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Research Article

Does Triggering an Autonomous Sensory Meridian Response Reduce Pre-Operative Anxiety? A Randomized Placebo Controlled Trial

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ABSTRACT

Background: Pre-operative anxiety is prevalent and associated with adverse patient outcomes. Many anxiolytic techniques have been utilized in the pre-operative setting, with varying degrees of success. The Autonomous Sensory Meridian Response (ASMR) is an increasingly popular method of relaxation used for anxiety reduction in general society. It is a non-invasive, inexpensive intervention with no known adverse effects. It has not been researched in a pre-operative setting. We aimed to investigate the effects of ASMR in the pre-operative patient population.

Methods: This prospective, double-blind trial randomly allocated 50 participants into either a placebo or ASMR group. Pre-operative anxiety was compared before and after viewing specially formatted educational video information in either an ASMR or non-ASMR format with validated anxiety scales-Visual Analogue Scale (VAAS), Amsterdam Pre-operative Anxiety and Information Scale (APAIS) and State-Trait Anxiety Inventory. The physiological characteristics of heart rate and blood pressure were measured as secondary outcomes.

Results: The control group demonstrated a reduction in pre-operative VAAS of 6.6 ($p = 0.01$) and 1.1 ($p = 0.02$) on the APAIS. The ASMR group had a reduction of APAIS of 1.9 ($p = 0.005$) and no change in the VAAS. Changes in State-Trait Anxiety Inventory for state anxiety score were the same in both groups. Increased trait anxiety was correlated with increased post-intervention VAAS and APAIS scores. There was no effect of pre-existing trait anxiety and pre-interventional anxiety on the efficacy of ASMR. Post-intervention, there was a significant decrease in mean systolic blood pressure by 2.7mmHg in ASMR group. In multivariable analysis, ASMR group had a drop of 3.9mmHg in post-intervention systolic blood pressure compared to placebo ($p<0.05$).

Conclusion: While our findings are inconclusive, potential benefits of ASMR in reducing pre-operative anxiety should be further explored with a larger sample.

Introduction

Pre-operative anxiety is common with a reported prevalence of 60- 80% in Western populations [1]. It is described as an unpleasant state of uneasiness or tension secondary to subjective concerns about the success of their surgery, the fear of anaesthesia and post-operative pain [2]. Pre-operative anxiety provokes a sympathetic response in patients resulting in increased heart rate, elevated blood pressure and increased cardiac contractility leading to possible cardiac arrhythmias [3]. It has been associated with increased time to extubation as well as increased post-operative side effects, increased need for post-operative analgesia, and a longer length of hospital stay [4]. Recent studies indicate potential

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anxiety-reducing roles for nonpharmacological interventions such as music therapy and educational multimedia [5].

A technique known as the Autonomous Sensory Meridian Response (ASMR) is an emerging approach to relaxation and is very popular in the online community [6]. You-Tube channels dedicated to producing ASMR videos have followings in the millions and achieve significant viewership. Despite its rising popularity in society, little has been done to scientifically evaluate the effects of ASMR [7]. ASMR incorporates visual and acoustic stimuli to evoke low-grade euphoria and a tingling sensation on the skin, commonly starting from the scalp and radiating down the limbs [8]. Examples of the stimuli that trigger ASMR include listening to softly spoken words or whispering, watching someone tap lightly on objects, and receiving personal attention [9]. Convenience sampling of participants in online surveys have revealed potential roles of ASMR in reducing chronic pain, anxiety and depression, but rigorous studies are pending to date [7].

Our aim was to evaluate the effects of ASMR on pre-operative anxiety in patients presenting for day of surgery admission to hospital. We compared the change in pre-operative anxiety after exposure to one of two instructive videos – an intervention video designed to trigger an ASMR, and a control video which conveyed the same information in a conventional format. Our primary outcome measure was a change in pre-operative anxiety as measured by validated questionnaires. Physiological changes were also assessed as secondary outcomes through serial measurements of vital signs.

