SYSTEM AND METHOD OF BALANCE TRAINING

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ABSTRACT
A system and method for use in moderating symptoms associated with vestibular disorders. The user stands atop a balance platform and balances or performs other exercises on the platform. The exercises require the user to work against the instability of the platform. Training difficulty may be increased or decreased by changing the pressure of the platform. Over time, the repeated performance of the exercise sessions improves the impairment the user is experiencing due to the symptoms of the vestibular disorder.
Fig. 2

SportKat System

Name: Joe Sample  Motion: Static  Legs: Joe  Level: 2
Mode: Maze  Pattern: None  Time: Joe  Speed: 3

Select a Maze Pattern

- Maze
- Easier
- Horizontal
- Vertical
- Diagonal

Start
Settings

Level

Speed
Fig. 3

SportKat System
Name: Joe Sample  Motion: Static  Legs: Right  Level: 2
Mode: Review  Pattern: None  Time: 30  Speed: 3

Start Settings
Level
Speed

Print
Graph
Fig. 4

SportKat System

Name: Joe Sample
Mode: Maze

Motion: Static
Pattern: None

Legs: Joe
Time: Joe
Speed: 3

Level: 2

PSI: 6

Start
Settings
Level
Speed
Fig. 5

SportKat System
Name: Joe Sample  Motion: Static  Legs: Joe  Level: 2
Mode: Maze  Pattern: None  Time: Joe  Speed: 3

Start Settings
Fig. 6

SportKat System

Name: Joe Sample  Motion: Static  Legs: Right  Level: 2
Mode: Maze  Pattern: None  Time: 30  Speed: 3

Start Settings

Level

Speed
Fig. 7

SportKat System

Name: Joe Sample  Motion: Static  Legs: Right  Level: 2
Mode: Maze  Pattern: None  Time: 30  Speed: 3

---

Diagram showing a maze pattern with the following settings:
- Name: Joe Sample
- Motion: Static
- Legs: Right
- Level: 2
- Time: 30
- Speed: 3

The maze pattern is labeled as 'Maze Pattern' and 'None' is selected for pattern.

---

Start Settings

Level

Speed
Fig. 8

SportKat System

Name: Joe Sample  Motion: Static  Legs: Right  Level: 2
Mode: Maze  Pattern: None  Time: 30  Speed: 3

Start Settings
Level
Speed
### Fig. 9

<table>
<thead>
<tr>
<th>Mode</th>
<th>Pattern</th>
<th>Legs</th>
<th>Level</th>
<th>PSI</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joe</td>
<td>Joe Sample</td>
<td>Joe</td>
<td>Joe</td>
<td>Joe</td>
<td></td>
</tr>
</tbody>
</table>

#### SportKat System

- **Name:** Joe Sample
- **Motion:** Joe Sample
- **Mode:** Joe Sample
- **Pattern:** Joe Sample
- **Legs:** Joe
- **Level:** Joe
- **Time:** Joe
- **Speed:** Joe

#### Clockwise Movig Square - B1 Score vs. Time

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>120</td>
</tr>
<tr>
<td>3</td>
<td>180</td>
</tr>
</tbody>
</table>

- **Zoom Out**
- **Zoom In**
- **Panning**
- **Print**
- **OK**
SYSTEM AND METHOD OF BALANCE TRAINING

[0001] This application is a continuation of U.S. application Ser. No. 11/351,486, filed Feb. 9, 2006.

FIELD OF THE INVENTIONS

[0002] The inventions described below relate the field of improvement of balance function.

BACKGROUND OF THE INVENTIONS

[0003] Balance training systems have been around for several years. For example, the apparatus disclosed in Mason et al., Kinesthetic Diagnostic and Rehabilitation Device, U.S. Pat. No. 5,112,045 describes a kinesthetic diagnostic and rehabilitation device. These devices have been utilized for measuring the extent of kinesthetic impairment resulting from a bodily injury or illness such as endolymphatic hydrops, vestibular neuronitis, migraines, trauma, toxic agents, infectious agents and motion sickness in addition to multiple sclerosis, Parkinson’s Disease, cerebellar degeneration, and Amyotrophic Lateral Sclerosis (ALS). No device has specifically addressed improving balance function in a broader range of subjects. Conventional systems use a rigid platform positioned on top of an unstable support. The user engages in exercises that require the user to maintain a fixed position on the platform as a function of instability of the unstable support. Over time, these exercises result in the user’s kinesthetic improvement. The entire disclosure of the ‘045 patent is herein incorporated by reference.

