

Implementing a fantasy space-themed video distraction programme to reduce sedation in paediatric MRI

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Dear Editor,

Magnetic resonance imaging (MRI) is an important diagnostic imaging modality, especially in children where radiation exposure is an important concern. As children undergoing MRI scans need to lie still for an extended period of time in an environment with loud noises, sedation is often required.¹ However, its use comes with risks of adverse cardiorespiratory events²⁻³ and utilisation of hospital resources when children are admitted for monitoring post-sedation. Optimising the MRI environment, distraction techniques and the use of mock scanners minimises the need for sedation in children.⁴⁻⁸ A multifaceted approach, which combines these components, has been shown to be effective in children as young as 4 years old.⁹⁻¹⁰

A prospective cohort study was performed from 1 April 2018 to 31 December 2020 in National University Hospital, Singapore as a pilot for children undergoing MRI scans with the combined use of video distraction and an immersive fantasy space-themed environment (FSTE). The primary outcome of interest was to determine if FSTE could help children undergoing MRI scans avoid sedation, and the secondary outcome was to determine the contributing factors to that.

Given that an MRI machine emits loud noises and has a circular body, similar to a space shuttle, a space-themed environment was chosen. Prior to this pilot, the patients who were referred to the paediatric sedation team for MRI scans would all receive sedation. As part of this study, patients aged between 4 and 11 years, who were more likely to benefit from theme-based simulations,⁹⁻¹⁰ and had been referred to the paediatric sedation service for MRI scans were eligible for study

inclusion, while patients who were critically ill were excluded. All those recruited still underwent fasting for 6 hours and intravenous cannulation to prepare for sedation in case the child could not cooperate.

Upon recruitment, a preparatory brochure (Fig. 1A) and a preparatory video (Fig. 1B) (<https://www.youtube.com/watch?v=pm67chS9F-A>) produced by the study team were introduced to the patient to prepare for the scan. The preparatory brochure provided parents with information on what to expect on the day of the scan, whereas the preparatory video briefed the child through an immersive experience.¹ On the day of the scan, the patients were brought down 30 minutes prior to their scan to begin the FSTE in the pre-lift-off room that had been refurbished to simulate a space station (Fig. 1C) where they could put on customised space suits (Fig. 1D), practice lying still in a mock tunnel that simulates the MRI machine and view the preparatory video. Football helmets were provided to simulate the head coils used in head/neck MRI scans (Fig. 1E). Specially designed floor stickers then guided children from the pre-lift-off room to the MRI scanner. In the scanner, movies were screened using an MRI-safe mirror projection system (Figs. 1F–G). All patients received a certification of completion of space mission as a reward.

Prospective patient clinical and demographic data were obtained following informed consent of patients enrolled into the programme. Recruited parents and/or caregivers also completed survey questionnaires at the end of the scan procedure. These questions pertained to the amount of time spent for preparation for the scan procedure, how comfortable and enjoyable the experience was,

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Fig. 1. Graphic description of the fantasy space-themed experience.



(A) Preparatory brochure given to parents; (B) educational video produced by the study team made publicly available on YouTube; (C) pre-lift-off room with space station-themed wall sticker and lighting decorations; (D) customised spacesuits as part of space-themed fantasy; (E) American football helmets provided to simulate head coils used in head and neck MRI scans; (F) external mirrors used to reflect the image from the wall-mounted screen so that upright images of movies can be viewed; (G) graphic description of MRI-safe mirror projection system.

rated on a scale from 1 (least comfortable/enjoyable) to 9 (most comfortable/enjoyable), and reasons why they were successful or unsuccessful. Statistical analysis was performed using STATA version 14 (College Station, TX, US) with statistical significance set at $P < 0.05$.

Sixty-seven children between the ages of 4 and 11 years were enrolled into the programme. The mean age at time of enrolment was 6.8 years; male:female distribution was 1:1.16. Moreover,

74.6% avoided sedation for their MRI scans (Table S1). Notably, 21 out of 29 patients who had previously required sedation for their MRI scans, avoided sedation with FTSE, including a child who previously had 7 MRI scans performed under sedation.

Patients who completed MRI scans without sedation had significantly higher parent-reported satisfaction scores with a mean enjoyment score of 7.3 ± 1.7 compared to a mean score of 4.9 ± 2.7

(95% confidence interval [CI] 3.6–6.3, $P < 0.001$) in the group that eventually required sedation. Patients who completed MRI scans without sedation also did so more comfortably with a mean comfort score of 7.0 ± 1.9 while those who required sedation reported a significantly lower score of 5.2 ± 2.8 (95% CI 3.7–6.6). Despite failing the interventions and requiring sedation, 52.9% (9/17) of these patients responded favourably that the programme had benefited the children overall. Parents of all 29 patients who had previously undergone MRI scans also responded favourably that the study scan experience was better than their previous experience, even though 27.5% (8/29) of them eventually still required sedation.

There were 26.9% (18/67) patients in the study with underlying neurodevelopmental conditions affecting cognitive function and behaviour, including 7 with epilepsy, 3 with autism and 1 with attention deficit hyperactivity disorder. Of them, 50% (9/18) successfully completed the scans without sedation.

The success of this pilot suggests that video distraction in an immersive FSTE helps to reduce the need for sedation in children undergoing MRI scans, including children with neurodevelopmental conditions. A Swedish case-control study incorporated video distraction as a strategy, where 30 out of 33 children in the intervention group underwent MRI without sedation.¹⁰ While the study excluded patients with obvious developmental delay, our study suggests that these patients might have benefited from it.

This study is limited by selection bias as patients who were likely to succeed would be more agreeable to join. Also, the small sample size may mean that the results were not adequately representative of most paediatric patients who require MRI scans. Furthermore, the absence of a control group makes it hard to ascertain if the success was solely due to FSTE.

Future research will look into mitigating these limitations, aim to conduct larger randomised controlled trials to verify the FSTE programme's efficacy and explore its feasibility in different cultural contexts.

Supplementary material

Table S1. Baseline characteristics of surveyed population ($n=67$).

Ethics statement

This study involving human participants was conducted in accordance with the ethical standards

of the institutional and national research committee, and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The National Healthcare Group Domain Specific Research Board Singapore approved the study [2015/00871].

Declaration

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