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Effects of Visual and Audiovisual Distraction on Pain and Anxiety Among Patients Undergoing Colonoscopy

ABSTRACT

The aim of this study was to test the effects of visual and audiovisual distraction on pain, anxiety, and procedure tolerance among patients undergoing colonoscopy. A prospective, randomized, controlled design was used with 180 consecutive patients who underwent colonoscopy. Subjects were randomly allocated into 3 groups: Group A received visual distraction, Group B received audiovisual distraction, Group C with routine care. Outcome variables included pain, anxiety, and willingness to undergo colonoscopy again if the procedure was to be repeated. No significant difference was found on the pain scores of the 3 groups. However, when groups A and B were further divided into groups A1, A2, A3 (low-, middle-, high-involvement groups), and B1, B2, B3 (low-, middle-, high-involvement groups) according to the level of distraction involvement, significant differences in pain scores were found between 7 groups (A1 and A3, A2 and A3, A1 and B3, A2 and B3, A3 and C, B1 and B3, B3 and C). The pain score of Group A3 was significantly lower than those of groups A1, A2, and C, and the pain score of Group B3 was significantly lower than those of groups B1 and C. The reduction of anxiety levels after procedure was insignificant between the 2 intervention groups and control group. The rates of willingness to undergo colonoscopy again if the procedure was to be repeated of the 2 intervention groups were significantly higher than that of the control group. Visual and audiovisual distraction is effective in promoting pain control for patients undergoing colonoscopy and improving their tolerance of the procedure.

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Colonoscopy is a routine procedure for diagnosing lower gastrointestinal disorders (Lindsay, Freeman, Cobden, Lindsay, & Record, 1998) and has been used for screening lower gastrointestinal tumors in many countries (Xu, 2003). However, this routine procedure is not such an easy thing for patients. Most patients consider colonoscopy an uncomfortable, painful, and invasive procedure. Studies have shown that patients experience moderate to severe anxiety during colonoscopy (Jones et al., 2004; Parker, 1992). In addition, reflex spasm brought about by colonic stimulation, the traction of the intestines and mesentery, and acute distension due to inflation may lead to pain experience to a large number of patients (Huang, Chen, & Chen, 2003). All these unpleasant experiences reduce patients' willingness to undergo the procedure and their tolerance of it (Bejes & Marvel, 1992).

In the United States (US) and the United Kingdom (UK), conscious sedation is used for relieving pain and anxiety during colonoscopies for more than 90% of

the patients (Arrowsmith, Gerstman, Fleischer, & Benjamin, 1991; Daneshmend, Bell, & Logan, 1991). However, sufficient evidence to support a significant higher rate of willingness to reundergo the procedure between patients who use conscious sedation and those who do not is lacking (Thiis, Hoff, Sauar, & Morten, 2000). Besides, conscious sedation may cause complications such as reduced oxygen saturation, respiratory suppression or apnea, and decreased heart rate and blood pressure (Barawi & Gress, 2000; Cataldo, 1996; Froelich, Gonvers, & Fried, 1994; Minoli, Meucci, Prada, Terruzzi, & Bortoli, 1999). In addition, higher cost and longer hospital stay prevent a global agreement in its use. As a result, conscious sedation is not used routinely for colonoscopy patient populations outside of American and British societies (Ristikankare & Julkunen, 1998). In China, colonoscopy with sedation is only a choice for some patients in some hospitals (Xu, 2003; Xu & Ji, 2005).

The hospital where this study was conducted, a tertiary medical center in southwestern China with more than 4,500 beds where more than 60 patients undergo colonoscopy per day, but only about 25% of the patients (Hospital statistics, 2009) chose sedation due to higher cost, about 2.5 times as much as that for standard care, as well as concerns about its complications. Therefore, it is imperative to find safe, easy-to-use, and cost-effective ways to relieve pain and anxiety for patients undergoing colonoscopy and increase their tolerance.