[0004] Degradation in balance function has traditionally been treated with drugs or non-specific exercises. We propose improving balance function with balance training systems in order to maximize stability and mobility and improve the quality of life.

[0005] When the use of a balance training system is combined with dynamic visual acuity testing, the device and method of use result in an effective and comprehensive balance-training optimization device. Currently, the market does not have any devices designed for balance training that combine a postural stability challenge with a dynamic visual task in one integrated system. Therefore, there is a need to combine an unstable platform with a dynamic visual task as an effective balance training tool.

SUMMARY

[0006] The method and device described below can employ the use of an inflatable device as described in Mason et al., Kinesthetic Diagnostic and Rehabilitation Device, U.S. Pat. No. 5,112,045, and similar devices in conjunction with a balance platform, a bladder, a monitor and a control system for moderation of symptoms associated with vestibular disorders. An individual desiring to improve balance function engages in a regimen using the balance training device. The individual stands atop the platform and balances or performs other exercises for a number of predetermined sessions. The system directs the user to manipulate the platform with his body movement to cause corresponding manipulation of a cursor element on the monitor display. The user manipulates the cursor to trace shape patterns, move through mazes, perform sports related tasks, or maneuver through a virtual environment presented on a monitor that the user views, using the balance platform as a joystick. The complexity of the patterns, mazes, or sports related tasks through the virtual environment may be increased or decreased over a course of treatment comprising multiple sessions spread over several weeks. The treatment is effective to improve balance function.

[0007] The method and device described below can also employ the use of a balance platform that is supported by air springs or hydraulics. The balance platform is used in conjunction with a monitor and control system.

[0008] The method may also include a user worn head tracker and a video projector or screen. The rate tracker is to be worn on the head by the user while engaging in an exercise regimen to sense horizontal or vertical head acceleration, velocity, or position. The rate tracker may sense the head acceleration, velocity or position by several different methods, including measuring user eye movement. The digital projector or screen works in conjunction with the rate tracker to project images on the screen according to the head movement of the user (a dynamic visual acuity task). A letter or some visual display will be viewed on the screen in response to the users’ head motion. The user can select the head motion speed and head direction that will generate the letter or visual display to be viewable by the user. By combining the tasks, this allows for more efficient balance training because the user can vary either the postural stability, element or dynamic visual acuity or both at the same time.

[0009] The exercises require the user to work against the instability of the balance platform. Training difficulty may be increased or decreased by changing the pressure of the balance platform. Increased pressure makes the platform firm and therefore easier to balance upon. Decreased pressure makes the platform less firm and therefore more difficult to balance upon. Over time, the repeated performance of the exercises improves balance function.

[0010] When used to improve balance function, many treatment sessions, spread out over several weeks to months are useful. A full training session consists of 20 to 30 minutes on the device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 illustrates the balance training system used by the user.

[0012] FIG. 2 illustrates a view of the monitor display prompting a user to select an activity;

[0013] FIG. 3 illustrates a view of the monitor display of a static training mode session;

[0014] FIG. 4 illustrates a view of the monitor display of a certain maze pattern;

[0015] FIG. 5 illustrates a view of the monitor display of an easier maze pattern;

[0016] FIG. 6 illustrates a view of the monitor display of a horizontal maze pattern;

[0017] FIG. 7 illustrates a view of the monitor display of a vertical maze pattern;

[0018] FIG. 8 illustrates a view of the monitor display of a diagonal maze pattern;

[0019] FIG. 9 illustrates a view of the monitor display of the graph mode;

[0020] FIG. 10 illustrates a view of the balance training system that incorporates the dynamic visual acuity features;

[0021] FIG. 11 illustrates another configuration of the balance training system; and
FIG. 12 illustrates a hydraulic system for use with the system of FIG. 11.

DETAILED DESCRIPTION OF THE INVENTIONS

FIG. 1 illustrates the balance training system 10. The balance training system 10 can comprise an inflatable bladder 12, a balance platform 14 comprising a platform disk 13 a bladder, a monitor 16, a control system 18, and a tilt sensor 19. The balance platform 14 rests atop of the inflatable bladder 12. The balance platform 14 is sized and dimensioned to accommodate an adult user standing on the top of the platform. The system may also have a pivot 17 located under the platform 14 to assist the bladder in providing varying degrees of stabilizing support beneath the platform 14. This assists the user in maintaining his position on the platform 14 surface.

