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Camera-related behaviours of female dental nurses and nursery school children during fluoride varnish application interactions in nursery school settings

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Objective. To investigate camera awareness of female dental nurses and nursery school children as the frequency of camera-related behaviours observed during fluoride varnish applications in a community based health programme.

Methods. Fifty-one nurse–child interactions (three nurse pairs and 51 children) were video recorded when Childsmile nurses were applying fluoride varnish onto the teeth of children in nursery school settings. Using a pre-developed coding scheme, nurse and child verbal and nonverbal behaviours were coded for camera-related behaviours.

Results. On 15 of 51 interactions (29.4%), a total of 31 camera-related behaviours were observed for dental nurses (14 instances over nine interactions) and children (17 instances over six interactions). Camera-related behaviours occurred infrequently, occupied 0.3% of the total interaction time and displayed at all stages of the dental procedure, though tended to peak at initial stages.

Conclusions. Certain camera-related behaviours of female dental nurses and nursery school children were observed in their interactions when introducing a dental health preventive intervention. Since the frequency of camera-related behaviours are so few they are of little consequence when video-recording adults and children undertaking dental procedures.

Introduction

Real-time video recording has been increasingly used for studying healthcare communication due to its obvious advantages of being able to capture both verbal and nonverbal aspects of communication, particularly as compared to some post-interaction approaches[1–3]. Two major concerns have emerged from studies involving video recording medical consultations due to the nature of video recording being more reactive and intrusive, relative to retrospective methods and real-time audio recordings. First, it is questionable whether awareness of video recording alters behaviour of clinicians or patients. If so, this awareness could eventually impact negatively on the internal validity of the study. This is because if clinicians and patients behave in an atypical manner in response to the presence of a camera, the observed results may not be a true reflection of normal behaviours without video recording. The second major concern is about whether camera awareness reduces participation in research studies, which could then influence the external validity of the research[4].

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Previous studies on camera awareness

Results from empirical studies examining the effects of awareness of video recording on clinician/patient behaviour seem, at first, to be encouraging. A number of findings are consistent in that clinician's consultation behaviours are not significantly affected by their awareness of video recording with regard to the length and quality of consultation[5–7]. Those who reported their behaviours being affected were only a minority[8].

It seems that less is known about whether and how video recording could influence patient's behaviour[9]. This may have been due to possible ethical problems associated with covert recording of patient's behaviour[4,10].

The handful of studies that examined the effects of camera awareness on patient's behaviour suggested that the majority of patients simply forgot about being video recorded[11–13]. It also appears that the video recording did not negatively affect patient's feelings about either the outcome[12] or satisfaction levels[14,15] of the consultation.

Based on existing studies up to the year 2000 on possible effects of camera awareness on clinician/patient behaviour, Coleman[4] argues that the internal validity is not threatened where studies use video cameras to assess the reliability of methods for evaluating consultation competence. Most evidence about video recording influencing external validity is largely derived from a very limited number of studies[12,16,17]. A recent review study[18] looking at effects of audio-visual recordings on clinician/patient behaviour concluded that (i) there was little evidence to suggest that recording consultations affects clinician or patient behaviour; and (ii) research involving audio-visual recording of consultations is both feasible and acceptable.

Camera-related behaviours

The two major concerns about possible effects of awareness of video recording on internal and external validity of studies might be better addressed if we can understand better the nature of camera awareness. No one, to our knowledge, has attempted to define 'camera awareness'. Our definition of 'camera awareness' may be stated as the effects of knowing or acknowledging the presence of a camera on cognitive, emotional and behavioural manifestations. If camera awareness does become observable, the behavioural presentations of being aware of the presence of a camera can be best described as camera-related behaviours, in contrast to the internal experience of camera awareness. Studies investigating participants' reactivity to a camera have progressed from examining participants' self-reports on awareness and subsequent behavioural changes after they participated in the video-recorded sessions[11–14] to using more objective methods of looking for camera-related behaviours[9].