Materials and Methods

This prospective, randomized, double-blind, placebo-controlled trial received HREC approval (011-2017) and is registered with Australian New Zealand Clinical Trials Registry (ACTRN12617001198314). A convenience sample of consecutive pre-operative participants were selected from the day-surgery unit at Sydney Adventist Hospital, between the hours of 11am – 5pm. We included patients at or over the age of 18, without significant visual and/or hearing impairment and with an adequate comprehension of the English language. Participants were approached by one of two investigators (KC or DN) who provided a scripted verbal explanation of the study, and an information document to the participant. Written and informed consent was then obtained prior to their inclusion in this study. Refusal to participate in this project did not affect delivery of patient medical care. Data were collected less than 2 hours prior to their surgical procedure.

Patients were randomly allocated to either the ASMR or control group by an unaffiliated third party and blinded to the researchers. The following demographic data was collected: age, sex, ethnicity, type of surgery, anaesthetic type, previous surgical experience, and ASMR experience. Before and after viewing the video, both groups completed questionnaires to measure state anxiety and the following vital signs were measured: heart rate, blood pressure and oxygen saturation using the WelychAllyn 52000 Series machine. Temperature was measured using WelchyAllyn SureTemp PLUS automatic thermometer. Trait anxiety was only measured preintervention. The intervention group watched a video lasting 6 minutes and 36 seconds, aimed to elicit ASMR. It featured an investigator (KC) communicating educational information about what to expect in the perioperative period, delivered with slow whispering, slow hand movements and repetition of certain words and syllables. Props used included a sphygmomanometer, oxygen mask and hospital blanket. The presenter lightly tapped on these objects and made crisp sounds by crinkling the blanket as an ASMR trigger. Personal attention was achieved by asking questions to the camera, for example, 'how are you feeling today'? These triggers are all commonly associated with ASMR [8]. The control group watched a video relaying the same educational information but delivered in a conversational tone without the use of props. This video lasted 2 minutes and 49 seconds. No background music was used in either video as it has been shown to inhibit the ASMR response.

The information, consent, questionnaires and video were incorporated in a single electronic file using REDCap (Research Electronic Data Capture) platform, accessible on an iPad for patient use. The questionnaire was designed to collect demographic, physiological, State-Trait Anxiety Inventory (STAI), Visual Analogue Anxiety Scale (VAAS) and Amsterdam Pre-operative Anxiety and Information Scale (APAIS) data prior to showing the video then collected physiological, VAAS, APAIS, State-Trait Anxiety Inventory for State Anxiety (STAI-S), and previous ASMR experience questions after the video. Only participants who indicated they were familiar with ASMR were prompted with further questions about their ASMR experience, triggers and effects.

STAI is a self-administered questionnaire consisting of 40 items that are grouped into two scales that measure state anxiety (STAI-S) and trait anxiety (STAI-T) [10]. STAI-S measures temporary anxiety, whereas STAI-T evaluates how the patient feels generally, and is indicative of more longstanding, baseline anxiety that would be unaltered by exposure to intervention. Each question has a weighted score of 1 to 4. For both STAI-S and STAI-T, scores range from 20-80 with 44 being indicative of clinically significant pre-operative anxiety. It has been validated in the pre-operative setting [11]. The VAAS is a quick and simple line on which patients rate their anxiety and offers a higher range than standard Likert scales [12]. The APAIS is designed to assess patient anxiety and contains 6 questions [10, 11]. These tools have been validated in multiple previous studies [11-13]. Study data was stored on REDCap's HIPAA compliant servers which is secured using 128bit Secure Socket Layer (SSL) technology, and then entered into a password secured Microsoft Excel spread sheet and de-identified. However, if a particular patient's scores indicated serious health-threatening anxiety (STAI score >55), we were obliged to inform appropriate medical staff.

