

Motion Sickness Desensitisation Therapy : An Indian Experience

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Abstract

Motion Sickness is defined as normal response to un-adapted or unfamiliar movement. The term 'motion sickness' includes airsickness, seasickness, car sickness, space motion sickness, and other related entities. The signs and symptoms of motion sickness include pallor, cold sweats, epigastric discomfort, nausea, vomiting, apprehension, hyperventilation etc. It is usually encountered while maneuvering in low visibility conditions and can be risk to flight safety, as the distracted pilot will have decreased situational awareness and performance capabilities. A significant variation in susceptibility and adaptation to motion stimuli is known among different individuals.

Motion Sickness desensitization can be achieved by repetitive exposure of the individual to these unfamiliar stimuli in a controlled environment. Various desensitization programs are being practiced around the world to combat the situation. Motion Sickness Desensitization Therapy (MSDT) has evolved in India over a period of time. The current MSDT program being followed is a combination of Progressive Muscle Relaxation (PMR), Physical Exercise Therapy (PET) and repetitive exposure to motion stimuli on Barany's Chair at 2 AMTC and cases who continue to be symptomatic even after two trials are subjected to MSDT at Institute of Aerospace Medicine, where the motion stimuli is given on DISO simulator with a gradual increase in the angular acceleration from 5 rpm to 25 rpm @ 2.5 rpm per day. Retrograde analysis of the data for last 5 years (Jan 2009 to May 2014) was carried out and it revealed that the success rate of the protocol was 76.9% (n= 18) at IAM and AMTC The overall success rate of MSDT protocol being followed is approximately 96%, which is very effective in re-fighting the sensitive aircrew back to cockpit.

Key words- Air sickness, MSDT, Aircrew

Introduction

Motion Sickness is defined as normal response to un-adapted or unfamiliar movement. The term 'motion sickness' includes airsickness, seasickness, car sickness, space motion sickness, simulator sickness and other related entities. The cardinal signs and symptoms of motion sickness include malaise, pallor, cold sweats, epigastric discomfort, nausea, vomiting, apprehension, hyperventilation, lightheadedness, drowsiness and apathy. In brief it can be said that motion sickness is basically the activation, by motion, of a position-response mechanism.

In aviation the air sickness is one of the major problem areas not only in aircrew flight training but also in regular operations. The motion sickness is of great aero medical concern as it is one of the potential hazards to flight safety and mission failure due to risk of incapacitation of the aircrew.

The severity of the symptoms depends not only on the frequency, magnitude, direction and duration of motion, but also on the body posture and other characteristics of the individual and the environment [1]. The individual susceptibility to motion sickness is critical in selection of aircrew as they will be exposed to provoking environment throughout their career [2]. On an average 30-40% of trainee pilots become airsick in their first air experience but many of them adapt adequately by the third or fourth sorties due to habituation of the body. However some of them fail to adapt adequately leading to possible future suspension from flying training.

Though the medications are available to overcome these symptoms but the same cannot be prescribed to aircrew because of their known side effects.

Sickness in trainee pilots is a major physiological limitation which not only leads to performance decrement and training interference but can lead to substantial economic loss to the organisation [3]. The trainees who are not able to adapt on their own even after two-three sorties, needs to undergo motion sickness desensitisation therapy (MSDT) program on ground where he is subjected to provocative stimulus on graduated scale repeatedly so that his sensory system gets habituated and adapted over a period of time.

Physiological basis of Motion sickness and MSDT

Various theories have been postulated to explain the etiology of motion sickness, but the most accepted one is the neural mismatch theory, according to which, any motion which results in conflicting sensations by

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different sensory organs will result in to motion sickness (Lansberg, 1961; Guedry, 1965). It is the magnitude and duration of this sensory incongruity which is believed to be the principal determinant of the incidence of motion sickness (Reason, 1970). The necessity of vestibular stimulation in the causation of motion sickness has been shown by the observation that the condition does not appear in individuals who lack a functional vestibular apparatus. However nausea, but rarely vomiting, may also be precipitated by visual cues of motion which are unaccompanied by the appropriate physical stimuli (e.g. cinema or fixed-base simulators with a moving display of an outside world)

Review of literature reveals that anxiety is a significant factor in the causation of airsickness. The evidences are conflicting, as some say that anxiety is the after effect of motion sickness. Studies have also shown correlation with neuroticism and susceptibility and it has been seen susceptible subjects tended to score higher on measures of introversion and anxiety and had more medical and emotional problems than non-susceptible people.