Penner *et al.* used behavioural observation and coding techniques to examine potential reactivity of cameras in medical interactions between 45 adult patients and 14 oncologists at a comprehensive cancer centre in the USA[9]. They used several cameras encased in enclosures to make the camera invisible externally and monitored the recording remotely in a separate room. Seven verbal and nonverbal camera-related behaviours were conceptualized based on previous research and detailed discussion within a research team. These behaviours were: looking at the camera, talking about the camera or the fact that one was being taped, gesturing toward the camera, whispering or lowering one's voice so it might not be picked up by a microphone, covering one's mouth or face while speaking, partially or fully obstructing the camera's view and self-reflective behaviours such as adjusting one's clothes and fixing one's hair. After the coding scheme for camera-related behaviours was developed, physician-patient interactions were video recorded and then coded, using the Noldus Observer Video-Pro® system, to explore the frequency and duration of camera-related behaviours within the total interaction time. An estimate of when these behaviours were likely to occur was also examined. The main finding was that camera-related behaviours occurred rather infrequently and took up very little time for both physicians and patients, constituting only about 0.1% of their total interaction time. The majority of camera-related behaviours occurred in the early stages (the first quarter) of the interaction.

We were therefore intrigued to enquire whether the main findings can be generalized to other health sectors with a very different context and purpose. Thus we attempted to follow up this study with very young children as patients who were being cared for by Childsmile staff[19] when nurses apply fluoride varnish onto the teeth of children of 3–4 year-old in nursery school settings. The Childsmile fluoride varnish application programme is a dental preventive intervention in Scotland. It involves a simple procedure of wiping children's teeth with cotton wool to remove excess saliva and then applying the

varnish onto the teeth of children. It is a non-invasive procedure (i.e. no local anaesthetic applied or use of dental drill). There is obvious concern about the recording of children onto video tape storage, but little evidence of how the process affects the children themselves or those who are in proximity providing healthcare.

Aim of the study

The aim of this study was to investigate camera awareness of female dental nurses and nursery school children as the frequency of camera-related behaviours observed during fluoride varnish applications in a community based health programme. This aim will be pursued in the form of exploring whether female dental nurses and young children display any of the camera-related behaviours identified by Penner *et al.*

Materials and methods

Participants

Staff participants were six female dental nurses (working in three pairs), aged 28–50 years, from National Health Service (NHS) Fife Health Board region in Scotland. Child participants were 51 nursery school children (34 boys and 17 girls, 18 three years old and 33 four years old children) from three nursery schools in NHS Fife. The three nursery schools were from NHS Fife, where the Childsmile fluoride varnish programme was first started and most well established. Up to the time when this study was conducted, all nurses involved in the Childsmile programme were female. These female dental nurses were recruited by the research team with the help from their regional NHS manager, who had been briefed about the research aim and design. Children were recruited through obtaining informed consent from their parents/guardians by a research assistant with school assistance.

For the dental nurses, this was their first time to deliver a dental-related service to young children independently and it was their first time to be video recorded for a research purpose. They were, however, not unfamiliar with video recording in general. For children, we expected that the majority would have been exposed to video recording situations from other settings such as family or school social activities.

Ethical approvals

The study was undertaken with the understanding and written consent of each participant and in full accordance with ethical principles including the World Medical Association Declaration of Helsinki. The study has been independently reviewed by the Fife and Forth Valley Research Ethics Committee (REC) Scotland, UK (approval number: 08/S0501/9).

Video recording

In order to minimize the intrusiveness of the presence of the camera, we used a small web camera attached to a laptop to record the nurse–child verbal and nonverbal interaction during the varnish application process. The web camera was placed at one corner of the room, facing the application setting. A typical fluoride application session involved two nurses (one taking the lead role of applying the varnish and the other taking the role of providing equipment) and one child. The lead dental nurse applied the varnish from either behind or beside the child when the child was lying on the reclined dental chair. Very occasionally, application took place from the front when the child sat on a chair if he/she refused to lie on the dental chair. The two dental nurses frequently changed their roles depending on mutual agreement and the intensity of their work load. Each varnish application was recorded as one video tape.

Coding

Two researchers, both trained in behavioural analysis, conducted the coding procedures in two steps. The first step involved a manual coding process in order to evaluate the suitability of the pre-existing coding scheme developed by Penner *et al.*[9] The scheme was

Table 1. The coding scheme for camera-related behaviours.

Category	Code	Operational definition
Verbal CRB		
Talking	t	Talking about the camera/the fact that one is being recorded; laughing about the camera/the fact that one is being recorded/someone else's talk about the camera
Whispering	w	Whispering or lowing one voice so that it might not be picked up by a microphone
Nonverbal CRB		
Looking at the camera	l	Looking at the camera or camera direction
Gesturing toward the camera	g	Gesturing toward the camera
Covering mouth/face	c	Covering one's mouth/face while speaking
Obstructing the camera's view	o	Partially or fully obstructing the camera's view
Self-reflective behaviours	s	Behaviours reflecting a concern about one's appearance such as adjusting one's clothes, fixing one's hair and applying make-ups
Nonclassifiable behaviours	n	All other behaviours neither in verbal nor nonverbal camera-related behaviours

CRB, camera-related behaviours.

discussed in frequent meetings of all authors to clarify the operational definitions for specific codes so that they reflected more accurately our context of interaction. The final detailed coding scheme is shown in Table 1.