A sample of 50 participants was required to detect a strict 0.5 SD (standard deviation) reduction in S-STAI scores from baseline at 5% significance level and 90% power. All analyses were performed with Stata (version 13.1, StataCorp, College Station, TX, USA) by a statistician blinded to group allocation. Results are reported as mean (SD) or median (IQR) for continuous variables, depending on symmetry of the distribution. Categorical variables are reported as numbers (%). Baseline testing for between-group differences was performed with the two-sample t-test or the Wilcoxon rank sum test for continuous variables depending on approximate normality. The Pearson's chi squared test was used for most categorical variables, but some variables with low expected cell counts (<5) required the Fisher's exact test. Univariable

analysis incorporates the use of paired t-testing for changes from baseline in each group, and two sample t-testing for differences in post-intervention anxiety between groups. Multivariable analysis consisted of multiple linear regressions, investigating the effect on post-intervention anxiety of ASMR, controlling for any differences in pre-intervention and trait anxiety in each group. In addition, all models included age, sex, surgery type, and time of surgery as independent variables. We made an a priori plan to investigate for any potential effect modification by pre-operative or trait anxiety on the intervention.

Results

Fifty-five patients were approached for the study and fifty completed the study. Five participants did not complete the study as they were called to theatres. All patients had general anaesthetic, and none had prior experience with ASMR, thus subsequent questions about ASMR were not addressed. Baseline demographic variables, and preintervention physiological and behaviour characteristics were the same in both groups (Tables 1 & 2 respectively).

Table 1: Baseline demographic characteristics for both the ASMR and control groups.

Variables	ASMR n = 25	Control n = 25	p-value
Age, years (mean +/-SD)	49 (17)	45 (16)	0.33c
Sex: female (%)	56	52	1.00a
Prior surgery (%),	8	8	1.00a
Surgery type (%)			0.16a
Ear nose throat	24	16	
Orthopaedics	12	40	
Urological	36	24	
Other	28	20	
Ethnicity (%)			0.11b
Asian	0	16	
Caucasian	100	84	
Time of surgery (%)			1.00a
11:00-13:59	36	40	
14:00-17:00	64	60	

a - Pearson's chi square test
b - Fisher's exact test
c – Two sample t-test

ASMR: Autonomous Sensory Meridian Response.

Table 2: Pre-intervention physiological and behavioural characteristics [median (IQR)] for both the ASMR and control groups.

Variables	ASMR n = 25	Control n = 25	p-value
Physiological			
HR (beats per minute)	64 (20)	63 (15)	0.54
Systolic BP (mmHg)	123 (12)	123 (16)	0.85
Diastolic BP (mmHg)	74 (7)	78 (8)	0.10
RR (breaths per minute)	19 (4)	20 (7)	0.23
SpO2 (%)	98 (2)	98 (3)	0.34
Temperature (°C)	36.7 (0.3)	36.6 (0.3)	0.36
Behavioural			
STAI-T	30 (16)	32 (14)	0.68
STAI-S	33 (13)	31 (16)	0.85
VAAS	21 (33)	27 (34)	0.98
APAIS	13 (3)	14 (5)	0.88

ASMR: Autonomous Sensory Meridian Response; HR: Heart Rate; BP: Blood Pressure; RR: Respiratory Rate; SpO2: Haemoglobin Saturation with Oxygen; STAI-T: Trait Anxiety; STAI-S: State Anxiety; IQR: Interquartile Range; VAAS: Visual Analogue Scale; APAIS: Amsterdam Pre-operative Anxiety and Information Scale.

The effect of the ASMR video on pre-operative anxiety was unclear, [reduced by 1.9 (p=0.005) on the APAIS, with no change shown in the VAA]. The educational video reduced anxiety [a reduction of 6.6 (p = 0.01) in the VAAS and a reduction of 1.1 (p = 0.02) in the APAIS scores] (Table 3). No significant change in STAI-S scores post-intervention was found in either group. In multivariable analysis as illustrated in (Table 4), there was no significant change in post-intervention S-STAI levels between the ASMR and control group. There was no effect of trait anxiety on ASMR responsiveness. There was also no evidence that pre-intervention anxiety influences the ASMR effect. Additionally, linear regression analysis showed that every 10-point increase in trait anxiety was correlated with a 7-point increase in VAAS ($p < 0.0005$) and a 5.6-

point increase in APAIS (p = 0.007). Being male was correlated with a 7.1 decrease in APAIS scores (p = 0.04). Pre-intervention anxiety, age, surgery type, and time of day was not significantly correlated with any changes in VAAS or APAIS.