The balance training system can contain a bladder 12 positioned beneath the centrally pivoted platform disk 13 that provides variable stability to the balance platform 14. The pressure in the bladder 12 can be adjusted according to training criteria or user preference. The pressure range in which the bladder is operable is between about 0 and 15 psi, preferably between 0 and 6 psi. The bladder has a valve 21 which is operable to change the pressure of air in the bladder. The valve provides for either inflating the bladder by adding air to it or deflating the bladder by withdrawing air from it. The training difficulty may be increased or decreased by adjusting the pressure in the bladder. Increased pressure makes the bladder firm, making the platform easier to balance on. This firm setting may be introduced in the early training sessions to allow the user to get used to the balance system. As the user improves and gains experience, the pressure in the bladder may be decreased to soften the bladder, making it more difficult to balance upon. The decreased pressure results in users’ improvement in neurosensory or balance function, increases user strength, develops dynamic balance, muscle control, and results in proprioceptive and vestibular improvement. A pressure adjustment means is provided, such as a pump or compressor 23. The pressure adjustment means is in fluid communication with the bladder via line 25. The pressure adjustment means can be adjusted by the user prior to beginning any exercise session. A pressure transducer 26 is also used to communicate pressure variations from the bladder 12 to the control system 18 via line 27.

The balance training system also contains a tilt sensor 19 for sensing the attitude of the platform. The tilt sensor is positioned on the top of the platform 14. The tilt sensor can be any sensing means such as an inclinometer, an accelerometer, an array of encoders dispersed around the platform, a gravitational sensor, or any other suitable means for sensing the attitude of the platform. The tilt sensor 19 is in electrical communication with the control system 18 via line 28. The tilt sensor measures the attitude of the platform and sends a corresponding signal to the control system 18. This data is analyzed to produce a record of the user’s movements for creating a user specific record. The tilt sensor can also contain stops (mounted under the balance platform) that are preprogrammed to ensure accurate height settings and movement. The tilt sensor will identify when the user has over rotated or can also lock the platform before the user steps on or off the platform.

The control system 18 of the system is operable to process all of the data it acquires in a manner which provides meaningful feedback information to the treating user. The control system receives input from the tilt sensor and interprets the input as indicating the attitude of the user’s position on the balance platform. The control system also receives input from the user regarding the desired modes, manners and other settings for use of the balance training system.

The control system can be installed and operated on Windows 98, Windows 2000, Windows XP Home Edition, Windows XP Professional Edition, Linux and other comparable operating systems. The control system relies on a serial port for communicating between the balance platform and the user interface. The serial port is the dedicated channel to gather information from the balance platform to calculate testing and training results. For each Windows or other operating system, a minimal requirement is placed on the Central Processing Unit (CPU). No designated minimum CPU requirement is specified for the control system other than to conform or surpass the minimal operating system that it is installed on. Likewise, the Random Access Memory (RAM) requirement is to conform to or surpass the minimal requirement set by the operating system and so it the hard drive storage capacity requirement. There is no specific requirement for the floppy drive, CD-RW drive and the DVD-RW drive. Additionally, a standard Windows or Windows compatible QWERTY keyboard is required. Additional hardware such as parallel ports, Ethernet, USB ports, serial ports, PCI slots, VGA out connectors and digital input/output lines can also be used.

The monitor of the system works in conjunction with the control system to display input received from the control system. The data regarding the attitude is sent to the monitor, which generates images or displays of the attitude on the monitor for the user to view. The monitor is also operable to work in conjunction with the control system to generate the images or displays for the user to view while engaging in an exercise session using the balance control system. According to the modes, manners and settings the user has input into the control system, predetermined images are displayed onto the monitor. These images instruct the user how to manipulate the balance platform with his legs, shifting his weight as necessary to affect motion of the graphic element or image on the display.

Referring now to FIGS. 1 and 2, in a currently preferred configuration, the monitor requires a minimum screen real estate of 800x600 pixels in dimension. The minimal requirement must support 16 bit color quality with 800x600 screen resolution. The monitor is designed to support users via both touch screen mode and/or mouse driven mode. Depending on the user’s choice of monitor, the touch screen feature may or may not be supported. If the monitor selected does not support the touch screen feature, the navigation of the user interface can be accomplished through the aid of a mouse. The mouse utilized must be a standard 2 buttons Window or Windows compatible mouse.

