

# The estimation of clinical and home-based tilt training efficacy

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## Abstract

**Introduction:** Tilt training is a method of treatment of vasovagal patients. Two strategies make it possible to be performed as clinical and home-based training. The aim of the study was an attempt to compare the efficacy of the two types of training.

**Material and methods:** The investigation was carried out on a group of 49 patients, between the ages of 16 and 73 (average 37.4±17.0) with recurrent syncopal episodes and positive head-up tilt test. To obtain a positive vasovagal reaction we used 4 different protocols: passive without any provocation test (pass-test), active using nitroglycerin (ntg-test), adenosine (adn-test), physiological fluid infusion (fluid-test). The patients were randomized into two groups – those treated in clinical and home-based tilt training. In both groups the criterion of efficacy was gaining the effect of 45 minutes of uninterrupted standing. The remote effect was also assessed – a relapse of syncope during 6 months of observation.

**Results:** In the group of patients treated in clinical conditions, the efficacy of training was 69%, compared with 56% among patients treated by home-based tilt training. A relapse of syncope occurred in both groups with comparable frequency (41 vs. 36%) during 6 months of observation.

**Conclusions:** Both variants of tilt training are characterized by a similar long-term efficacy. The type of method applied should be mainly dependent on the abilities and preferences of the patient.

**Key words:** syncope, tilt training, vasovagal reaction.

## Introduction

Vasovagal syncope, defined as a sudden loss of consciousness on account of reflex-mediated hypotension and/or bradycardia, is the most frequent cause of syncope in clinical practice [1]. According to the majority of opinions, it is included in the group of mild syncope, which does not threaten the life of patients, but is extremely onerous with regard to its relapse. Moreover, the individual course of the syndrome causes difficulty in fixing the probability of the syncope relapse as well as the most efficacious action in preventing it [2].

**Table I.** Clinical characteristics of the study patients

Training	Home-based	Clinical
Number of patients	25	24
Female (%)	18 (72)	19 (79)
Male (%)	7 (28)	5 (21)
Age	38.7±16.5	35.9±17.9
Frequency of episodes/year	2.6±2.4	2.7±2.4
Duration of head-up tilt test	28.4±12.1	30.7±10.7
Type of syncope:		
type 1 (%)	8 (32)	9 (38)
type 2 (%)	10 (40)	9 (38)
type 3 (%)	7 (28)	6 (25)

The decision to start appropriate treatment in patients with vasovagal syncope should depend on the frequency and inconvenience of syncopal episodes. Teenagers should be educated about the causes of the disease and reassured about the benign character of the condition, as well as informed that having completed the period of puberty they might “outgrow” the condition [3]. Education should include directions on how to avoid situations that provoke symptoms. If those situations cannot be predicted, the patient should be informed about the possibility to prevent complete syncope (e.g. immediate change of body position) [1, 3, 4]. In many cases (80% of young women) such advice may be completely sufficient. If general recommendations are not effective (approximately 20% of young women), pharmacological treatment should be introduced. A promising form of treating malignant and recurrent neurocardiogenic syncope is tilt training, for the first time recommended in 1998 by Ector et al. [5, 6]. It consists in undergoing the tilt test many times until the patient achieves a negative result – no vasovagal reaction in time of assuming the supine position [7, 8]. The tilt training described above was conducted in hospital conditions. Because of its excessive cost and time consumption we decided to modify the test. A modification of this method is outpatient tilt training, which is mostly carried out individually by the subject at home. The aim of the study was an attempt to compare the efficacy of the two types of training.

### Material and methods

The investigation was carried out on a group of 109 people (47 females, 32 males) at mean age 37.4±17.0 years with recurrent syncopal episodes, according to a physician interview, and positive head-up tilt test. In 21 (43%) patients loss of consciousness occurred during the passive test (30

minutes in upright position at a standard angle of 60 degrees). 28 (57%) patients in addition underwent the active test with sublingual application of a spray consisting of 0.4 mg nitroglycerin. All persons who fainted in the active test were excluded from further study. Strict criteria were meant to reproduce possible syncopal episodes in the most natural way. In the assessed group 19 people (39%) were diagnosed as having cardio-inhibitory type (type 2), 13 people (26%) vasodepressor type (type 3), and 17 people (37%) mixed type (type 1) of vasovagal syncope, according to the VASIS'99 (*the Vasovagal Syncope International Study*) criteria. After explaining the mechanism of vasovagal reaction and the ways of preventing syncope, all were recommended tilt training (as the only method of treatment). The investigation obtained the agreement of the Scientific Committee of the Bioethical Committee at the Medical University of Gdansk. The patients were randomised into two groups – those treated in clinical and outpatient conditions (Table I).