Attention distraction has been used in many studies and has been demonstrated being effective in controlling pain and anxiety among patients undergoing blood sample taking, injection, chemotherapy, dressing change, fiberoptic bronchoscopy, and dental manipulations (Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003; Hodes, Howland, Lightfoot, & Cleeland, 1990; Hoffman, Sharar, et al., 2004; Seyrek, Corah, & Pace, 1984; Sparks, 2001; Tse, Ng, & Chung, 2003; Valet, Sprenger, Boecker, Willoch, & Rummeny, 2004; Vasterling, Jenkins, Tope, & Burish, 1993; Vessey, Carlson, & McGill, 1994). However, no such kind of study has been performed in Mainland China, especially among patients undergoing colonoscopy. As a cognitive therapy, the effects of attention distraction on Chinese patients may differ from those of patients of other nationalities because of cultural diversity. This study aims to explore the effects of visual and audiovisual distraction on pain and anxiety among patients undergoing colonoscopy as well as on their willingness to undergo colonoscopy again if the procedure was to be repeated.

Methods

Design

A prospective, randomized, controlled design was used. Subjects were randomly assigned into three groups: Group A (visual distraction group), Group B (audiovisual distraction group), and Group C (control group) according to a customized set of random numbers produced by Research Randomizer.

Participants

Using convenience sampling, 180 consecutive patients who met the following criteria were recruited from the endoscopy center of a tertiary medical center in southwestern China. Inclusion criteria were: (1) undergoing colonoscopy for the first time; (2) being older than 18 years; (3) with a normal cognitive function (score 8–10) as evaluated by the Abbreviated Mental Test–Modified (AMT); and (4) willingness to participate in the study. Exclusion criteria were: (1) undergoing colonoscopy with sedation; (2) with the history of abdominal and/or pelvic surgery; (3) with visual or hearing disorders; and (4) having taken anxiolytic medication or analgesic drugs in the previous 72 hours.

Sample size was determined through power analysis. According to Polit and Hungler (1995), the simplest approach to doing a power analysis for comparing the means of three or more groups is to estimate eta-square (η^2) based on information from either other relevant studies or a pilot study. If estimates of η^2 cannot be developed on the basis of prior research, researchers can determine the sample size on the basis of Cohen's conventional values of small, medium, and large effect sizes, which would be the values of η^2 equal to 0.01, 0.06, and 0.14, respectively. This would correspond to sample size requirements of 22, 53, and 319 for each group assuming an α of .05 and power of 0.80. This study set α at 0.05, power at 0.80, and effect size at medium (0.06), and a sample size of 53 subjects per group was required. Given sample loss, 10% was added, and the final sample size for each group was 60, with a total of 180 subjects.

Intervention

Group A watched a soundless DVD play with earphones on. Group B watched a DVD with sound play and wore earphones. Group C underwent routine care. XINGKE SDP-1280 10.2-inch multimedia mobile DVD made by Xingke Electronic Group Co. Ltd., was used in the study. All examinations were performed by the same endoscopist, using a CF-Q2401 electronic colonoscopy (Olympus Company).

Prior to the study, 60 patients who went to make an appointment for colonoscopy in the endoscopy center were asked about what types of disc they would prefer if DVD play was available. Ten types of preferable discs including landscape scenery, animation, comedy, romantics, historical figures, animal world, Chinese Kungfu, war film, and palace drama were prepared

accordingly. Subjects chose from among these discs according to their preferences.

Outcome Measurement

Visual analogue scale, on which 0 = no pain and 10 = extreme pain, was used to evaluate the level of pain, one of the primary outcomes in this study. Subjects were asked to rate the degree of pain they perceived during the examination immediately after the procedure was completed.

The level of anxiety was assessed using the Spielberger State-Trait Anxiety Inventory (STAI; Chinese version). The inventory was tested among the Chinese population and had a test–retest reliability of 0.88 in SAI, 0.90 in TAI, and Cronbach's alpha of .91 (Wang, 1999). Subjects were asked to fill in the "trait" scale before the examination and "state" scale before and after the examination. For those who could not complete by themselves, the interview format was used to help them fill in the scale.