The second step involved using computer software, The Observer XT system, to code camera-related behaviours. The Observer XT is a system for collection, analysis, and presentation of observational data. When the coders observed the occurrence of any predefined behaviour in the coding system (e.g. 'looking at the camera'), they pressed the key on the computer key board that was associated with the behaviour (i.e. the letter 'l' for 'looking'). By doing so, the frequency of behaviour was then recorded as well as the time when the behaviour took place. The duration of a behaviour was calculated for the elapse of time between the beginning of two mutually exclusive behaviours, as the beginning of a behaviour is always the end of another behaviour that proceeds it. In order to ensure coding accuracy, we adjusted the time setting to 1 ms and used the playback speed control to reduce the normal speed.

Both inter- and intra-coder reliabilities were checked using Cohen's Kappa (K). Cohen's Kappa is an overall measurement of agreement that is corrected for agreement by chance[20]. For inter-coder reliability, we selected 15 tapes where camera-related behaviours occurred most frequently. The average Cohen's Kappa for the 15 tapes was 0.83 (range = 0.48–1.00). For intra-coder reliability, the main coder coded the same 15 tapes twice in a week interval. The average Cohen's Kappa was 0.93 (range = 0.51–1.00). Both inter- and intra-coder reliabilities were above 0.80, which was considered satisfactory.

Results

Frequency of camera-related behaviours

Table 2 summarizes the frequencies of camera-related behaviours that were observed in this study. On 15 of the 51 tapes (29.4%), a total of 31 instances of camera-related behaviours were observed for either dental nurses (nine tapes) or children (six tapes). On the remaining 36 tapes (70.6%), neither dental

Table 2. Frequency of camera-related behaviours.

	Number of instances				
	Nurse (n = 6) (n = 1, 16.7%)		Child (n = 51) (n = 6, 11.8%)		
Category	Lead	Support	Boy	Girl	Total 51 tapes
Talking	1	0	0	0	1
Whispering	0	0	0	0	0
Looking	0	13	15	2	30
Gesturing	0	0	0	0	0
Covering	0	0	0	0	0
Obstructing	0	0	0	0	0
Self-reflective behaviour	0	0	0	0	0
Total	14 (9 tapes)		17 (6 tapes)		31 (15 tapes)

nurses nor children displayed any camera-related behaviour. The average frequency of camera-related behaviours per interaction (one video tape is regarded as one nurse–child interaction) was 0.61 if all 51 interactions are considered, and 2.07 if only the 15 interactions are concerned. The average interaction time (min) for the 15 tapes where camera-related behaviours occurred (mean = 3.81, SD = 1.18) was similar to that for the 36 tapes without any camera-related behaviour (mean = 4.22, SD = 1.29), and the overall duration for all 51 tapes was 4.10 min.

Among the 31 instances of camera-related behaviours, one out of six dental nurses (16.7%) displayed a total of 14 instances of camera-related behaviour including 13 instances of 'looking at the camera' when the nurse was in the support nurse role and one instance of 'talking about being video recorded' (i.e. 'are we filming this one?') when she was taking on the lead nurse role. The average frequency of camera-related behaviours per nurse was 2.33 for six nurses. Six out of 51 children (11.8%) engaged in a total of 17 instances of camera-related behaviours. Among the six children, three were 3-years-old and three were 4-years-old. These observable camera-related behaviours displayed by young children seemed to be all quick glances toward the camera direction and each glance lasted no more than 1.5 s. The majority of child's camera-related behaviours (12 instances of looking) were displayed by two boys and both were facing the dental nurse. The average frequency of 'looking at the camera' per child was 0.33 if 51 children were included, and 2.83 for the six children only.

Duration of camera-related behaviours

The camera-related behaviours occupied very little duration of the nurse–child total interaction time (Table 3) either considering only those 15 interactions where camera-related behaviours occurred (1.0%) or all 51 interactions including those where no camera-related behaviours took place (0.3%). For nurse, camera-related behaviours constituted about 0.1% of their total interaction time, while for child it occupied about 0.2% of their total interaction time.