Clinical training was carried out once a day at the Department of Cardiology and Electrotherapy, Medical University in Gdansk. The patients underwent a head-up tilt test on a motorised tilt table with foot support. During the procedure, there was continuous electrocardiographic (ECG) monitoring and arterial blood pressure was measured beat-to-beat (CNS System). The patient remained in an upright position until the first prodromal symptoms connected with vasovagal reaction occurred (change of heart rate, blood pressure or other presented symptoms). The training was repeated several times until the upright position could be sustained for 45 minutes.

In home-based tilt training the patients were trained sustaining the upright position while standing motionless, with the back against a wall (at an angle of about 60 degrees) during a period of time planned in advance (at the beginning 5 minutes on the first day). The session had to be carried out daily, in a safe

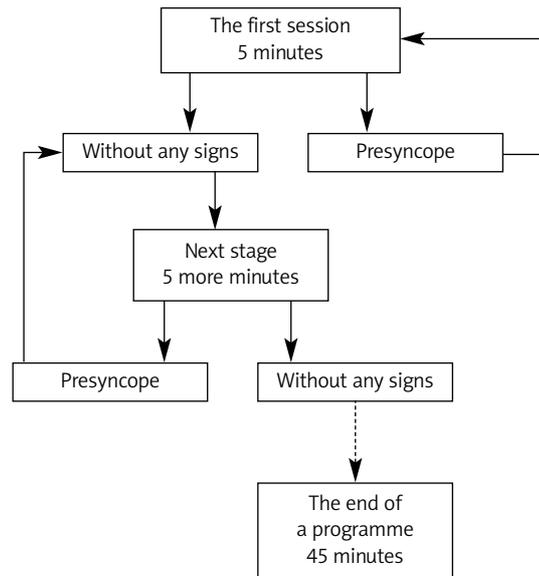
environment – best if near a bed – and if possible in the presence of a family member. The planned time of training was to be extended gradually (by 5 minutes per day), and at the same time the patient was informed about the absolute necessity of finishing training upon the appearance of any kinds of symptoms connected with syncope. In such a situation, the next day's training was to be shorter by one stage (Figure 1). We instruct the patient to begin tilt training with 5 minutes, in the morning, and in the presence of somebody else. Then the patient should increase the duration every day in order to reach the time limit of 45 minutes. But if the exercise results in pre-syncope symptoms, the duration should be shortened by 5 minutes, that is to the time limit withstood on the day preceding the pre-syncope exercise. The above-described training rule is shown on the scheme. The criterion of efficacy was – as in the case of clinical training – sustaining the upright position for 45 minutes, without the vasovagal reaction occurring (no appearance of prodromal symptoms).

During 6-month follow-up the appearance of syncopal and presyncopal episodes as well as the current condition of the patients was estimated. Factors which may exert an influence on the course of the training (age, sex, type of vasovagal reaction, frequency of syncope before the initiation of the treatment) were also estimated.

## Results

The efficacy of tilt training in the group treated in clinical conditions was 67%. This signifies that in 16 out of 24 patients it was possible to sustain the upright position for 45 minutes on a tilt table without the occurrence of any presyncopal symptoms. Patients often required from 2 to 6 repetitions (mean  $3.2 \pm 0.8$ ). In 8 people (33%) the training was interrupted before completion. For 3 of them continuation proved to be impossible due to backache occurring after longer periods of assuming the supine position. In 5 sufferers the training was interrupted after repeated attempts, due to recurrent, badly tolerated presyncope during daily sessions (truly inefficacious).

In the group performing home-based training, the expected final effect (after a mean duration of 26 days – min. 8, max 44) was obtained by an insignificantly smaller number of individuals (14 people – 57%, the difference is statistically insignificant). Among persons who had not finished training, the majority (5 patients) carried out exercises incorrectly – these were above all done irregularly, with several-day intervals. 2 other patients interrupted training due to backache, after obtaining 20-minute sustainability of the upright position, and another 3 interrupted it because of recurrent presyncope. One person discontinued on account of psychological causes (fear of losing consciousness).



