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UNC DPT Capstone Project

Evidence Table and Literature Review

Title/Author/Year	Study Details
<p>Home exercise program adherence strategies in vestibular rehabilitation Gaikwad et al. (2016)¹</p>	<p>Objective: The aim of this systematic review was to investigate for effective strategies to improve home exercise program (HEP) adherence in vestibular rehabilitation (VR).</p> <p>Study Design and Methods: This systematic review included studies that were: 1) published in English language, 2) randomized controlled trials, case control studies, observational studies and cross-sectional surveys that were published in peer-reviewed journals, 3) related to VR and motion sensitivity intervention, and 4) related to implementation of HEP adherence strategies. The studies that investigated pediatric population were excluded. This systematic review focused on investigating adherence to HEP and we chose to use the modified form of quality assessment tool, which consists of a standardized set of 13 predefined criteria [12]. The criteria used in the quality assessment tool checks for both internal and external validity of a study [13]. A score of 0 was given to criteria that did not meet the quality standard while a criterion that met the quality standard was given a score of one. We summed the scores of 13 criteria; the tool scoring range was 0 to 13.</p> <p>Results: A total of 1,041 citations were identified from six databases. After the first screening 1,003 studies were excluded and 28 relevant studies were saved for secondary screening. A total of 28 studies were reviewed by two investigators SG and EJ. After achieving consensus between the opinions of these two investigators a total of eight studies were selected to be included in the review. Strong evidence was identified for 3 major categories of effective HEP adherence strategies including providing patients with written summary of HEP, asking patients to maintain a record of HEP and symptoms, and providing tele-rehabilitation in the form of email and/or telephone support along with in person treatment sessions. Finally, strong evidence indicated that computerized technology was not superior to other strategies for improving HEP adherence in VR.</p> <p>Conclusions and Interpretation: Vestibular exercises require regular and consistent repetition for vestibular adaptation to occur, thus, patient's adherence to the HEP is a critical factor. Various HEP adherence</p>

	<p>strategies have been implemented in the field of VR to ensure patient’s adherence to HEP. Examples of these strategies include a recording calendar, booklet-based VR and telephone support, and written summary and homework assignment. Among the HEP strategies available to physical therapists for providing effective VR, it is unclear which HEP strategy is most effective for improving adherence.</p>
<p>Effect of home training and additional physical therapy on recovery after acute unilateral vestibular loss Kammerlind et al. (2005)²</p>	<p>Objective: To evaluate the effects of additional physical therapy on recovery after acute unilateral vestibular loss given to patients receiving home training.</p> <p>Study Design and Methods: In this randomized controlled trial patients were included from ear, nose and throat departments in three hospitals, and followed for six months. A total of 54 patients (29 men and 25 women) with a mean age of 52 years (standard deviation (SD) 13, range 27-78) were included. The patients who agreed to participate in the study were then randomly assigned to home training with or without additional physical therapy by means of sealed envelopes. All patients received oral and written instructions concerning home exercises to be performed at least 15 minutes a day beginning on the day of inclusion and continuing for as long as any symptoms of vertigo and disequilibrium remained. The exercise instructions were quick horizontal and vertical eye movements, fixating a stationary target while moving the head, standing with feet together and eyes closed, walking on a line, and moving the head to look to the right and left and up and down while walking.</p> <p>Results: The mean for reported length of home exercises in the study population was nine weeks (SD 7, range 1-26). There were no significant differences in how long the patients had been training at home with respect to training group. No significant differences between training groups were detected in the variables of asymmetry of vestibular caloric response, clinical balance tests or subjective ratings of symptoms at the one-week, 10-week or six-month follow-ups, or when groups were compared concerning change over time.</p> <p>Conclusions and Interpretation: No differences in results were found between the home training group with additional supervised physical therapy and the home training group without. For some patients it may be that home training instructions at an early stage or no instructions at all is enough for total recovery. If so, we need to be able to identify the patients who are at risk of a poor outcome and supply them with intensive supervised vestibular rehabilitation. Thus, predictors for outcome, predictors of the need for intensive supervised vestibular</p>