After the examination, patients were asked their willingness to undergo colonoscopy again with the same mode of intervention if the procedure was to be repeated.

In addition, subjects in the intervention groups were assessed about their involvement in DVD play, using a scale of 0–10, in which "0" stands for "not involved at all" and "10" for "completely involved." The level of involvement was self-reported by the subjects.

Ethical Considerations

Protocol approval was obtained from the Medical Ethics Committee of Sichuan University, People's Republic of China. Informed consent was obtained from all participants before they were recruited for the study. The study was also registered at Chinese Clinical Trial Register, registration number ChiCTRChiCTR-TRC-12002530.

Statistical Analyses

The comparison of quantitative normal data was carried out using the analysis of variance or Student's *t* test. The comparison of quantitative nonnormal data was performed using the rank-sum test, and the comparison of categorical data using the chi-square test. The confidence intervals were expressed at 95% ($\alpha = .05$). The data were analyzed using The Statistical Package for Social Sciences

TABLE 1. Characteristics of the Patients (*N* = 180)

	Group A (Visual) (*n* = 60) *f*(%)	Group B (Audiovisual) (*n* = 60) *f*(%)	Group C (Control) (*n* = 60) *f*(%)	Statistics	*p*
Age (M+Q, years)	40.00 ± 16.50	38.50 ± 20.50	38.00 ± 15.00	$H = 2.398$	.302
Gender					
Male	33 (55.00)	36 (60.00)	33 (55.00)	$\chi^2 = 0.407$	.816
Female	27 (45.00)	24 (40.00)	27 (45.00)		
Educational level					
No schooling	7 (11.70)	4 (6.70)	2 (3.30)		.7758[a]
Primary school	17 (28.30)	16 (26.70)	18 (30.00)		
Junior and senior high school	30 (50.00)	32 (53.30)	33 (55.00)		
Associate degree and above	6 (10.00)	8 (13.30)	7 (11.70)		
Indications for colonoscopy					
Abdominal pain	25 (41.70)	28 (46.70)	28 (46.70)		.3650[a]
Diarrhea	16 (26.70)	11 (18.30)	12 (20.00)		
Constipation	3 (5.00)	7 (11.70)	8 (13.30)		
Hemafecia	6 (10.00)	7 (11.70)	1 (1.70)		
Change of bowel habit	5 (8.30)	3 (5.00)	6 (10.00)		
Physical examination	1 (1.70)	2 (3.30)	4 (6.70)		
Others	4 (6.70)	2 (3.30)	1 (1.70)		

[a]*P* = Fisher's exact probability value.

TABLE 2. Features of the Colonoscopy Procedures (*N* = 180)

	Group A (Visual) (*n* = 60) *f*(%)	Group B (Audiovisual) (*n* = 60) *f*(%)	Group C (Control) (*n* = 60) *f*(%)	Statistics	*p*
Mean duration of procedure (M+Q, minutes)	5.96 ± 2.65	6.00 ± 2.34	5.73 ± 2.80	$H = 0.385$	.825
Patients completed colonoscopy					
Yes	58 (96.70)	59 (98.30)	60 (100.00)		.7740[a]
No	2 (3.30)	1 (1.70)	0 (0.00)		
Patients underwent biopsy					
Yes	9 (15.00)	6 (10.00)	7 (11.70)	$\chi^2 = 0.725$	.696
No	51 (85.00)	54 (90.00)	53 (88.30)		
Pathological findings					
Normal	41 (68.30)	47 (78.30)	50 (83.30)		.1700[a]
Inflammatory bowel diseases	11 (18.30)	9 (15.00)	3 (5.00)		
Polypus	6 (10.00)	3 (5.00)	7 (11.70)		
Tumor	2 (3.30)	1 (1.70)	0 (0.00)		

[a]*P* = Fisher's exact probability value.

(SPSS) version 10.0 and Fisher's exact probability value, which could not be analyzed by SPSS and was calculated using Statistical Analysis System (SAS) version 9.0.