Susceptibility to motion sickness is the most important factor that determines the individual tolerance to provocative stimuli. The susceptibility of an individual for motion sickness depends on three closely integrated variables namely Receptivity, Adaptability and Retentivity. Any of these factors singly cannot determine the susceptibility. For example a person high on receptivity will have high incidence of motion sickness on initial exposure but if he is high on adaptability and retentivity also, he will be able to adapt faster and will retain the adaptation better and thus will not have persistent problem. In contrast a person with low adaptability and retentivity will continue to be motion sick in spite of multiple efforts to desensitize him. Thus an individual who is high on adaptability and retentivity will be able to get desensitise better even if he his high on receptivity.

Repeated exposure to an unfamiliar motion stimulus makes the same stimulus familiar to body internal model and by gradually increasing the intensity of exposure habituation and adaptation to the stimulus develops. Thus, the most potent therapeutic measure for air crew is adaptation to the provocative motion stimuli of the flight environment by regular and repeated exposure to motion stimuli, either in aircraft or in a simulator. It will always be better to start desensitisation schedule on ground first and once the same is achieved the same can be continued in the cockpit with gradual induction of aircraft maneuvers in flight training.

MSDT Protocols in India

In the past, airsickness in the Indian Air Force was managed on conventional lines with reassurance and

anti-motion sickness drugs. The desensitization programme was introduced in 1981 at the Institute of Aerospace Medicine (IAM), India, in which subjects were given desensitization training by voluntary head movements during rotation on a motorized Barany Chair. Later Deshmukh et al developed a set of rotation exercises (Physical Exercise Training) PET, designed to produce Coriolis stimulation, which was used for desensitization. PET includes a set of four exercises and takes about 20 minutes to complete.

- (a) The first exercise is turning about vertical axis in standing posture with one arm raised vertically up, in a set of five rotations each in clockwise and anticlockwise directions.
- (b) The second exercise involves the subject bending forward at waist level and rotating in clockwise and anticlockwise directions five times at near uniform rate at intervals of 30-45 seconds.
- (c) The third exercise involves the subject walking forward at a moderate pace to complete 20 steps, then turning around to return to the original spot while rotating the head in clockwise and anticlockwise direction.
- (d) The fourth exercise involves the subject lying supine on a flat surface and raising both legs together to assume a near vertical, head-down position. The body rests only on shoulders and head.

Later few Yoga exercises were included in desensitisation program, as they are known to allay anxiety, modulate autonomic system and allow self-initiation of a relaxation response to extraneous motion stimuli. These exercise include 'Surya Namaskar', 'Pranayama', 'Sarvangasana', 'Halasana', 'Chakrasan', 'Dhanurasna', 'Padmasna', and 'Shavasana'

A combination of PET, yoga exercise and Barany chair rotation is being practiced at 2 AMTC at the Air Force Academy for desensitization of sensitive trainee aircrew followed by gradual exposure to aircraft maneuvers in cockpit.

IAM Protocol

In 2005 with installation of DISO simulator at IAM the desensitisation protocol was further refined and it included graduated exposure to provocative motion stimuli by subjecting the pilot to runs in DISO Simulator on Branay chair mode in dark condition starting from 5 rpm in clock wise and anti-clock wise direction and gradually increasing upto 25 rpm @ 2.5 rpm per day. During this run the subject is asked to move his head forward, backward, right and left and Coriolis time interval is measured at each position and an assessment of motion sickness is made on motion sickness rating scale of 1-7. Eight such sets are done in each of the two

sessions of the day. In case of severe nausea or vomiting the run is discontinued for the day and the next day it is started again with 2.5 rpm less than the previous day value.