	<p>rehabilitation, and the required intensity of this training, need further investigation.</p>
<p>The effect of supervision in vestibular rehabilitation in patients with acute or chronic unilateral vestibular dysfunction Lilius et al (2021)³</p>	<p>Objective: The investigation of supervised vestibular rehabilitation treatment role vs unsupervised treatment for individuals with dizziness and imbalance due to peripheral, unilateral vestibular disorders.</p> <p>Study Design and Methods: The titles and abstracts of 372 electronic articles were screened, and only 10 of them were considered possibly eligible. After a full-text analysis of the 10 articles, five studies were eligible. The other five studies did not meet the inclusion criteria because of the following reasons: assessment of subjects with non-vestibular dizziness, assessment of elderly patients with fall risk due to unclear pathology, development of a study protocol, no supervised intervention, and evaluation of elderly patients with noncentral and non-vestibular balance disorders.</p> <p>Results: A total of 317 subjects were recruited into the included studies. The total duration for the VRT programs ranged from 3.5 weeks to 12 months. The duration of treatment sessions ranged from 30 to 90 minutes. Evaluation measures included posturography, Romberg’s position, the Dynamic Gait Index, Functional Gait Assessment, and walking speed. Self-reported measures included most commonly the Dizziness Handicap Index, Vertigo Symptom Scale, and the Visual Analog Scale for perceived symptoms.</p> <p>Conclusions and Interpretation: This systematic review provides weak evidence that supervised VRT for patients with dizziness and imbalance due to UVH leads to statistically significant improvement compared to unsupervised protocols. Supervised VRT is considered effective as it increases compliance and motivation and changes a participant's psychological status. Moreover, a supervised rehabilitation program is probably ideal for people with cognitive impairment, mobility dysfunction, or fear of falling. In addition, the improvement of several parameters observed within control groups that performed normal daily activities probably reflects the spontaneous central compensation process.</p>
<p>Understanding patient experiences of self-managing chronic dizziness: a qualitative</p>	<p>Objective: This study explores participants' experience of self-management of dizziness using booklet-based vestibular rehabilitation (VR), with or without expert telephone support.</p> <p>Study Design and Methods: This study was nested within a VR trial of booklet-based self-management of dizziness by patients in primary care.</p>

<p>study of booklet-based vestibular rehabilitation with or without remote support Muller et al. (2015)⁴</p>	<p>23 VR trial participants were randomized to either a routine care group, booklet only group or booklet with telephone support group. The trial used the self-treatment VR booklet 21 to evaluate the cost-effectiveness of two models of VR delivery for people with dizziness: booklet only and booklet with telephone support. This study used qualitative, semi structured interviews to explore and understand participant experiences of dizziness self-management using booklet-based VR alone or with telephone support. The sample consisted of 10 men and 23 women between the ages of 27 and 84 (M=59.3, SD=14.27). Fifteen participants (6 men, 9 women) were in the booklet only condition group and 18 participants (4 men, 14 women) were in the booklet and telephone support condition group. Participants were invited onto the trial because they had a diagnosis of vestibular dizziness. Symptom severity was measured by the Vertigo Symptom Scale-Short Form 27 as part of the VR trial.</p> <p>Results: Analysis of 33 interview transcripts identified three main themes; (1) living with dizziness prior to the VR therapy; (2) experiences of therapy, and (3) therapy barriers and impact. Results from the trial found that both the booklet only and booklet with telephone support groups had significantly improved vertigo symptoms compared to the routine care group at 1 year follow-up. Both treatment models were also found to be highly cost-effective.</p> <p>Conclusions and Interpretation: Participants found the booklet easy to understand and follow and were surprised by how simple and gentle the exercises were. Many participants also discussed improvements in their dizziness symptoms since following the VR exercise. Participants described feeling more confident, empowered, less anxious and more supported by family and friends. Participants also discussed partaking in social and physical activities that they could not previously do. These findings suggest booklet-based VR to be an acceptable and valued model for delivering VR. There were some indications that telephone support might encourage better adherence to the VR program. Many participants described the support of their therapist and the positive attitude of their therapist towards their progress as being a key element in their perseverance with the exercises.</p>
<p>Clinical and cost effectiveness of booklet based vestibular rehabilitation for chronic dizziness</p>	<p>Objective: This study is a single blind, parallel group, pragmatic, randomized controlled trial with the objective to determine the clinical and cost effectiveness of booklet based vestibular rehabilitation with and without telephone support for chronic dizziness, compared with routine care.</p>