Results

A total of 180 eligible patients completed the study, and their data were entered into final statistical analysis. No significant difference was found on age, gender, educational level, and indications for colonoscopy among the three groups (Table 1). The comparison of the three groups in terms of duration of the procedure, proportions of participants who completed colonoscopies and biopsies, and pathological findings did not show significant differences (Table 2). Three participants, all in the intervention groups, did not complete the examination. The reason was that colon tumor prevented the colonoscopy passing through the lumen of the colon.

Level of Pain

The pain scores were lower in visual distraction (M = 4.89, SD ± 2.80) and audiovisual distraction groups (M = 4.51, SD ± 2.26) as compared with that in the control group (M = 5.16, SD ± 2.90), but did not reach significant difference (F = 0.891, $p = 0.412$). When groups A and B were further divided into three subgroups according to the level of DVD involvement: A1 (low-involvement group, involvement score < 4), A2 (middle-involvement group, involvement score 4–6), A3 (high-involvement group, involvement score > 6); and B1 (low-involvement group), B2 (middle-involvement group), and B3 (high-involvement group), significant differences in pain scores were found between seven groups (A1 and A3, A2 and A3, A1 and B3, A2 and B3, A3 and C, B1 and B3, B3 and C). The pain score of group A3 was significantly lower than those of groups A1, A2, and C, and the mean score of group B3 was significantly lower than those of groups B1 and C (Table 3).

Level of Anxiety

No significant difference was found among the three groups for trait anxiety and state anxiety before the procedure. The level of state anxiety after the procedure was significantly lower than that before the procedure in all three groups. The reduction of the anxiety level was greater in the two intervention groups, although significant differences were not found (Table 4).

Willingness to Undergo Colonoscopy Again If the Procedure Was to Be Repeated

The differences in the rates of willingness to undergo colonoscopy again if the procedure was to be repeated between the visual distraction group (n = 47, 78.3%), audiovisual distraction group (n = 45, 75%), and the control group (n = 35, 58.3%) was statistically significant ($X^2 = 6.632$, $p = 0.036$). The difference between the two intervention groups (N = 92, 76.67%) was not statistically significant. The willingness rates of the two intervention groups were significantly higher than that of the control group.

TABLE 3. Comparisons of Pain Scores During the Procedure After Stratification

	C	B3	B2	B1	A3	A2
A1	0.676	0.029*	0.474	0.926	0.031*	0.577
A2	0.254	0.004**	0.191	0.514	0.005**	
A3	0.018*	0.978	0.144	0.039*		
B1	0.763	0.037*	0.535			
B2	0.636	0.137				
B3	0.017*					

*$P < .05$. **$P < .01$.

Discussion

Effect of Visual and Audiovisual Distraction on the Pain of Patients Undergoing Colonoscopy

Although statistically insignificant, this study found that the pain scores of both visual and audiovisual distraction groups were lower than that of the control group, suggesting that visual and audiovisual distractions are helpful for reducing pain to a certain extent. Researchers have found that a person's capacity for processing information is limited, and allocation of attention to one task limits his attention to another. By exercising attention on interesting tasks, links between conditioned stimulus and conditioned response can be shielded, making people feel less or no pain (Johnson, 2005). In this study, it is possible that when subjects in the intervention groups watched DVD play, less attention was available for focusing on pain. As a result, less pain was experienced.

When visual and audiovisual distraction groups were further divided into low-, middle-, and high-involvement groups, the comparison of pain scores between subgroups and between subgroups and the control group using analysis of variance was made. We found that the two high-involvement groups, groups A3 and B3, had significantly lower mean scores on pain than low-involvement groups and the control group, suggesting that when distraction is used for pain control, the more attention is directed toward the distracter, the less pain is experienced.

The results are congruent with findings of some previous studies. A tourniquet pain study of Tse, Ng, and Chung (2002a, 2002b) among healthy volunteers reported a 33% increase in pain threshold and a 27% increase in pain tolerance while watching video via a television and a 52% increase in pain threshold and a 40% increase in pain tolerance while watching video via an eyeglass display. Hoffman et al., 2000 and Hoffman et al., 2001 found that virtual reality (VR) distraction was a more effective distracter than movie distraction in controlling dental pain and the pain of burn patients undergoing dressing changes.