Table 3: Change in anxiety pre- vs. post-intervention [mean (95% confidence interval)] in both ASMR and control group.

Change in Anxiety	ASMR n=25	P value	Control n=25	P value
VAAS	1.84 (-6.3, 10.0)	0.65	-6.6 (-11.5, -1.6)	0.01
APAIS	-1.9 (-3.1, -0.6)	0.005	-1.1 (-2.0, -0.2)	0.02
STAI-S	-1.0 (-5.6, 3.6)	0.66	-1.8 (-4.0, 0.4)	0.10

ASMR: Autonomous Sensory Meridian Response; VAAS: Visual Analogue Scale; APAIS: Amsterdam Pre-operative Anxiety and Information Scale; STAI-S: State Anxiety.

Table 4: Effect of watching the ASMR video, pre-intervention anxiety, trait anxiety, age, sex, type of surgery, and time of surgery on post-intervention anxiety [mean (95% confidence interval)].

	Post-intervention STAI-S	P-value	Post-intervention VAS	P value	Post-intervention APAIS	P value
ASMR group (vs. control group)	1.2 (-4.1, 6.6)	0.65	2.8 (-3.1, 8.8)	0.34	2.5 (-3.4, 8.3)	0.40
Pre-intervention anxiety (per every 10 points)	7.2 (2.8, 11.5)	0.002	0.5 (-1.3, 2.3)	0.61	6.7 (-1.7, 1.5)	0.12
STAI-T (per every 10 points)	0.8 (-4.1, 5.8)	0.74	7.0 (3.3, 10.7)	<0.0005	5.6 (1.6, 9.6)	0.007
Age (per 10 years)	0.2 (-1.6, 2.0)	0.83	0.1 (-2.0, 2.2)	0.94	-0.1 (-2.1, 1.8)	0.89
Male	-4.3 (-10.6, 2.0)	0.18	-6.7 (-14.1, 0.6)	0.07	-7.1 (-13.7, -0.5)	0.04
Surgery type		0.32		0.25		0.18
ENT	1.0 (referent)		1.0 (referent)		1.0 (referent)	
Ortho	4.2 (-4.0, 12.5)	0.31	7.4 (-1.7, 16.6)	0.11	8.1 (-0.8, 17.0)	0.07
Uro	4.9 (-4.2, 14.0)	0.28	-1.1 (-11.3, 9.2)	0.83	-0.8 (-10.5, 8.8)	0.86
Other	-1.4 (-10.1, 7.3)	0.75	3.5 (-6.8, 13.8)	0.50	4.0 (-6.0, 13.9)	0.43
Time of surgery (%)		0.98		0.33		0.27
11:00-13:59	1.0 (referent)		1.0 (referent)		1.0 (referent)	
14:00-17:00	0.08 (-6.3, 6.5)		-3.4 (-10.4, 3.6)		-3.6 (-10.2, 2.9)	

ASMR: Autonomous Sensory Meridian Response; BP: Blood Pressure; VAAS: Visual Analogue Scale; APAIS: Amsterdam Pre-operative Anxiety and Information Scale; STAI-S: State Anxiety.

There was a significant decrease in post-intervention systolic blood pressure [mean 2.7mmHg (p=0.017)] in the ASMR group compared to the pre- intervention value (Table 5). Given that systolic blood pressure was the only univariate finding that showed statistically significant change in the ASMR group, (Table 6) demonstrates the effect of other variables on systolic blood pressure. The only significant finding was that the ASMR group had a decrease of 3.9mmHg in post-intervention systolic blood pressure compared to control group (p=0.043).

Table 5: Change in physiological variables pre- vs. post-intervention [mean (95% confidence interval)] in both the ASMR and control groups.