<p>in primary care Yardley et al. (2012)⁵</p>	<p>Study Design and Methods: Participants randomly allocated to receive routine medical care, booklet based vestibular rehabilitation only, or booklet based vestibular rehabilitation with telephone support. For the booklet approach, participants received self-management booklets providing comprehensive advice on undertaking vestibular rehabilitation exercises at home daily for up to 12 weeks and using cognitive behavioral techniques to promote positive beliefs and treatment adherence. Participants receiving telephone support were offered up to three brief sessions of structured support from a vestibular therapist.</p> <p>Results: Of 337 randomized participants, 276 (82%) completed all clinical measures at the primary endpoint, 12 weeks, and 263 (78%) at one year follow-up. We analyzed clinical effectiveness by intention to treat, using analysis of covariance to compare groups after intervention, controlling for baseline symptom scores. At 12 weeks, scores on the vertigo symptom scale in the telephone support group did not differ significantly from those in the routine care group (adjusted mean difference -1.79 (95% confidence interval -3.69 to 0.11), P=0.064). At one year, both intervention groups improved significantly relative to routine care (telephone support -2.52 (-4.52 to -0.51), P=0.014; booklet only -2.43 (-4.27 to -0.60), P=0.010).</p> <p>Conclusions and Interpretation: This trial has shown two simple and cost-effective means of managing chronic dizziness in primary care for a group of patients who are currently very poorly served. At a minimum, the simple provision of a booklet explaining to patients how to self-manage their symptoms using vestibular rehabilitation exercises seems to have lasting benefits, without incurring any additional resource use relative to routine care. This approach seems to benefit a substantial proportion of patients with chronic dizziness that is aggravated by head movement, in whom a non-vestibular cause has been excluded. To enhance the effects of this intervention, telephone support from a suitably trained therapist might be useful for patients who need and want the additional support. Although telephone support is a little more costly, the enhanced approach is highly cost effective, and would not be difficult to implement within the health service.</p>
<p>VestAid: A tablet-based technology for objective exercise monitoring in vestibular</p>	<p>Objective: The objective of this study was to determine the impact of a tablet-based technology on home exercise adherence and performance for individuals with vestibular dysfunction.</p> <p>Study Design and Methods: This study designed to test the development and laboratory evaluation of VestAid, an innovative, low-cost, tablet-based system that helps patients perform vestibulo-ocular reflex (VORx1)</p>

<p>rehabilitation. Hovareshti et al. (2021)⁶</p>	<p>exercises correctly at home without therapist guidance, is presented. VestAid uses the tablet camera to automatically assess patient performance and compliance with exercise parameters. The system provides physical therapists (PTs) with near real-time, objective (head speed and gaze fixation compliance), and subjective (perceived difficulty and pre- and post- exercise symptoms) metrics through a web-based provider portal. The accuracy of the head-angle and eye-gaze compliance metrics was evaluated. The accuracy of estimated head angles calculated via VestAid’s low-complexity algorithms was compared to the state-of-the-art deep-learning method on a public dataset. The accuracy of VestAid’s metric evaluation during the VORx1 exercises was assessed in comparison to the output of an inertial measurement unit (IMU)-based system.</p> <p>Results: There are low mean interpeak time errors (consistently below 0.1 s) across all speeds of the VORx1 exercise, as well as consistently matching numbers of identified peaks. The spatial comparison (after adjusting for the lag measured with the cross-correlation) between the VestAid and IMU-based systems also shows good matching, as shown by the low mean absolute head angle error, in which for all speeds, the mean is less than 10 degrees.</p> <p>Conclusions and Interpretation: The accuracy of the system is sufficient to provide therapists with a good assessment of patient performance. While the VestAid system’s head pose evaluation model may not be perfectly accurate as a result of the occluded facial features when the head moves further towards an extreme in pitch and yaw, the head speed measurements and associated compliance measures are sufficiently accurate for monitoring patients’ VORx1 exercise compliance and general performance. This study further concludes that the vestibular exercises given as a home program are valid, and this technology allows PTs to have near real time feedback on patient performance. There is a higher chance for the success of the home exercise program if the patient (a) understands the exercise procedure, (b) performs the exercises according to the prescribed regimen, (c) reports pre- and post-exercise symptoms and perceived difficulty, and (d) gets feedback on performance.</p>
<p>iPod-based in-home system for monitoring gaze-stabilization exercise compliance of</p>	<p>Objective: The objective of this study was to describe the research testing and feasibility of a iPod product for in home gaze stabilization training for individuals with vestibular hypofunction.</p> <p>Study Design and Methods: The system’s accuracy for measurement of rotational velocity against an independent motion tracker was validated.</p>