FIG. 11 illustrates an alternative configuration of the balance training system having a balance platform, a monitor 16 and a control system for use in conjunction with hydraulics or air springs 22 to control the stability of the balance platform. The hydraulics or air springs 22 are used in place of the inflatable bladder 12 to provide varying degrees of stabilizing support beneath the platform. A pump 29 can be used to maintain a static pressure in the air springs or hydraulics as selected by the user and will be under software control. This system contains hydraulics or air springs positioned beneath
a platform plate 15. The balance platform disc has tilt sensors and load cells 24 positioned beneath it. The tilt sensors and load cells are positioned on top of the platform plate. The combination of the balance platform, the hydraulics or air springs and the platform plate form the entire balance platform on which a use balances. In addition to the tilt sensors for sensing the attitude of the platform, the load cells can sense the weight of the user. The platform disc 13 rests atop of the tilt sensors and nests into a recess in the platform plate. The entire balance platform 14 is supported by a base 20 intended to offer user stability.

[0032] FIG. 12 illustrates a hydraulic system 30 for use with the system of FIG. 11. The hydraulics serve to provide the control system some measure of control over the motion of the platform. These controls are to be in both the X and Y axis, the range of tilt motion and the rate of motion. The hydraulics contain the following components: custom RAM type hydraulic cylinder 31, a normally closed spool valve 32, a check valve 33, a bubble trap and fill point 34, a proportional control valve 35, a custom manifold 36 (which incorporates the normally closed spool valve, the check valve, the bubble trap and fill point and the proportional control valve), a flexible hydraulic hose 37 and control electronics 38 (which controls the items of the custom manifold). The normally closed spool valve 32 is closed when de-energized and blocks the flow of fluid. When energized, the valve opens allowing fluid to flow freely. The check valve 33 can be spring loaded closed therefore blocking the flow in a forward direction. A small amount of pressure in the reverse direction can overcome the spring and allow fluid to pass. The proportional control valve 35 is closed when de-energized, blocking flow in both directions. When current is applied to the valve, it begins to open letting some fluid pass in both directions. As current is increased, the valve opens farther, allowing more fluid to flow. When fully energized, the valve is fully open by allowing fluid to flow freely in both directions. Therefore, by controlling the current to the valve, the rate of the flow through the valve can be controlled.

[0033] The range of motion can also be controlled. Where the platform angle is less than a predetermined limit, both of the valves are energized and therefore the valves opened. This allows the fluid to flow freely in both directions between the cylinders. The platform is therefore allowed to tilt freely in the left and right directions. If the platform reaches the tilt limit in the right direction, the left solenoid valve is closed, blocking flow into the left cylinder. The fluid from the right cylinder has nowhere to go and right motion stops. The check valve allows fluid to flow out of the left cylinder only. As a result, the platform can move no further to the right but is free to move to the left. If the platform reaches the tilt limit in the left direction, the right solenoid valve is closed, blocking flow into the right cylinder. The fluid from the left cylinder has nowhere to go and left motion stops. The check valve allows fluid to flow out of the right cylinder only. As a result, the platform can move no further to the left but is free to move to the right. The Y axis function is identical to the X axis function behavior.

[0034] The rate of motion can also be controlled. Rate information for the X and Y axis is supplied to the control electronics 38. The controller adjusts the current to the proportional control valve to limit the flow rate between the cylinders. The X and Y axis can be independently set. The current settings are taken from an empirically derived table which approximates the desired tilt rate. This tilt rate is an approximation since it only defines the flow at a specific pressure. The actual rate of motion will vary with the applied load. No feedback is provided at this time to monitor and control the actual rate.

