usage of the toothbrush, spitting and rinsing, by a magnitude of 7%, 19%, 2% and 10% respectively. However, there was a deterioration of behaviour demonstrated in relation to the duration of brushing by 19% and areas brushed by 14% (Fig 2.2). Statistical significance was found only in the improvement in circular usage of the toothbrush.

Discussion

This study, the first in its field, aims to evaluate a clearly focused issue of whether a peer-led oral hygiene education video is an effective method for improving oral hygiene knowledge and behaviour in Year Two and Three children. The content of the video was validated by a panel of dental professionals to enhance its credibility.

Resource limitations restricted the possibility of undertaking a randomised controlled trial (RCT), therefore a prospective cohort design was chosen. This design reduced the influence of confounding factors on outcomes and maximised sample size. Convenience sampling provided ease of availability and affordability in collecting data. As only children from one school were sampled, sampling bias may be likely, therefore further study is recommended with a broader sample size. The school was geographically located within the most socioeconomically deprived quintile by IMD, so this resource was potentially delivered to children of low socioeconomic families whom are more likely to have oral disease. Participants did not receive any school-based oral health intervention prior to this study, which helped reduce contamination bias.

Adopting the outcomes of oral hygiene knowledge and behaviour enabled fair evaluation of the effectiveness of the video in improving oral hygiene. The questionnaires and check sheets that were used as the outcome measures were developed and extensively used in primary school engagements by the Leeds School of Dentistry *OpenWide* and *RAISED in Yorkshire (RiY)* collaboratives. They also remained identical at baseline and two-week follow up, preventing inconsistencies. Construct validation of these were not undertaken, therefore they may not have measured the children's true oral hygiene knowledge and behaviour (Cronbach and Meehl, 1955).

Data was collected suitably and consistently in many aspects, such as the type of toothbrush, toothpaste and other equipment provided, classroom used, etc. Controlling these variables reduced performance bias from exposure to factors other than the video (Richards, 2009). However, observational bias could have occurred if participants altered their habitual brushing method from awareness of being observed (Monahan and Fischer, 2010).

Results and comparisons to published literature

The main finding of this study was that a peer-led oral hygiene education video was associated with a non-statistically significant improvement in the mean oral hygiene knowledge and behaviour of all the children sampled. These findings were consistent with a Cochrane systematic review by Silva et al., 2016, whom highlighted that a single intervention providing oral health education is unlikely to produce significant impact. The apparent ineffectiveness of the video was also supported by a further systematic review by Kay and Locker, 1998 whom suggested that mass media or peer-led oral health programmes have not demonstrated effectiveness in improving oral health knowledge or behaviour. In contrast, Hawkins et al., 2000 and Chapman et al., 2006 have shown statistically significant improvements in oral hygiene knowledge in five to eight-year-old children achieved by means of classroom-based lessons, although these were prospective cohort studies that are less rigorous and did not involve videos or peer-led education.

There are numerous possible explanations for the apparent ineffectiveness of the video in these aspects. Studies on memory have suggested that the encoding of sensory information into short-term memory requires time and focus, and progression into long-term memory requires elaboration, rote or repetition (Anderson, 2000). The video was only played to the children once, therefore it is highly likely that some information could have been delivered too quickly for the children to focus on or build meaningful connections to. It may also have been too overwhelming for the children to retain all the key messages in the video (Miller, 1956), or that the content may not have been organised well enough for efficient recall (Bransford et al, 2000).

There is a complex relationship between knowledge, attitudes, beliefs and behaviours, as highlighted by psychosocial theories. It is widely acknowledged that knowledge improvements, albeit important, do not necessarily lead to behaviour change. First, according to the Dreyfus model of skill acquisition (Dreyfus and Dreyfus, 1980), learning a behaviour requires practice, which watching a video does not provide. This is similar to not undertaking the final "do" stage in the "Tell, Show, and Do" approach (Addlestone, 1959). Second, the self-efficacy (Health Belief Model (Becker and Maiman, 1975) and Health Action Model (Tones, 1987)) or intention (Theory of Reasoned Action model (Fishbein, 1967)) for initiating or maintaining a behaviour change may still be lacking. Third, the children may still be precontemplating or contemplating on making a change as suggested by the Transtheoretical Model (Prochaska and Clemente, 1983). Fourth, it may also be that positive behaviours were not immediately acknowledged e.g. with praise, approval or gifts, therefore preventing their reinforcement (Pinkham, 1993). Lastly, it may simply be because the children themselves have not acquired sufficient manual dexterity at their age to satisfactorily undertake oral hygiene behaviours independently (Kerr, 2017).

This study found statistically significant improvements in particular oral hygiene knowledge components (frequency of brushing and toothpaste amount), but not others (duration of brushing, areas to brush, circular usage of the toothbrush, and rinsing), which could further suggest that certain information in the video was more attractive, relatable or easier to learn than others (Bransford et al, 2000), or that old correct knowledge was displaced at the expense of new knowledge gained.

Of the behaviour components analysed, a statistically significant improvement was observed only in the behaviour relating to the circular usage of the toothbrush. This finding was coherent with Reinhardt et al., 2009, whom found improvements only in toothbrushing technique in seven to nine-year-old children after a peer-led oral hygiene education school programme. A possible explanation of this result could be that this particular oral hygiene behaviour was easier to learn than others. This behaviour was also the most poorly performed at baseline, therefore larger initial improvements could have been more easily achieved, reflecting the learning curve for motor skills (Luft and Buitrgo, 2005). The clinical significance of this requires further investigation.

It is interesting that statistically significant improvements were found in the mean oral hygiene knowledge of Year Three children but not that of Year Two. Taking limitations in the materials and methods aside, this could suggest that a one-year-age difference enabled better reception and acquisition of knowledge from the video by the Year Three children as compared to their Year Two counterparts, as explained by developmental theories by Piaget, 1964. This leads us to hypothesize that for a peer-led oral hygiene education video to be effective in improving oral hygiene knowledge, a child needs to be a minimum of seven-years-old.

Recommendations for further study

An RCT study design may be beneficial in evaluating the inferiority, equivalence or superiority of the video against a current 'gold-standard' in oral hygiene education, such as parental-supervised toothbrushing (Silvia et al., 2016) or direct one-to-one instruction by dental professionals using "Tell, Show, and Do" (Addlestone, 1959). Sample size calculation could be undertaken based on findings from this study. Characteristics of the sample can be recorded in more detail e.g. individual ethnicities, IMDs, etc for better subgroup analyses.

Conclusion

This study found that a peer-led oral hygiene education video was not an effective method in improving the overall oral hygiene knowledge and behaviour of Year Two children, but was effective in improving the overall oral hygiene knowledge of Year Three children. Specific improvements were noted in the knowledge related to frequency of brushing and toothpaste amount, and in the behaviour of using the toothbrush in a circular motion by both Year Two and Year Three children. An RCT study design is required to evaluate the effectiveness of this intervention more accurately.

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