<p>individuals with vestibular hypofunction. Huang et al. (2014)⁷</p>	<p>Then a seven-day in-home trial was conducted with 10 individuals to assess the feasibility of implementing the system. Compliance was measured by comparing the recorded frequency and duration of the exercises with the exercise prescription. The velocity and range of motion of head movements was recorded in the pitch and yaw planes. The system also recorded dizziness severity before and after each exercise was performed. Each patient was interviewed briefly after the trial to ascertain ease of use. In addition, an interview was performed with PTs in order to assess how the information would be utilized. The age range was 28–67 years. Nine of the ten patients had unilateral loss, and one had bilateral vestibular loss, with most patients receiving treatment within six months of their diagnosis. The prescription for the number of repetitions for both yaw and pitch movements ranged from two to eight times per day, and the duration of exercise performance was either 30 or 60 seconds.</p> <p>Results: The correlation of the velocity measurements between the iPod-based system and the motion tracker was 0.99. Half of the subjects were under-compliant with the prescribed exercises. The average head velocity during performance was 140 deg/s in the yaw plane and 101 deg/s in the pitch plane. The PTs were asked to review each patient chart, including those for duration, dizziness rating, velocity, range of motion and head-turn frequency. All four PTs were able to find the problems regarding skipping sessions (shown in the Duration chart), small range of motion, and unchanging dizziness symptom ratings perhaps indicating that the prescription parameters were not challenging enough. When asked about the value of the system, PTs suggested that the patient data might increase accountability for the patient, increase the PT’s understanding of the patient, and assist in patient documentation and patient sharing.</p> <p>Conclusions and Interpretation: The iPod-based system was able to be used in-home. Interviews with PTs suggest that the quantitative data from the system will be valuable for assisting PTs in understanding exercise performance of patients, documenting progress, making treatment decisions, and communicating patient status to other PTs. This study once again utilizes validated home exercises in addition to an iPod-based delivery system to ensure patient adherence and accuracy with exercise. The iPod system will need to be further evaluated in the future, but this is one method to provide more objective feedback for patients and therapists.</p>
<p>The Use of Computer-</p>	<p>Objective: The purpose of this study was to evaluate whether elderly patients with vestibular dysfunction are able to preserve physical</p>

<p>Assisted Home Exercises to Preserve Physical Function after a Vestibular Rehabilitation Program: A Randomized Controlled Study. Smaerup et al. (2016)⁸</p>	<p>functional level, reduction in dizziness, and the patient’s quality of life when assistive computer technology is used in comparison with printed instructions.</p> <p>Study Design and Methods: Single-blind, randomized, controlled follow-up study. Fifty-seven elderly patients with chronic dizziness were randomly assigned to a computer-assisted home exercise program or to home exercises as described in printed instructions and followed for three months after discharge from an outpatient clinic. Exclusion criteria were unstable peripheral vestibular dysfunction including Ménière’s disease, Benign Paroxysmal Positional Vertigo (BPPV), and acute vestibular neuronitis.</p> <p>Results: The participants in the intervention and control group did not differ at baseline for the home training period. The mean duration of dizziness among the participants was more than five years. Central vestibular dysfunction was the most common diagnosis. They did not observe any significant difference in functional level, level of dizziness, or quality of life between the groups. Both groups had maintained their high functional levels three months after finishing the outpatient rehabilitation. No statistically significant difference was found in outcome scores between the two groups.</p> <p>Conclusions and Interpretation: Elderly vestibular dysfunction patients exercising at home seem to maintain their functional level, level of dizziness, and quality of life three months following discharge from hospital. In this specific setup, no greater effect was found by introducing a computer-assisted training program, when compared to standard home training guided by printed instructions. This study suggests that the printed vestibular rehabilitation exercises are effective in maintaining functional status and symptom modulation despite moderate compliance.</p>
<p>Comparison of Activity-Based Home Program and Cawthorne-Cooksey Exercises in Patients With Chronic Unilateral Peripheral Vestibular</p>	<p>Objective: This study aimed to investigate the effects of an activity-based home program and an exercise-based home program on dizziness severity, balance, and independent level of daily life activities in patients with dizziness due to chronic unilateral peripheral vestibular disorders.</p> <p>Study Design and Methods: A single-blind randomized controlled trial. Individuals (N=75) between 18 and 65 years of age who had chronic unilateral peripheral vestibular disorders and vestibular rehabilitation indication. Participants were randomly divided into 3 groups: an activity-based home program (group 1/activity group), an exercise-based home program (group 2/exercise group), and a control group (group 3). After an initial assessment, all groups participated in the patient education</p>