[0035] The control electronics 38 receives data from the control system and the tilt sensor and controls the state of the spool valves and the proportional flow control valve. A small micro controller receives rate and limit data from the control system. Limit data is written out to 4 D/A converters creating a left, right, forward and back analog limit voltage. Four comparators compare this voltage to the analog signal from the tilt sensor. The output of the comparators drive the gate of a power fet which applies 24 DC to the appropriate spool valve. Where the tilt sensor values are less than the limits, the solenoid valves becomes equal to or greater than the limit, the comparator output goes low de-energizing or closing the valve and stopping motion in that direction. As the value falls below the limit, the value is again energized, freeing the platform. Rate information is used to select a value from a table within the micro controller. The table value sets the duty cycle of a pulse width modulation (PWM) controller. The PWM controller derives a power fet which supplies energy to the solenoid. The drive sent to the solenoid coil is pulsating DC voltage. The ration of on time to off time is the PWM value. This pulse width modulation of the DC voltage controls the power sent to the solenoid coil and thus the strength of the magnetic field. The stronger the field, the more the valve opens. When the PWM is zero, the valve is closed and no fluid can flow. When the PWM is at 100% the valve is fully open and maximum flow is obtained.

[0036] Platform plate 15 can be made from cast aluminum or any other suitable material that can accommodate the user maximum weight requirements. The platform plate has a maximum tilt of 20 degrees in order to allow more stability to the user when performing the exercises. The maximum tilt angle ensures a user will not fall when engaging in the exercises and also provides stability when a user is getting on or off from the disc. The load cells 24 ensure accurate height settings and movement of the balance platform 14.

[0037] In use, a user begins by standing on the balance platform of the balance training system and initiating the monitor 16 and control system 18. Information regarding the user’s age, height, and weight are input into the control system in order to set up the balance training system. Optionally, the user may utilize a Smart Card of Fit-Key System that identifies that individual and is specific to the user. This way the user does not have to enter the information every time. The Smart Card or Kit-Key System may also store programs and records workout data of each user. The user is then prompted to select from one of several different modes, patterns, and other settings. According to the settings selected, the user then engages in exercises involving manipulation of the balance platform by shifting the weight in his legs. The control system is operable to provide displays on the monitor for the user to view in order to manipulate the display according to the platform attitude.

[0038] The settings for the exercise settings require several different inputs by the user. The monitor prompts the user to adjust the amount of pressure to adjust the stability of the platform. The pressure ranges from 0 to 15 psi, preferably between 0 and 6 psi. A lower pressure provides for greater instability of the platform. A higher pressure provides for a more stable platform. Typically users initially set the pressure setting closer to 6 psi to provide a good balance between
stability and resistance. The selected pressure is generally one which at least somewhat destabilizes the platform and causes the user to work kinesthetically in maintaining the position of the platform surface. The monitor also prompts the user to input a foot pattern in that the user may either use his left foot only, his right foot only, or both feet simultaneously to manipulate the platform. Additionally, the monitor prompts the user to enter a time interval for the exercise session.

[0039] The user must select from one of the following desired modes: 1) maze; 2) review; 3) test; or 4) training. If the user selects the maze, test, or training mode, he must further select the desired manner for these modes. Any of these modes must be performed in one of the three following manners: 1) static; 2) dynamic move; or 3) dynamic. A user views a cursor or graphical element on the display monitor. Graphically this cursor is represented by an “X” on the monitor. The cursor is a virtual representation on the monitor of the user’s body movements. As the user moves, the cursor on the monitor moves in a corresponding submode.

[0040] In a static submode, the user attempts to maintain his body position on the balance platform such that the X cursor is centered on the display monitor throughout the entire exercise interval.

[0041] FIG. 3 illustrates the display viewed by a user on the monitor during a static submode exercise session. The goal of the dynamic submodes is to engage the user in a series of exercise sessions where the balance platform is used as a joystick. The user either traces a pattern or moves through a virtual environment in order to complete the exercise session. In the dynamic pattern submode, the user attempts to manipulate the cursor along the outline of a selected pattern in order to trace the pattern. The pattern may be any of the following: a circle (clockwise or counterclockwise); a square (clockwise or counterclockwise); a cross; a FIG. 8; or an infinity symbol.

[0042] In the dynamic submode, the user views both the cursor on the monitor as well as a square icon. The user attempts to manipulate the cursor in different ways with his body position. The cursor is manipulated so that it is positioned over the square icon and then moves the square icon. The square icon is moved throughout a series of mazes or other activities that appear on the monitor. Each activity contains paths and obstacles. Contained within the obstacles of the configuration are circle icons. The user manipulates the X cursor over the square icons in order to “pick up” and “move” or “drag” the icons through the maze and on top of the circle icons. Once the square icon has been positioned over the circle icon, the circle icon is considered captured and the user may then move on to capturing the other circle icons. Once all of the circle icons have been captured, the maze is completed and the session time is recorded and used for assessment of improvement.