Another study among 18- to 20-year-old healthy volunteers also found that with thermal pain stimulation, less pain was experienced in the High Tech VR group than in the Low Tech VR group (Hoffman, Richards, et al., 2004). The reason explained is that more attention is directed toward the distracters in the High Tech VR group. Because significant lower pain scores were only found between the high involvement groups and low involvement groups (control group in the present study), findings suggest both visual and audiovisual distractions are effective therapeutics for pain control, but measures to increase involvement in using these therapies need to be taken.

Effect of Visual and Audiovisual Distraction on the Anxiety of Patients Undergoing Colonoscopy

No significant difference was found among the three groups in trait anxiety and state anxiety before the procedure. The state anxiety scores of all three groups were significantly decreased immediately after the procedure is completed. The result is consistent with the findings of Andrada, Vidal, and Aguilar (2004) and is possibly related to patients' relief about the procedure being over. Visual and audiovisual distraction groups had a greater reduction in the levels of anxiety than the control group, but the differences did not reach statistical significance.

TABLE 4. Comparison of Anxiety Levels ($N = 180$)

	Group A (Visual) ($n = 60$), Mean ± SD	Group B (Audiovisual) ($n = 60$), Mean ± SD	Group C (Control) ($n = 60$), Mean ± SD	*F*	*p*
Trait anxiety	42.72 ± 7.69	42.03 ± 8.34	41.97 ± 7.87	0.163	.850
State anxiety					
Precolonoscopy	33.35 ± 10.30	34.13 ± 8.85	35.00 ± 9.30	0.453	.637
Postcolonoscopy	28.20 ± 6.93	29.18 ± 7.08	30.88 ± 9.32	1.793	.169
Post-/predifference	5.15 ± 8.76	4.95 ± 8.64	4.12 ± 8.63	0.239	.787

This result is consistent with the findings of Schneider and Workman (1999) and Schneider, Prince-Paul, Allen, Silverman, and Talaba (2004). They used VR as a distraction intervention in cancer patients undergoing chemotherapy and found that VR could relieve symptom distress and fatigue but did not affect state anxiety scores. Diette et al. (2003) allowed patients to enjoy scenic views and natural sounds and found that audiovisual distraction could relieve pain, but had no effect on anxiety as well.

Several reasons may explain why visual and audiovisual distraction did not significantly reduce the levels of anxiety. First, greater anxiety may be produced by the concern about the pathological findings of the examination than by the endoscopy procedure itself. Second, watching DVD play is an interesting and engaging thing. It is likely that subjects were so involved in or got so excited about the content that it prevented the inducement of a calmness and relaxation response. In addition, it is possible that this kind of distraction is less effective for reducing anxiety during a painful manipulation but may work better during nonpainful or less painful manipulations, which warrants further study.

In contrast, El-Hassan, Mckeown, and Muller (2009) found a significant greater reduction in anxiety scores in their music intervention group compared with the control group among patients undergoing upper and lower gastrointestinal endoscopies. The inconsistency of their findings with ours might be due to different natures of intervention. Music might produce better calming and relaxing effect than visual and audiovisual distractions, which merits further exploration.

Effect of Visual and Audiovisual Distraction on the Rate of Willingness to Undergo Colonoscopy Again If the Procedure Was to Be Repeated

Rate of willingness to undergo colonoscopy again if the procedure was to be repeated is an index often used to define patients' acceptance and tolerance of colonoscopy (Andrada et al., 2004; Lee et al., 2004). In this study, visual and audiovisual distraction groups reported higher rates of willingness to repeat the procedure and statistical difference was found ($p < .05$), suggesting that visual and audiovisual distraction can improve patients' acceptance and tolerance of colonoscopy. Less pain experienced may have contributed to the result.