Physiological variables	ASMR n = 25	P value	Control n = 25	P value
HR (bpm)	-0.6 (-3.6, 2.4)	0.344	0.1 (-1.7, 1.9)	0.463
Systolic BP (mmHg)†	-2.7 (-5.2, - 0.2)	0.017	1.0 (-1.5, 3.6)	0.206
Diastolic BP (mmHg)†	-0.9 (-2.9, 1.1)	0.345	-1.2 (-4.8, 2.4)	0.484
RR (bpm)	-0.3 (-1.3, 0.6)	0.249	0.0 (-1.1, 1.2)	0.472
SpO2 (%)	-0.1 (-0.8, 0.5)	0.704	0.2 (-0.1, 0.6)	0.185
Temperature (°C)	0.06 (-0.03, 0.14)	0.215	0.06 (-0.05, 0.18)	0.266

ASMR: Autonomous Sensory Meridian Response; BP: Blood Pressure; RR: Respiratory Rate; SpO2: Haemoglobin Saturation with Oxygen.

Table 6: Effect of watching the ASMR video, pre-intervention anxiety, trait anxiety, age, sex, type of surgery, and time of surgery on systolic BP.

	Post-intervention systolic BP (mmHg)	p-value
ASMR group (vs control group)	-3.9 (-7.7, -0.1)	0.043
Pre-intervention systolic BP (per every 10 mmHg)	8.8 (7.2, 10.4)	<0.0005
STAI-T (per every 10 points)	0.5 (-1.6, 2.5)	0.65
Age (per 10 years)	-0.6 (-1.9, 0.7)	0.36

Male	0.4 (-4.2, 5.0)	0.85
Surgery Type		0.75
Ear nose throat	1.0 (referent)	
Orthopaedics	-0.2 (-6.0, 5.7)	0.95
Urological	3.6 (-3.0, 10.2)	0.28
Other	0.71 (-5.6, 7.0)	0.82
Time of surgery (%)		0.42
11:00-13:59	1.0 (referent)	
14:00 – 17:00	-1.8 (-6.1, 2.6)	

ASMR: Autonomous Sensory Meridian Response; BP: Blood Pressure.

Discussion

This is the first study to explore the effects of ASMR on pre-operative anxiety. We demonstrated a small anxiolytic effect of ASMR based on the lower APAIS scores and fall in systolic blood pressure. This is consistent with a recent study in the non-pre-operative setting, where 10.8% of participants stated that ASMR videos helped to reduce their anxiety [14]. A reduction in pre-operative anxiety was also demonstrated in the control group as in both the VAAS and the APAIS scores but not in the STAI-S scores. This is also consistent with previous studies demonstrating that education reduces pre-operative anxiety [15]. Subjects who had higher trait anxiety was found to have higher anxiety scores in both the VAAS, STAI-S and the APAIS. The close relationship between the STAI-T and the VAAS, STAI-S and the APAIS help to confirm the consistency between the different measures. Current studies are based on self-reported outcomes, rather than physiological or clinical measurements.

A significant portion of participants did not have pre-operative anxiety to begin with. A VAAS threshold score of 46 has previously been shown to be correlated with the presence of pre-operative anxiety – that is, those whose VAAS score is above 46 have pre-operative anxiety whereas those whose VAAS score is below 46 do not [12]. In our control group, 7 participants were considered to have pre-operative anxiety prior to watching the video. After the video, 6 of these participants had their VAAS score decreased below the 46-point threshold. In our ASMR group, there were also 7 participants who had pre-operative anxiety prior to watching the ASMR video. However, just 3 of these participants had their VAAS scores drop below 46. These few data points suggest that ASMR may not be as effective as the control video in reducing pre-operative anxiety. Also, 1 of the control group participants and 3 of the ASMR participants who did not have pre-operative anxiety prior to watching their respective videos had their VAAS score increased above 46 after watching the video.

The mean APAIS score of the ASMR group decreased from 13 to 11 whereas the mean APAIS score of the control group decreased from 14 to 12. A score of 11 had previously been defined as the cut-off for clinically anxious patients [11]. In the control group, 18 of the participants scored above 11 before watching the video. After the video, 2 of these participants had their anxiety decreased below the 11-point threshold. In the ASMR group, 20 of the participants scored above 11 before watching the ASMR video and 7 of these participants' APAIS scores dropped below the 11-point mark. In contrast to the findings from the VAAS, a larger proportion of the ASMR participants were found to no longer have pre-operative anxiety than the control participants. There were also no participants whose score increased from having no pre-operative anxiety to having pre-operative anxiety.