[0043] The user can also select a testing mode that tests for dynamic visual acuity. This testing mode requires that the user input the desired head motion speed as well as specify the head direction. The mode then allows the user to do one of the following three: 1) the user views visual letters or optotypes in a random pattern; 2) the user views visual letters or optotypes only if the head is moving within a particular velocity range and the user can change this range as desired; or 3) the user views letters or optotypes only if the head is moving in a particular direction (right, left, up and down) and the user can change this direction as desired. In use, once the settings have been input for the desired dynamic visual acuity mode, the user would observe a letter or optotype only if the user was moving his head in the desired preset range. The wrong velocity and wrong direction would result in no display to the user. The visual output would be displayed to the user on a video projector that displays images at a distance of 5 to 10 feet from the rehabilitation device. Alternatively, the output may be displayed on the monitor.

[0044] FIGS. 4 through 8 illustrate different mazes that may be selected for use by the user in the dynamic submode. FIGS. 4 and 5 illustrate mazes that contains a honeycomb pattern with circles positioned within the honeycomb pattern. FIG. 6 illustrates a maze pattern that contains horizontal block obstacles with circles positioned between the obstacles. FIG. 7 illustrates a maze pattern that contains vertical block obstacles with circles positioned between the obstacles. Finally, FIG. 8 illustrates a diagonal maze pattern where the circles are positioned at the corner of each diagonal. The goal with each of these mazes is to have the user manipulate the X cursor over each of the square icons. The user then “picks up” the square icon and “moves” or “drags” it through the maze to capture the circle icons. Each maze requires different steps of manipulation by the user because each maze has different obstacles prevent certain types of movement of the square icon.

[0045] Once the interval is complete, the user can view the results of the interval and compare it to previous interval sessions in order to note improvement. This is done by selecting the review mode. A representation of the graphs the user views are illustrated in FIG. 9. A user viewing the report of FIG. 9 may review the data from previous sessions and compare it to more recent sessions in order to determine what amount of progress has been achieved. The data is presented in a bar chart that summarizes the score the user received during each training session versus the time it took to achieve that score.

[0046] FIG. 10 illustrates a view of the balance training system that incorporates the dynamic visual acuity features. The balance training system includes an inflatable bladder 12, a balance platform 14 comprising a platform disk 13 and a bladder, a monitor 16, a control system 18, a tilt sensor 19, a head tracker 39 and a video screen 41. The videostagmographic head tracker 39 is worn on the head of the user. The purpose and function of the rate sensor is to sense horizontal or vertical head motion of the user. The sensor receives and communicates the users’ head velocity to the control system 18. The control system is operably connected to a video screen 41 that displays images at a distance of 5 to 10 feet from the user. While the user is engaging in an exercise regimen, the head velocity readings are communicated to the control system and a visual output is then projected onto the video screen. The visual output can be in the form of a letter capable of being viewed by the user.

[0047] Once the user has selected which mode is desired (testing, review, maze, or training), then the user selects an additional mode for testing dynamic visual acuity. The user wears the head tracker 39 while engaging in an exercise regimen. The head tracker contains sensors that can determine the position and orientation of the user while on the balance platform. The sensors and associated head tracker can sense the head acceleration, velocity, and/or orientation of the head. Alternatively, the sensors can be adapted to determine the acceleration, velocity and/or orientation of the head by using eye movement sensors. The sensor is operably connected to the control system and the users head velocity is communicated to the control system as the user engages in an
exercise regimen. The control system then communicates a visual output display to the video screen. The visual output can be in the form of a display letter that appears in a random pattern on the video screen. Alternatively, the display letter can appear to the user only if the users’ head is moving within a particular velocity range or else only if the users’ head is moving in a particular direction (right, left, up, and down). The desired mode of operation setting can be adjusted by the user prior to engagement in the exercise regimen. Before use, the user can also input the size of the display desired to be viewed using the normal eye chart as a reference.