**Figure 1.** Diagram of home-based tilt training

During the 6 months which followed the termination of the training, the percentage of patients in both groups (out of those who obtained the expected result) who had relapse syncope or presyncope was similar (44 vs. 36%).

## Discussion

The main purpose of treating patients with vasovagal syndrome is to prevent the relapse of syncope and injuries connected with it as well as to improve the quality of life by diminishing the frequency of presyncope. The chosen procedure strategy should be based on acquaintance with the neurocardiogenic reaction pathomechanism and in addition being well tolerated and lacking long-term side-effects [9-12]. This is especially important taking into consideration the fact that, in the opinion of most experts, vasovagal syncope is characterised by a mild course and beneficial remote prognosis [12]. Tilt training fulfils these conditions. The method makes use of the generally known fact that a constant effect of the force of gravity on the circulatory system is indispensable for maintaining correct orthostatic tolerance of the body position. People with orthostatic intolerance suffer from blood pressure fall in the standing position, which may lead to brain ischaemia and loss of consciousness. Parallel effects exist in astronauts spending some time in space microgravity and in patients after prolonged bed rest. The correct reflex reaction for the change of body position (from horizontal to supine) is the stimulation of the sympathetic system, which causes an increase in vessel resistance, acceleration of cardiac rhythm and enlargement in contractility of the myocardium, and protects from hypotension [13]. According to circumferential theory, in people with neuro-

cardiogenic syncope this increase of tonus in the autonomic nervous system is excessive. This releases a paradoxical depressive response in the cardiovascular system, which causes a blood pressure fall with slowing down of cardiac rhythm, leading to syncope [1]. It has been suggested that daily tilt training may reduce the sensitivity of this reflex, thought to be one of the mechanisms which mobilise the vasovagal reaction, and it may improve orthostatic tolerance. In the first, as well as in subsequent reports, the authors suggested tilt training's high efficacy in preventing relapse of syncope in patients with different types of vasovagal reaction [5-7]. It has also been indicated in an Italian research centre, where a controlled study was carried out, that this method significantly improves orthostatic tolerance of patients for whom earlier pharmacological management proved to be ineffective [8, 14].

The original project assumes carrying out daily training sessions with the aid of a tilt table, which means during at least several days of hospitalisation. This is not always possible to achieve. Home-based tilt training is a modification which consists above all in omitting the clinical stage (the whole cycle of exercises is carried out by the patient at home). In addition, the protocol adapted is extended over greater time. It consists of short 5-minute stages with the help of which the individual gradually reaches the planned time of 45 minutes, acknowledged as a sufficient orthostatic tolerance. The attempt at comparing the efficacy of both variants of training which were carried out failed to show a distinct superiority of either. It is true though, that in clinical training a somewhat larger number of patients (non-significant statistically) obtained the assumed 45-minute supine position effect, but the long-term effect was alike in both groups. The most important factor which lowered the efficacy of home-based tilt training happened to be the lack of full acceptance of daily exercises by the patients. In the group of patients we observed, 20% of people carried out the training incorrectly (not daily, often with several-day interruptions). Among these patients, there was no one who managed to complete the programme with a positive result. A fact stressed in the literature confirms that the therapeutic effect can be achieved only through systematic application [5-7, 14]. In some patients, mostly elderly, obtaining a complete effect may be difficult with regard to backache occurring after longer assumption of a supine position. This problem concerns both clinical and outpatient training. However, older patients (especially those living alone) may not accept home-based tilt training because of psychological causes – mainly from fear of syncope in the absence of another person. It seems that in this group, with regard to the particular ease of the occurrence of injuries during a fall, due to loss of consciousness clinical training should be preferred.

The long-term effect – clinically assessed during 6 months of observation as a lack of syncope and/or presyncope relapse – amounts to about 60% and is not dependent on the method the training is based on. The “training” of the autonomic nervous system in terms of arterial blood pressure and heart rate regulation while assuming a supine position is therefore temporal. In the case of those who suffer from syncope again after an accomplished training, it seems sensible to repeat the training (according to the same scheme accepted by the patient).

In conclusions both variants of tilt training are characterized by a similar remote efficacy. The type of method applied should be mainly dependent on the abilities and preferences of the patient.

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