Relationship between time and frequency

The frequency of camera-related behaviours as a function of the interaction time for nurses and children was plotted separately (Fig. 1). This shows when camera-related behaviours occurred. The average interaction time (mean) for the 51 interactions was 4.10 min (median = 4.15, mode = 3.15, SD = 1.26). The majority of camera-related behaviours for the nurse occurred during the first 2 min and the behaviour took place most frequently at about 1 min after the interaction started (Fig. 1a). It seemed, however, certain camera-related behaviours (i.e. 'looking at the camera', and 'talking about being video recorded') were still observable 2 min after the varnish application started. The pattern seemed to be more complex for children (Fig. 1b). It looked as though camera-related

Table 3. Duration of camera-related behaviours.

Duration of nurse-child interaction (min:sec:millisec)			
51 total interactions	209:23:26		
9 interactions where CRB* occurred (nurse)	26:69:239		
6 interactions where CRB occurred (child)	30:47:124		
15 interactions where CRB occurred (nurse & child)	57:56:363		
Duration of camera-related behavior and percentage of CRB			
		out of 15 interactions	*out of 51 interactions*
14 instances displayed by nurse	0:12:346	(0.4%)	(0.1%)
17 instances displayed by child	0:19:319	(0.6%)	(0.2%)
31 total CRB instances (nurse & child)	0:31:665	(1.0%)	(0.3%)

*CRB=camera-related behaviours.

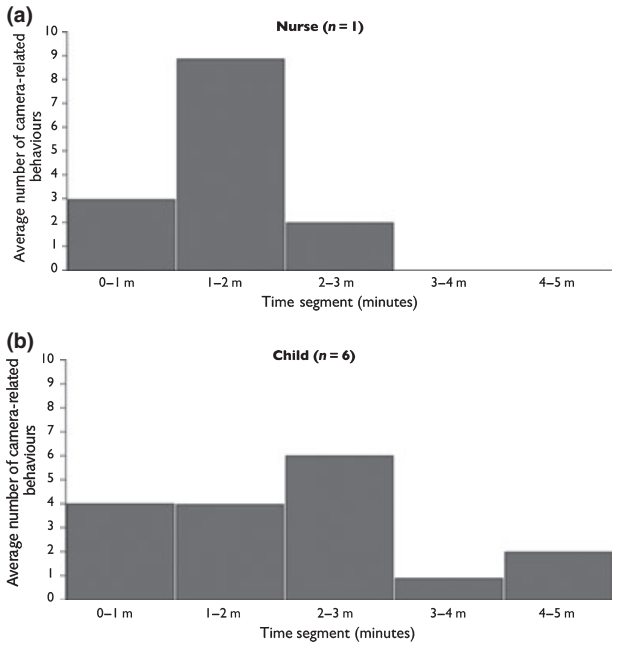

Fig. 1. Frequency of camera-related behaviours as a function of time.

behaviours occurred from the very beginning (within the first minute after the interaction) till the end stage of the interaction (4 min after the interaction). The most frequent camera-related behaviour (quick glance at the camera) took place at around 2 min following the beginning of the varnish application.

Discussion

Regarding the 31 instances of camera-related behaviours, the findings show that certain camera-related behaviours of female dental nurses and nursery school children were observable during their interactions when nurses were introducing a dental health preventive intervention in a community setting. Since the frequency of camera-related behaviours are so few they are of little consequence when video-recording adults and children undertaking dental procedures. Although the average number of camera-related behaviours per interaction was rather low (0.61), the results have suggested that participants might be aware of the presence of a camera in this particular context. This is because that it is possible that observable camera-related behaviours are as a result of being aware of the presence of a camera. On the other hand, as suggested by Penner *et al.* that participants' self-reports of camera awareness were not correlated with actual observed camera-related behaviours; it might be inferred that participants are highly aware of video recording during every stage of the interaction, their behaviours in response to the presence of a camera can be hidden and made unobservable to any outsider. In this sense, we cannot assume nonexistence of awareness if behaviours are not observed. Cautions, therefore, needs to be taken when making assumptions about the correlation between the existence of camera awareness and observable camera-related behaviours.

The most frequent camera-related behaviour was 'looking at the camera' (96.8% out of all observed instances of camera-related behaviours), which is consistent with Penner *et al.*'s[9] finding that most frequent camera-related behaviours for patient and physician in medical consultations in a comprehensive cancer centre were 'looking at' or 'talking about the camera'. It seems that in different healthcare sectors with different context and purpose of interaction, the most frequent observable camera-related behaviours were rather similar.