[0048] In use, the head tracker could be set for Right-50-100 deg/sec therapy. In this case the user would only see a letter display on the screen if they were moving his head rightward in the range of 50-100 deg/sec. If the user’s head is not moving in the correct velocity range, the head tracker sensors communicate this to the control system which removes the visual display from the video screen. A user may engage in repetitive head turning exercises for the entire duration of the exercise regimen. The user would continue to view the letter as long as his head was moving in the appropriate direction and velocity. The letter disappears once the users’ head stops moving or as it moves back to center. The user then once again views the letter upon achieving head movement in the correct direction and at the correct velocity. This could continue for the entire span of any particular exercise interval session. The user could then change the input to Left-100-150 and would result in a displayed letter only when the user was moving his head leftward in the range of 100-150 deg/sec.

[0049] The system is calibrated by utilizing a series of instructions used with respect to the existing setup. For each calibration screen, the user is instructed to perform a specific task in order for the system to collect the necessary calibration data. For example, the user may first be prompted to step on or off the platform and press OK. When the user is on the platform, he may be instructed to tilt all the way forward or backward, then hit OK. Then the user may be instructed to step back on the platform, tilt all the way to the right or left, and then hit OK.

[0050] Thus, while the preferred embodiments of the devices and methods have been described in reference to the environment in which they were developed, they are merely illustrative of the principles of the inventions. Other embodiments and configurations may be devised without departing from the spirit of the inventions and the scope of the appended claims.

We claim:

1. An apparatus comprising a processor and memory storing machine executable instructions that when executed by the processor cause the apparatus to:
   receive a signal indicating motion of a user on a platform;
   receive a signal indicating motion of a head of the user;
   output a display signal including video indicating performance of a combination of tasks controlled with the signals.

2. The apparatus of claim 1 wherein the combination of tasks require the user to balance against an instability in the platform.

3. The apparatus of claim 1 further comprising the platform, wherein:
   the platform is adapted to sit at a variable tilt angle ranging between minimum and maximum limits relative to a base; and

the platform, when supporting the user, sits at the minimum or maximum limit unless actively balanced by the user to sit at a tilt angle between the limits;

4. The apparatus of claim 1 further comprising a head motion sensor configured to generate the signal indicating the motion of the head.

5. The apparatus of claim 1 wherein the machine executable instructions, when executed by the processor, further cause the apparatus to display, in the video, direction to the user for performing the tasks.

6. The apparatus of claim 1 wherein:
   the video includes a graphic that moves in response to the signal indicating motion of the user on the platform; and
   one of the tasks directs the user to move the graphic in a prescribed pattern.

7. The apparatus of claim 6 wherein the display signal includes a pattern and the one of the tasks directs the user to trace a pattern with the graphic.

8. The apparatus of claim 6 wherein the display signal includes a maze and the one of the tasks directs the user to move the graphic through a maze.

9. The apparatus of claim 1 wherein the tasks combine a postural stability challenge with a dynamic visual task.

10. An apparatus comprising a processor and memory storing machine executable instructions, that when executed by the processor, cause the apparatus to:
   receive a signal indicating motion of a user on a platform requiring the user to balance against an instability in the platform; and
   output a display signal including a graphic that moves in response to the received signal, and including a stability task requiring the user to move the graphic in a prescribed pattern.

11. The apparatus of claim 10 wherein the instructions, when executed by the processor, further cause the apparatus to receive a signal indicating motion of a head of the user, wherein the display signal further includes a dynamic visual task to perform simultaneously with the stability task.

12. A method of treating a person to improve the person’s stability, comprising:
   displaying on a monitor a graphic that moves in response to motion of a platform requiring the person standing on the platform to balance against an instability in the platform;
   displaying on the monitor a task requiring the person to move the graphic in a prescribed pattern;
   scoring a performance of the task; and
   displaying the scoring on the monitor.

13. The method of claim 12, further comprising:
   scoring multiple performances of the task; and
   displaying on the monitor changes in the scoring over the multiple performances.

14. The method of claim 12, wherein the method treats a vestibular disorder of the person.

15. A method of treating a person to improve the person’s stability:
   displaying on a monitor a graphic that moves in response to motion of a platform caused by a person standing on the platform;
   displaying on the monitor a stability task requiring the person to move the graphic in a prescribed pattern;
   displaying on the monitor a graphic indicating performance of a dynamic visual task by the person;
scoring a simultaneous performance of the stability task and the dynamic visual task; and
displaying the scoring on the monitor.

16. The method of claim 15, further comprising:
scoring multiple simultaneous performances of the task; and
displaying on the monitor changes in the scoring over the multiple simultaneous performances.

17. The method of claim 15, wherein the method treats a vestibular disorder of the person.

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