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Video-otoscopy in children and patient-centered care: A randomized, controlled study

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ABSTRACT

Objectives: Medicine today is moving towards patient centered care and patient empowerment. This enhances patient autonomy, allows shared decision making and increases satisfaction. Current technology enables the caregiver to share visual data with the patients, making them more active participants in a medical encounter. It has been shown that higher patient satisfaction rate has a positive effect on outcome and patient compliance. Otoscopic examination is one of the most common procedures performed in the pediatric population. Video-otoscopy uses endoscopic technology to project the image of the tympanic membrane onto a monitor visible to both the physician and the patient. The objective of this study is to assess whether video-otoscopy used in a pediatric emergency department can improve patient-centeredness and parental satisfaction with treatment.
Methods: A randomized, controlled study comparing video-otoscopy with conventional otoscopy was performed. Patients were randomized into 2 groups. In one, ear examination was performed by video-otoscopy and in the other by conventional otoscopy. Following examination, parents in both groups were asked to fill a questionnaire regarding their satisfaction with the otoscopic examination and the patient-centeredness of the encounter.
Results: 60 children were recruited and were randomized into two groups: 30 in the video-otoscopy group and 30 in the conventional otoscopy group. Parental satisfaction was significantly higher in the video-otoscopy group. The level of patient-centeredness was significantly higher in the video-otoscopy group. There was a positive correlation between patient-centeredness and parental satisfaction in both groups, with a significantly higher correlation in the video-otoscopy group.
Conclusions: Video-otoscopy was found to encourage patient-centered care and increase parental satisfaction with otoscopy. There is a significantly higher positive correlation between patient-centeredness and parental satisfaction when video-otoscopy is used.

1. Introduction

Current medical practice is evolving from an paternalistic approach towards one characterized by patient/caregiver interaction [1,2]. The patient's self-experience during a medical procedure or interaction with a medical caregiver was formerly considered to be either irrelevant or detached from "objective" clinical practice or results [3]. Focusing on diseases and their management rather than on the patient, while disregarding the complexity of the patient, can create various obstacles in patient/caregiver communication [4]. Clinicians should resist sidelining patient experience as too subjective or mood-oriented, divorced from the 'real' clinical work of measuring safety and effectiveness [3]. The concepts of patient-centeredness and patient empowerment offer opportunities for clinicians to allow patients to increase their autonomy and their

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involvement in their care and treatment. This in return can result in better health/disease management, better objective medical outcomes and increased patient satisfaction [5]. In terms of cost effectiveness, patient-centered communication is associated with increased visit length but also with less diagnostic testing expenditure [6]. A Canadian study of 311 family practice patients revealed that the more patient-centered the visit, the less the cost for diagnostic testing in the two-month follow-up period [7]. When physicians don't provide a positive, patient centered approach, patients are likely to be less satisfied, less enabled, and may have greater symptom burden and higher rates of referral [8]. This transition towards patient-centered care is notable in the establishment of the Patient-Centered Outcomes Research Institute (PCORI) in 2010 [9]. Video-otoscopy (VO) has been in clinical use for more than decade and is capable of producing high quality images of the tympanic membrane. VO images are comparable to the views obtained by conventional otoscopic and oto-microscopic examinations [10]. Currently on the market are small hand-held devices that connect directly to a laptop computer and do not require any additional equipment. This kind of a device is readily available to be used in any clinical setting, and does not require any special training. Parents can also see the tympanic membrane with a microscope connected to a camera and a screen. This equipment is usually only available in otolaryngology clinics and mostly not in a pediatric emergency departments. Effective viewing of the tympanic membrane by parents with a standard otoscope held by the physician or with a microscope not connected to a camera and a screen is not possible. Since acute otitis media is one of the commonest diseases in children [11], an otoscopic examination is a required routine procedure in almost any sick child visit. For a worried parent the ability to be a part of the clinical examination can have a marked effect on their satisfaction with the medical procedure and compliance with treatment. In a regular otoscopic examination the parent is excluded from viewing the clinical image. VO allows parents to view what the physician sees during the examination and take a more active and knowledgeable part in their child's examination. To our knowledge, the effects of VO on patient-centered care and parental satisfaction have not yet been evaluated by a randomized controlled study. The objective of this study is to assess whether VO used in a pediatric emergency department can improve patient-centeredness and parental satisfaction with treatment. We hypothesized that VO would increase patient-centeredness and thereby increase parental satisfaction with otoscopy.