Conclusions

In conclusion, distracting patients with audio and visual stimulation promotes pain control for colonoscopy patient population and improves their tolerance of the procedure. This study is the first of its kind in mainland China and is an exploratory study on the effect of visual and audiovisual distraction on pain and anxiety control of Chinese clinical patients. Testing the therapeutic effect of visual and audiovisual distraction in other patient populations and comparing it with other distraction techniques are suggested for future studies. ✪

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REFERENCES

Andrada, J. M., Vidal, A. A., & Aguilar, T. T. C. (2004). Anxiety during the performance of colonoscopies: Modification using music therapy. *European Journal of Gastroenterology and Hepatology*, *16*, 1381–1386.

Arrowsmith, J. B., Gerstman, B. B., Fleischer, D. E., & Benjamin, S. B. (1991). Results from the American Society for Gastrointestinal Endoscopy/US Food and Drug Administration collaborative study on complication rates and drug use during gastrointestinal endoscopy. *Gastrointestinal Endoscopy*, *37*, 421–427.

Barawi, M., & Gress, F. (2000). Conscious sedation: Is there a need for improvement? *Gastrointestinal Endoscopy*, *51*, 365–368.

Bejes, C., & Marvel, M. K. (1992). Attempting the improbable: Offering colorectal cancer screening to all appropriated patients. *The Family Practice Research Journal*, *12*, 83–90.

Cataldo, P. A. (1996). Colonoscopy without sedation: A viable alternative. *Diseases of the Colon & Rectum*, *39*, 257–261.

Daneshmend, T. K., Bell, G. D., & Logan, R. F. (1991). Sedation for upper gastrointestinal endoscopy: Results of a nationwide survey. *Gut*, *32*, 12–15.

Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A., & Rubin, H. R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy. *Chest*, *123*, 941–948.

El-Hassan, H., Mckeown, K., & Muller, A. F. (2009). Clinical trial: Music reduces anxiety levels in patients attending endoscopy. *Alimentary Pharmacology & Therapeutics*, *30*, 718–724.

Froelich, F., Gonvers, J. J., & Fried, M. (1994). Conscious sedation, clinically relevant complications and monitoring of endoscopy: Results of a nationwide survey in Switzerland. *Endoscopy*, *26*, 231–234.

Hodes, R. L., Howland, E. W., Lightfoot, N., & Cleeland, C. S. (1990). The effects of distraction on responses to cold pressor pain. *Pain*, *41*, 109–114.

Hoffman, H. G., Doctor, J. N., Peterson, D. R., Carrougher, G. J., & Furness, T. A. (2000). Virtual reality as an adjunctive pain control during burn wound care in adolescent patients. *Pain*, *85*, 305–309.

Hoffman, H. G., Garcia-Palacios, A., Patterson, D. R., Jensen, M., & Ammons, W. F. Jr. (2001). The effectiveness of virtual reality for dental pain control: A case study. *CyberPsychology & Behavior*, *4*, 527–535.

Hoffman, H. G., Richards, T. L., Coda, B., Bills, A. R., Blough, D., Richards, A. L., & Sharar, S. R. (2004). Modulation of thermal pain-related brain activity with virtual reality: Evidence from fMRI. *Neuroreport*, *15*, 1245–1248.

Hoffman, H. G., Sharar, S. R., Coda, B., Kharash, E., & Syrjala, K. (2004). Manipulating presence influences the magnitude of virtual reality analgesia. *Pain*, *111*, 162–168.

Huang, B., Chen, S. H., & Chen, S. L. (2003). Colonoscopy through spasmolytic sedation and analgesia. *Chinese Journal of Endoscopy*, *7*, 4–6.

Johnson, M. H. (2005). How does distraction work in the management of pain? *Current Pain and Headache Reports*, *9*, 90–95.

Jones, M. P., Ebert, C. C., Sloan, T., Spanier, J., Bansal, A., Howden, C.W., & Vanagunas, A. D. (2004). Patient anxiety and elective gastrointestinal endoscopy. *Journal of Clinical Gastroenterology*, *38*, 35–40.

