[54] METHOD AND APPARATUS FOR DYNAMIC HEALTH TESTING EVALUATION AND TREATMENT

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[57] ABSTRACT

Method and apparatus for a dynamic health testing, evaluation and treatment comprising the recordation of test data from large numbers of individuals to establish dynamic physical performance norms for patients of many varied types. Historical data is taken from a patient which, in conjunction with a physical examination, is used to establish a specific theoretical dynamic physical performance norm for that particular patient and the recommended loading for the dynamic health testing machine. The patient is placed on the exercise machine which is under a programmed load based upon the basic data and numerous parameters of the patient's state of health are monitored under dynamic conditions. The monitored information is continuously fed back to correct the programmed load to protect the patient against overstrain. The patient's performance is then compared with his own theoretical norm and treatment is recommended consistent with the patient's age and health which would lead toward the achievement of the dynamic physical performance norm.

11 Claims, 3 Drawing Figures
FIG. 3
METHOD AND APPARATUS FOR DYNAMIC HEALTH TESTING EVALUATION AND TREATMENT

This invention is directed to a method and apparatus for carrying out the method for establishing an accurate, standardized, dynamic, and repeatable health evaluation system which will diagnose, evaluate, and systematically program an individual from a condition of minimal to optimal physical performance reserve, excluding, of course, certain non-reversible cardiopulmonary pathologies.

At the present time there is nothing known to be available in the prior art in the form of either a standardized, dynamic health evaluation; dynamic physical performance rehabilitation program; or combination evaluation, reconditioning and post conditioning maintenance system. Static cardiac tests (EKG) have been shown to be essentially valueless for prognostic or corrective tests.

Heart disease is the number one medical problem as it is the leading cause of death in the United States with 54.3 percent of all deaths resulting from heart disease. Above the age of 45 years, heart disease claims lives by a two to one ratio over the next leading cause of death.

The primary object of the present invention is to provide a new and improved method and apparatus adapted to test for and establish levels of reversible cardiovascular and cardiopulmonary disease or cardiovascular deconditioning in various population segments and to develop and prescribe an optimum therapy program leading to a state of normal health.

A further important object of the invention is to provide a new and improved method and apparatus adapted to establish a unique and standardized nationwide source of dynamic physical performance data for cardiovascular and cardiopulmonary research.

In accordance with the invention there is provided a novel method and means for carrying out the method, which method comprises the steps of establishing and recording basic patient data in the form of the significant parameters of cardiac, pulmonarv, and physical characteristics for differing categories of patients and establishing a physical, cardiac, and pulmonary norm for each category; further, establishing and recording the significant cardiac, pulmonary and physical characteristics of a specific patient; comparing the significant cardiac, pulmonary, and physical characteristics of the patient with the norm for the category into which he fits to establish the amount of deviation from the norm; establishing a dynamic treatment program in accordance with such deviation, and modifying the dynamic treatment in accordance with the monitored data to provide an optimum level of reconditioning therapy to lead the patient to a normal state of health.

For a better understanding of the present invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

In the drawings:

FIG. 1 is a perspective view of the apparatus according to the present invention in operation;

FIG. 2 is a block diagram of a computer program for carrying out the method of this invention, and

FIG. 3 is a block diagram of the complete dynamic health evaluation system according to the present invention.

The method and apparatus of this invention which shall be termed the dynamic health evaluation system 10 and as preferred embodiment thereof disclosed in FIG. 1 involves the unique combination of several different systems. These are the static data input systems 12, the exercise systems 14, the body parameter measurement or sensor system 15, the central processor system 16, and the data output systems 18. The static data input system 12 comprises a typewriter, reader, and paper tape input device which is standard peripheral equipment of the PDP-12 computer, sufficiently described below, and which receives patient data and physical deconditioning data for input to the central processor. The exercise system 14 comprises a load device such as a treadmill, bicycle ergometer, or crank ergometer and provides a controlled and programmed load to the patient during the test. The sensor data is being obtained. A suitable treadmill is known as model P-2000, manufactured by Warren E. Collins, Inc., 220 Wood Road, Rainlert, Mass. The body parameter measurement system 15 obtains the dynamic body functions through sensors and pickups digital for input to the central processor system. The central processor or computer system 16 which may be a model PDP-12 computer from Digital Equipment Corp., 146 Main Street, Maynard, Mass. includes a combination of digital input converters, programmable output devices, historical data storage, and the central processor. This system receives the static patient data, the dynamic body measurement data, population research data and the exercise load data, and computes, compares, and programs output data to the output data systems 18 which include the printer, printout reader, exercise load setting device, and magnetic tape memory storage. A suitable printer is manufactured by Houston Comptron, Houston Instruments Division of Bausch & Lomb in Bellair, Texas. The printout reader, exercise load setting device and magnetic tape memory storage are standard peripheral equipment of the PDP-12 computer.