2. Materials and methods

A randomized, controlled study comparing VO to conventional otoscopy was performed. The study was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans and was approved by the Human Experimentation Ethics Committee of the Ziv Medical Center. Patients were recruited through the Ziv Medical Center pediatric emergency ward. All parents and children were given a full explanation of the study by an experienced member of the research team before randomization. Informed consent was obtained for experimentation with human subjects from the parents or guardians of the children who served as subjects of the investigation. Children aged 8 months to 18 years undergoing otoscopic examination in the emergency department were included in the study. Younger children were excluded due to technical limitations of the device. Exclusion criteria were lack of parental consent and external otitis causing pain during otoscopy that likely would influence satisfaction with the examination. Patients were randomized into 2 groups with an allocation ratio of 1:1. This initial study was limited by budget, but in order to ensure valid parametric statistical testing, both the standard otoscopy

Fig. 1. Positioning for VO examination allowing both child, parent and clinician to view the monitor simultaneously.

group and the VO group were composed of 30 participants each. The randomization was performed by generation of a random sequence of numbers (www.randomizer.org). Otoscopy was performed either by VO (FireFly DE500, Firefly Global, Belmont, MA, USA) or by conventional otoscopy (Macroview otoscope, Welch-Allyn, Skaneateles Falls, NY, USA) according to randomization. This VO device does not include pneumatic otoscopy ability. In order to eliminate bias due to dissatisfaction with allocation to the standard otoscopy group, parents were offered the possibility of a repeat examination using VO following filling the questionnaire. VO was performed with the child seated on the parent and the examiner behind them. The screen was placed in front of the child and the parent, enabling a clear view of the screen for all (Fig. 1). All otoscopic examinations were performed by an experienced clinician, either an attending pediatrician or an experienced pediatric resident. Several different attending clinicians participated in this study. Following examination parents in both groups were asked to fill a questionnaire regarding their general satisfaction with the otoscopic examination and the patient-centeredness of the encounter. Demographic data was also collected. For the purpose of the current study, we used a questionnaire of 6 self-report questions (Fig. 2), formulated after an extensive literature search and based on previously published questionnaires [8]. The items were scored on a Likert scale ranging from 0 (not satisfied at all) to 5 (very satisfied). The questionnaires were piloted on a subset of participants, and patients were interviewed to clarify the wording of ambiguous questions. The internal reliability of the five patient-centeredness items was $\alpha = 0.788$. The patient-centeredness factor was calculated as the mean of those five items. Questionnaire validity was ensured by using a questionnaire whose face validity was established by content experts. Participants were recruited intermittently, only during times that the first author was present in the pediatric emergency ward. After initial evaluation by a pediatric resident, children were recruited to the study, parents were consented and children were randomized according to the generated random sequence of numbers. Children randomized to the standard otoscopy group who had undergone standard otoscopy as part of the initial evaluation filled the questionnaire regarding the examination that had already been performed. Children randomized to the standard otoscopy group who had not undergone standard otoscopy as part of the initial evaluation, then underwent standard otoscopy and filled the questionnaire regarding this examination. Children randomized to the VO group who had undergone standard otoscopy as part of the initial evaluation were

1. How satisfied were you with the examination of your child's ears?
2. During and after the ear examination, did you have the opportunity to ask questions?
3. During and after the ear examination, did you receive explanations regarding the test results?
4. Did the ear examination increase your feeling that the doctor cared about you as a person?
5. Did the ear examination increase your feeling that the doctor cared about your child as a person?
6. Did the ear examination increase your feeling of involvement in the examination of your child?

Fig. 2. Patient-centeredness and parental satisfaction questionnaire.

excluded from the study in order to prevent bias due to comparison to the recently performed standard otoscopy.

Statistical methods: For continuous variables summary tables are provided giving arithmetic mean (M) and standard deviation (SD). The two-sample T-test was applied for testing differences between the study groups for quantitative parameters. For categorical variables a summary is provided giving sample size, absolute and relative frequencies. The Pearson Chi-square test was applied for testing the correlations between the study groups for the categorical parameters. The significance of the difference between the two Pearson correlation coefficients was calculated by the Sobel test. All tests applied are one-tailed, and p-value of 5% or less was considered statistically significant. The data was analyzed using the SPSS version 20.0.2 (SPSS Inc. Chicago, IL, USA).

3. Results

The study was conducted at the Ziv Medical Center, between February and March 2015. All in all, 82 children were recruited to the study, consented and randomized. 22 children randomized to the VO group had already undergone standard otoscopy as part of the initial evaluation and were excluded from the study. In these cases, the next child recruited was randomized to the VO group instead of the child that had been excluded. At the end of this process, the 60 remaining children had been randomized into two groups: 30 in the VO group and 30 in the conventional otoscopy group. Demographic data are presented in Table 1. There were no significant differences between groups regarding the presence or absence of otalgia or the number of previous otoscopic examinations. There was a significant difference between the two groups regarding the average age of the children, which was 4.6 years in the conventional otoscopy group and 10.1 years in the VO group. Parental satisfaction was high in both groups, with a significantly higher satisfaction level in the VO group ($p = 0.043$). The level of patient-centeredness was significantly higher in the VO group ($p < 0.001$) (Table 2). There was a positive correlation between patient-centeredness and parental satisfaction both in the VO group and in the conventional otoscopy group, with a significantly higher correlation in the VO group (Table 3). The VO system was found to be easy to use and the technology was well accepted by staff, children and parents. It is of note that the cost of the VO system used in this study was approximately 25% less than the cost of a corresponding, commonly-used conventional otoscope.