The fact that other camera-related behaviours, such as 'whispering' or 'self-reflective behaviours', did not become observable in this study may have been due to the quality of recording or to the nature of the interaction. The sound recording system in our study was not sensitive enough to pick up very low voices. Furthermore, lying on the dental chair would have prevented children from displaying certain camera-related behaviours such as gesturing toward the camera or talking about recording, although they were allowed to talk when the application was taking place.

The two boys, who received application when sitting on a chair facing the nurses, displayed the majority of the camera-related behaviours that were observed for children. This might be explained by the position that is most convenient for displaying and observing camera-related behaviours. This result implies that whether certain camera-related behaviours become observable and how often these behaviours take place may be depen-

dent on the nature of the interaction, e.g. the position of the interaction.

The total duration for the 31 instances of camera-related behaviours lasted for a short time, occupying approximately 0.3% of the total interaction time. For nurse and child separately, the camera-related behaviours constituted about 0.1–0.2% of their total interaction time respectively, which was slightly higher than the findings from the Penner *et al.*'s study (0.1%). This might have been explained by the difference in the length of the interaction time. In our study, the average nurse–child interaction duration was 4 min, while in Penner *et al.*'s study; the average doctor–patient consultation time was 35 min.

The results from this study of a different group of staff and patients did not seem to fully support Penner *et al.*'s finding that the majority of camera-related behaviours occurred at the very beginning of the interaction. Rather, it seemed that, while most camera-related behaviours happened at the early stage of the interaction particularly for dental nurses, young children's camera-related behaviours could happen fairly often at the middle stage of the interaction and even approaching the final stage of the interaction. Again, this might have been due to the particular position of the two boys facing the dental nurse, which made it easier for them to look at the camera at almost any time during the interaction.

It is worth noting that children's camera-related behaviours seemed to be independent from adult's response to cameras as the six interactions involving children's camera-related behaviours were completely different interactions where nurses' camera-related behaviours took place. The majority of studies looking at effects of video recording on clinicians and/or patients were using adult participants[5,9] and relatively little is known about how young children respond to cameras. The average number of camera-related behaviours was 0.33 per child and 2.33 per nurse; our results suggest that children seemed to be less bothered about being video recorded relative to the response of adult nurses, not to mention that the same dental nurse pair would also have been video recorded several times. This might be to do with the young generation having been brought up in a culture of frequent exposure to video recording.

Limitations and future research

One obvious limitation of this study is that the application procedure might have prevented children from verbally expressing camera-related behaviours. In addition, a small web camera attached to the top of a laptop has also made it impossible to distinguish looking at the camera from looking at the laptop. We might have thus overestimated the number of instances of looking at the camera. Furthermore, we might have underestimated the number of instances of talking about video recording as the unsatisfactory sound recording system has prevented us from picking up sensitive low voices. In future studies, researchers might concentrate their investigation on nonverbal camera-related behaviours if verbal behaviours are not easily observed either due to the recording system or to the nature of the interaction.

It would be desirable to ask dental nurses and children to report themselves whether they were aware of being video recorded and how much the presence of a camera would influence their behaviour. Results from objective methods (e.g. The Observer XT system) and subjective methods (e.g. self-reports) can be linked to investigate the convergence of findings from different methods. Thus future researchers should explore new methods of measuring camera awareness. New techniques, such as measuring participant's physiological reactions to a camera (e.g. blood pressure) can be experimented with. In addition, multi-observation methods might be used to enhance the reliability of observable occurrence of camera-related behaviours, e.g. by triangulating results from analysis on live observations and pre-recorded media files. Furthermore, tape review methods[21,22] can be also used to invite participants to identify behaviours of interest while watching their own recorded video tapes.

Finally, future research is needed to explore further the relationship between observable behaviours and awareness and how camera-awareness impact on aspects of interactions.

What this paper adds

- This paper has shown that a small amount of time and a minority of young children and adults displayed certain camera-related behaviours.
- It has suggested that young children may display a different pattern of camera-related behaviours and their camera-related behaviours were not necessarily influenced by those of adults.

Why this paper is important for paediatric dentists

- It is important for us to know how the process of video recording affects children in a community based dental-related health programme.
- It has practical implications for researchers who want to study children's behaviours in dental-related programmes using the video recording method. Filming children in a community setting during a dental health preventive intervention can be acceptable due to infrequent occurrence and short duration of camera-related behaviours displayed by children.

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