Lee, D. W. H., Chan, A. C. W., Wong, S. K. H., Fung, T. M. K., Li, A. C. N., Chan, S. K. C., … Chung, S. C. S. (2004). Can visual distraction decrease the dose of patient-controlled sedation required during colonoscopy? A prospective randomized controlled trial. *Endoscopy*, *36*, 197–201.

Lindsay, D. C., Freeman, J. G., Cobden, I., Lindsay, D. C., & Record, C. O. (1998). Should colonoscopy be the first investigation for colonic disease? *BMJ*, *296*, 167–169.

Minoli, G., Meucci, G., Prada, A., Terruzzi, V., & Bortoli, A. (1999). Quality assurance and colonoscopy. *Endoscopy*, *31*, 522–527.

Parker, D. (1992). Human responses to colonoscopy. *Gastroenterology Nursing*, *15*, 107–109.

Polit, D. F., & Hungler, B. P. (1995). *Nursing research: Principles and methods* (5th ed., pp. 456–457). Philadelphia, PA: J. B. Lippincott Company.

Ristikankare, M. K. O., & Julkunen, R. J. K. (1998). Premedication for gastrointestinal endoscopy is a rare practice in Finland: A nationwide survey. *Gastrointestinal Endoscopy*, *47*, 204–207.

Schneider, S. M., Prince-Paul, M., Allen, M. J., Silverman, P., & Talaba, D. (2004). Virtual reality as a distraction intervention for women receiving chemotherapy. *Oncology Nursing Forum*, *31*, 81–88.

Schneider, S. M., & Workman, M. L. (1999). Effects of virtual reality on symptom distress in children receiving cancer chemotherapy. *Cyberpsychology and Behavior*, *2*, 125–134.

Seyrek, S. K., Corah, N. L., & Pace, L. F. (1984). Comparison of three distraction techniques in reducing stress in dental patients. *The Journal of the American Dental Association*, *108*, 327–329.

Sparks, L. (2001). Taking the "ouch" out of injections for children: Using distraction to decrease pain. *American Journal of Maternal Child Nursing*, *26*, 72–78.

Thiis, E. E., Hoff, G. S., Sauar, J., & Morten, H. V. (2000). Patient tolerance of colonoscopy without sedation during screening examination for colorectal polyps. *Gastrointestinal Endoscopy*, *52*, 606–610.

Tse, M. M. Y., Ng, J. K. F., & Chung, J. W. Y. (2002a). The effect of visual stimuli on pain threshold and tolerance. *Journal of Clinical Nursing*, *11*, 462–469.

Tse, M. Y. M., Ng, J. K. F., & Chung, J. W. Y. (2002b). The effect of visual stimulation via the eyeglass display and the perception of pain. *Cyberpsychology & Behavior*, *5*, 65–75.

Tse, M. M. Y., Ng, J. K. F., & Chung, J. W. Y. (2003). Visual stimulation as pain relief for Hong Kong Chinese patients with leg ulcers. *Cyberpsychology & Behavior*, *6*, 315–320.

Valet, M., Sprenger, T., Boecker, H., Willoch, F., & Rummeny, E. (2004). Distraction modulates connectivity of the cingulofrontal cortex and the midbrain during pain—an fMRI analysis. *Pain*, *109*, 399–408.

Vasterling, J., Jenkins, R. A., Tope, D. M., & Burish, T. G. (1993). Cognitive distraction and relaxation training for the side effects due to cancer chemotherapy. *Journal of Behavior Medicine*, *16*, 65–80.

Vessey, J. A., Carlson, K., & McGill, J. (1994). Use of distraction with children during an acute pain experience. *Nursing Research*, *43*, 369–372.

Wang, X. D. (1999). *Manual rating scales for mental health*. Beijing: Chinese Mental Health Journal Publishing Company.

Xu, F. X. (2003). *Lower gastrointestinal endoscopy*. Shanghai, China: Shanghai Science and Technology Press.

Xu, X. F., & Ji, D. N. (2005). Conscious sedation endoscopy: Current status and clinical application. *Chinese Journal of Practical Internal Medicine*, *23*, 221–222.