<p>Disorders. Tekin et al. (2021)⁹</p>	<p>program. In addition, the activity-based home program was administered to the first group, while the Cawthorne-Cooksey home exercise program was administered to the second group. In the activity-based home program, Cawthorne-Cooksey exercises were incorporated into purposeful activities. Patients were instructed to carry out the activity-based and exercise-based home treatment programs twice a day, 5 days per week, for a total of 4 weeks. Patients were requested to record their progress in an activity journal.</p> <p>Results: There were no statistically significant differences between the groups in the pretreatment evaluation parameters ($P>.05$). The study found that the severity of dizziness decreased with the treatment in the groups in which the activity-based and exercise-based home programs were applied, while there was no change in the control group. A statistically significant improvement was found in the activity and exercise groups in terms of Visual Analog Scale, Vestibular Disorders Activities of Daily Living Scale, Sensory Organization Test (SOT) 5, SOT 6, and SOT (composite) scores compared with the control group ($P<.05$).</p> <p>Conclusions and Interpretation: The activity-based home program was more effective in improving the home management task, the occupational task, and balance than the exercise-based home treatment program in patients with chronic peripheral vestibular disorders. However, both intervention groups had significant improvements when compared to the control group. This study suggests that while traditional vestibular rehabilitation home exercises are effective in reducing symptoms of dizziness and improving function, activity-based exercises might provide more therapeutic benefit.</p>
<p>The effectiveness of home-based pencil push-up therapy vs office-based therapy for the treatment of symptomatic convergence insufficiency in young adults. Momeni-Moghaddam et al. (2015)¹⁰</p>	<p>Objective: The purpose of this study was to compare the efficacy of office-based therapy with home-based therapy as measured by changes in both objective findings (near point convergence, near heterophoria and positive fusional vergence) and patient symptoms in students with convergence insufficiency.</p> <p>Study Design and Methods: In this semi-experimental study, participants were 60 students from Zahedan University of Medical Sciences (mean age of 21.3 ± 0.9 years). The inclusion criteria were, a survey score 21 or greater using the convergence insufficiency symptom survey (CISS) questionnaire: near exo-deviation which was at least 4 prism diopters more than distance, remote near point convergence (6 cm or more), insufficient near positive fusional vergence, the best corrected monocular visual acuity of 20/25 or better at far and near. Block randomization was used to divide subjects into two groups: Home-based</p>

	<p>PPT and office-based therapy groups. The subjects were followed up 4 and 8 weeks later</p> <p>Results: Prior to starting therapy, the NPC ($P = 0.610$), near heterophoria ($P = 0.821$), and PFV ($P = 0.580$) were not statistically different between groups. After 4 and 8 weeks, only PFV was statistically significantly different between groups ($P = 0.001$). After 4 and 8 weeks, NPC was not statistically different between groups ($P = 0.805$). There was no statistical difference between groups in near heterophoria after 4 and 8 weeks ($P = 0.701$). The mean score of CISS for the two groups was not significantly different before intervention using the independent-samples t-test ($P = 0.308$), but this difference was statistically significant at the end of the therapy sessions ($P < 0.001$).</p> <p>Conclusions and Interpretation: The results of this study indicated that there was a statistically significant decrease in symptoms in both groups, but there was no significant difference between the efficacy of PPT versus office-based therapy for the treatment of convergence insufficiency. While more sophisticated treatment options exist for convergence insufficiency, pencil push-ups provide an affordable, accessible, and simple method for patients with this dysfunction.</p>
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