4. Discussion

The concepts of patient-centeredness and patient empowerment offer opportunities for clinicians to allow patients to increase their autonomy and their involvement in their care and treatment. This in return can result in better health/disease management, better objective medical outcomes and increased patient satisfaction. Otoscopy is a commonly performed procedure, mainly in the

Table 1
Participant demographics according to type of exam (standard vs. video-otoscopy).

	Standard otoscopy ($n = 30$)		Video-otoscopy ($n = 30$)		p
	N	%	*N*	%	
Gender of parent					
Male	13	43.3	13	43.3	-
Female	17	56.7	17	56.7	
Otalgia					
Present	6	20.0	7	23.3	0.754
Absent	24	80.0	23	76.7	
Parent's country of origin					
Israel	26	86.7	25	83.3	0.718
Other	4	13.3	5	16.7	
	M	Sd	*M*	Sd	p
Age of parent (years)	36.4	9.4	39.7	6.4	0.113
Education of parent (years)	14.0	2.6	13.7	3.7	0.717
Age of child (years)	4.6	4.2	10.1	5.5	<0.001
No. of previous otoscopic examinations	8.1	6.9	7.1	7.4	0.592

Table 2
Patient-centeredness and parental satisfaction on a Likert scale ranging from 0 (not satisfied at all) to 5 (very satisfied), according to type of examination (standard vs. video-otoscopy).

	Standard otoscopy ($n = 30$)		Video-otoscopy ($n = 30$)		
	M	Sd	*M*	Sd	p
Patient centeredness (Mean of 5 questions)	3.3	1.4	4.6	0.6	<0.001
Parental satisfaction with otoscopy	4.0	1.0	4.7	1.0	0.043

Table 3
Pearson correlations between patient-centered treatment and parental satisfaction from treatment according to type of exam (standard vs. video-otoscopy).

	Parent satisfaction from treatment		*p*-Value of Sobel test
	Standard	Video-otoscopy	
Patient-centered treatment	0.630***	0.848***	0.032

*** $p < 0.001$.

pediatric population. In most cases, as far as the patients and parents are concerned, this examination is a ''black box'' and they are excluded from viewing the results. To our knowledge, ours is the first randomized controlled study to examine the use of VO in children and examine its effect on patient-centered care. Our results indicate that the use of VO promotes patient-centered care and that parental satisfaction was found to be higher in the VO group. We also found that there is a positive correlation between patient-centeredness and parental satisfaction. This correlation was significantly higher in the VO group. Patient-centeredness was higher in the VO group. It seems that the technology itself and the families' exposure to the generated images encourage and even mandate patient-centeredness on the part of the physician [12,13]. It has previously been shown that patient-centeredness increases patient involvement and autonomy, leading to increased patient satisfaction [3,6,8,14]. Accordingly, our findings of a positive correlation between patient-centeredness and parental satisfaction are not surprising. It is notable that not only were the patient-centeredness and the parental satisfaction higher in the VO group, but the correlation between PC and parental satisfaction was also significantly higher in the VO group. This means that for any given increment in patient-centeredness, the corresponding benefit in parental satisfaction is greater when using VO. Limitations of this study include the relatively small sample size and the significant difference in the age of the children between the two groups. This age difference was caused by the exclusion from the study of the children randomized to the VO group whom had already undergone standard otoscopy as part of the initial evaluation. The proportion of younger children undergoing otoscopy as part of the initial evaluation is higher than the proportion of older children. Thus, the age of children in the VO group became significantly higher in comparison to the standard otoscopy group. It would have been preferable to recruit and randomize children before initial evaluation, but, due to standard operating procedures in the pediatric emergency ward, this was not possible. Magaret et al. [15] examined patient stasfaction in the pediatric emergency department. Factors significantly correlated with pediatric patient satisfaction were the percieved quality of interaction, percieved adequacy of information given and the resolution of pain. The child's age was not found to be correlated with child or parent satisfaction. Based on the above and on our experience with the use of VO, it is our impression that the age difference is irrelevant in respect to our results. Furthermore, the questionnaires were filled by the parents and not the children and there was no significant difference between the two groups regarding any of the parents' demographic characteristics.

5. Conclusions

VO was found to encourage patient-centered care and parental satisfaction with otoscopy. There is a significantly higher positive correlation between patient-centeredness and parental satisfaction when VO is used. VO is an affordable, easy to use and well-accepted technology.

Conflicts of interest statement

None.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ijporl.2015.10.026.

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