The flight cadets referred to IAM for MSDT are those who have already undergone desensitization at 2 AMTC at the Air Force Academy and despite this continue to be symptomatic. At IAM, these cadets are once again evaluated by an ENT specialist to rule out any pathological cause. In absence of any organic pathology they are subjected to Psychometric evaluation by the Aviation Psychologist which includes detailed interview, 16 PF test, MPQ (Modified Personality Questionnaire), SATI (State and Trait Anxiety Inventory) and Motion Sickness Questionnaire. After psychological evaluation the candidate is taught Progressive Muscle Relaxation (PMR) by Psychologist and PET & Yoga exercise by Ground Training Instructor and he needs to practice the same under supervision daily. Once correct technique is perfected the subject exercise once daily under supervision. He is then expected to repeat the exercises twice at his own convenience and is advised to conduct the learnt exercises preferably on an empty stomach or at least 2-3 hours after food. The candidate is also given a 'Magic Mixture' prior to every run which is mixture of glucose and ginger powder (Tab Phenargan is added if required, in cases of severe symptoms, for a day or two)

Material and Method

All the cadets who develop symptoms of air sickness are subjected to MSDT at 2 AMTC at Air Force Academy, where they are subjected to provocative motion stimuli on the Barany's chair along with PET and Yoga. Cadets who continue to be symptomatic even after two trials are referred to IAM for further evaluation and desensitisation. At IAM these cadets undergo MSDT as explained above and a record is maintained. A retrograde analysis of the records maintained, at the Department of Acceleration Physiology and Spatial Orientation, IAM Bangalore, for the MSDT conducted in last 05 years plus (ie 01 Jan 2009 to 30 May 2014), was carried out, for the outcome of the densensitisation protocol to assess the efficacy of the protocol.

Result

A total of 18 cases of Air Sickness among flight cadet and aircrew were referred to IAM for the MSDT in the 5 years period (from Jan. 2009 to May 2014). All of them were male, in the age group 19 to 20 years other than two trained aircrew who were 26 and 27 years respectively.

A breakdown of the candidates for MSDT and their outcome is presented in Table 1 and the result of follow up of these candidates is presented in Table 2

Table 1: Categories of subjects

| Category | No | Successful completion | Failure to complete |
|---|----|-----------------------|---------------------|
| Aircrew trainee (Flight cadet/ FgOffr) F(P) | 13 | 10 | 03 |
| Trained Aircrew F(P) | 02 | 01 | 01(Vertigo) |
| Aircrew (WSO) U/T F(N) | 02 | - | 02 |
| Airmen Aircrew Flt Eng U/T | 01 | - | 01 |
| Total | 18 | 11 | 07 |

Table 2: Follow-up of cases Post MSDT at IAM

| Category | Successful completion | Failure to complete |
|--|---|--------------------------------|
| Aircrew trainee (Flight cadet/ FgOffr) F(P) (13) | 10 6- Fighter 3- Heptr 1- F(N) | 3 1-Tpt 1- F(N) 1-Adm |
| Trained Aircrew F(P) (02) | 01(Tpt) | 01(presently in LMC) |
| Aircrew (WSO) U/T F(N) (02) | 00 | 02- F(N) |
| Airmen Aircrew Flt Eng U/T (02) | 00 | 01 |

Out of 18 subjects who have undergone MSDT profile at IAM, 13 flight cadets were those who have already undergone the MSDT at AMTC twice before coming to IAM and out of these 10 could successfully complete the profile and were re-flighted thereafter. Thus the success rate of MSDT in the trainee aircrew is 76.9%.

Follow up of cases revealed that the cadets who had successfully completed the MSDT protocol are presently successfully pursuing their flying carrier, 60% in fighter and 30% in helicopter stream.

Discussion

Previous studies at 2 AMTC have revealed that approx 30 to 40% of ab-intio pilots have air sickness during initial sorties and approx 9% report to this centre