The ASMR group had lower mean post-intervention systolic blood pressure than participants in the control cohort. There has been no research into the effect of ASMR on patient's vital signs. However, other interventions used to reduce pre- operative anxiety such as listening to music, have not demonstrated changes in any physiological parameters, including blood pressure, despite reductions in STAI anxiety levels [16]. Research has shown that decreases in blood pressure of more than 5mmHg resulted in 7% reduction in all-cause deaths, including 9% reduction in cardiac disease-related deaths [17]. Thus, our finding of the mean reduction of 2.7mmHg in post-intervention systolic blood pressure in the ASMR group is unlikely to be of clinical significance.

Strengths of our study are that it is a randomized prospective, double blinded, placebo-controlled study. We enlisted an appropriate number of participants and used valid and objective instruments to measure anxiety levels and physiological signs. Both researcher and the statistician were blinded to avoid bias upon collection and analysis of outcome measures.

A limitation of our work is the unknown prevalence of ASMR responsiveness with estimates varying from 5% to over 50% [18, 14]. There is also much speculation about the cause of ASMR-responsiveness. A study showed a relationship between ASMR-responsiveness and personality traits such as empathy and openness to experience [14]. Others have found that ASMR-responders had a high prevalence of synesthesia among them and have suggested a correlation between the two phenomena [8, 14].

We made no attempt to identify ASMR responders or determine the type of stimuli that evoked a response. The ASMR experience is quite personal, and its effects vary depending on the individual. The same piece of multimedia may cause a wide range of different responses depending on the individual. It is not currently possible to identify and standardize elements in ASMR. There are a multitude of triggers that have varying effects in different people – the most common triggers are soft sounds, crisp sounds, and a focus on personal attention and details [14, 19]. We chose to deliver these triggers in a video format was because video has been found to be the most effective at conveying information to patients [15]. We included the most common triggers of ASMR in our video to cover as many people as possible – however, there

is no guarantee that it would have induced a response in an AMSR responder. It may be helpful in the future to specifically recruit ASMR responders to validate media designed to elicit an ASMR response.

Even among ASMR responders, there are those who dislike the tingling sensation that ASMR invokes. This may even induce a feeling of distress and increased anxiety [20]. The feeling could be akin to the response that some people get when they hear nails scraping on a chalkboard. The presence of these responders may contribute to the increased range of scores in the ASMR group in both the VAAS and the APAIS. Especially the several participants who reported increased VAAS and APAIS anxiety scores after watching the ASMR video. This is compared to only one participant who reported increased anxiety in the control group. It is important to note that these increases may not be limited to negative responders though, since factors such as too much information, or perhaps finding the ASMR presentation peculiar and disturbing rather than clinical might also increase anxiety [21]. Again, these numbers are too small to hold any statistical significance and requires more data.

Several participants unfamiliar with iPad technology were confused as to how to input the correct value into the VAAS. Rating their anxiety on a line seemed to be less intuitive than tapping on discrete numbers and answers. This may have led to the large intraindividual variations in our VAAS raw dataset, potentially a significant source of error in our VAAS measurements. These variables, combined with our demographics which consisted mostly of middle-aged participants of Caucasian descent, make it difficult to generalize our results to the wider population. Ideally, a larger sample size would have been recruited, and from multiple sites as this study was conducted in one hospital.

Conclusion

Our results are conflicting, and we cannot confirm an anxiolytic effect of ASMR. Further studies targeted specifically at ASMR responders may more accurately assess its effects on pre-operative anxiety. The non-invasive, inexpensive intervention makes it an attractive proposition if a genuine benefit can be demonstrated. Another potential avenue for ASMR application is in the management of insomnia with 41% of participants reporting ASMR videos helped them to fall asleep. Future research could investigate these effects in a clinical setting with physiological outcome measures, exploring the potential use of ASMR in healthcare.

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