In carrying out the method of this invention, the physiologic monitoring parameters of primary importance to be measured by the body parameter measurement system 15 are believed to be heart rate and rhythm, blood pressure, ST segment of the electrocardiograph, oxygen consumption, CO2 production, and respiratory rate and volume. The system 15 may comprise an electrocardiograph such as model 317 available from the Bircher Corporation, 4371 Valley Blvd., Los Angeles, Calif. for taking an EKG which supplies a signal to a heart rate meter such as model 760-20-121 manufactured by the Sanborn Division of Hewlett Packard Co., 175 Whymar Street, Waltham, Mass. Oxygen consumption may be measured by a model 778 Oxygen Processing Analyzer from Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton, Calif. and CO2 production may be measured by a model 315 Infra Red CO2 analyzer from the same company. Blood pressure may be measured by a model 1900 London Pressureometer from the Avionics Research Products Corp., 6901 West Imperial Hwy, Los Angeles, Calif. and the respiratory rate by a model 760-20-130 meter from the Sanborn Division of Hewlett Packard Co., 175 Whymar Street, Waltham, Mass. These measurement parameters are chosen because they are believed by leading cardiologists across the nation to be the best current indexes to cardiopulmonary function, and because they can be used with safety and without surgical insult to the patient. The measurements made are concerned with dynamic conditions, that is, it is the rate of change per unit time under dynamic patient conditions in each of the parameters stated that is considered significant.

The present invention takes all of these measurements and correlates, weights and evaluates them and brings them into the determination at the best possible time. For example, the change in heart rate may be the most important at the very beginning of the exercise program. The change in oxygen consumption may be more significant when it reaches the steady state after several minutes. Blood pressure is usually most important at that time. Furthermore, it is believed that it is necessary to provide a device which will allow patients to exercise at their own level of comfort and that the exercise should be continuous to allow the exercise to be motivational and not to be overly stressful. Therefore, the present invention preferably includes a cramp exerciser, a treadmill, a bicycle ergometer or a crank ergometer and provides a controlled and programmed load to the patient during the test. The sensor data is being obtained. A suitable treadmill is known as model P-2000, manufactured by Warren E. Collins, Inc., 220 Wood Road, Rainlert, Mass. The body parameter measurement system 15 obtains the dynamic body functions through sensors and pickups digital for input to the central processor system. The central processor or computer system 16 which may be a model PDP-12 computer from Digital Equipment Corp., 146 Main Street, Maynard, Mass. includes a combination of digital input converters, programmable output devices, historical data storage, and the central processor. This system receives the static patient data, the dynamic body measurement data, population research data and the exercise load data, and computes, compares, and programs output data to the output data systems 18 which include the plotter, printout reader, exercise load setting device, and magnetic tape memory storage. A suitable plotter is manufactured by Houston Comptron, Houston Instruments Division of Bausch & Lomb in Bellair, Texas. The printout reader, exercise load setting device and magnetic tape memory storage are standard peripheral equipment of the PDP-12 computer.

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a weighted and regulated workload regardless of which device is being used. The processor of the system comprises a computer which is programmed to compare a given individual using the dynamic testing device, against a preestablished norm for a person of that type. The device establishes approximately how a specific individual should perform if he were in good physical and cardiopulmonary health. This performance curve is accomplished by a comparison of the individual’s data with clinical data stored in a memory bank that considers such important parameters as physical handicaps, known cardiac disease, age, weight, existing pathology of non-cardiac origin, and the like. The dynamic health evaluation (DHE) system establishes that if the pertinent information concerning a specific person is recorded and evaluated against sufficient known clinical dynamic performance data, it will show what that specific person’s physical performance capacity should be. Subsequently, when the same patient goes through the actual dynamic testing process, he prints out his own personal curve of performance in the readout system. Simultaneously, the computer prints out a proposed curve of performance for that same individual as if he were in a normal state of health. The personal performance curve would be first of all, a series of curves representing approximately five or six specifically weighted physiological parameters such as, but not limited to heart rate and rhythm, blood pressure, ST segment of the EKG wave, oxygen consumption, carbon dioxide production, respiratory volume and rate. The computer would, in addition, combine this information into a single weighted performance summary curve for that patient. The purpose is to provide the dynamic health evaluation clinic physician or other physicians reviewing the patient’s condition complete information on what the person’s performance was in each parameter. The individual himself would receive a copy of the summary curve of performance, so that he could compare himself against, not necessarily an athletic model, but rather a person just like himself, in a good state of health.

An additional function of the computer of the DHE clinic is to compare the two curves, that is the curve of the individual’s own performance and the theoretical curve of a similar individual in optimum physical condition, and produce a recommended reconditioning level designed in terms of intensity, frequency, and duration to systematically program this patient to an optimum state of physical capacity that is consistent with his age and general health.

A simplified description of the computer operation follows. There are four separate inputs or signals to the computer. These are: (1) basic patient statistics, (2) normal population coefficients, (3) no-go limits and, (4) patient dynamic measurement parameters. The outputs or signals from the DHE system includes: (1) point by point plot of each dynamic measurement parameter of the patient, (2) point by point plot of each dynamic measurement parameter corrected to provide a curve of the patient as if he were in normal cardiac health, (3) summary plot or curve combining all patient dynamic measurement parameters into a single curve utilizing previously established weighting factors, (4) summary plot or curve for patient in normal cardiopulmonary health, (5) plot of difference between patient summary curve (3 above) and ideal summary curve (4 above), (6) programmed load for a load device such as a treadmill, and (7) printout of optimum reconditioning level and schedule to minimize variation in (5).

Reference is now made to FIG. 2 which shows a simplified block diagram of the intelligence flow of the system. The basic patient statistics are collected and data introduced as at 20. These include the significant history and physical examination data. Based upon this actual patient historical and physical examination data, normal curves which are generally representative of this patient for each significant parameter such as heart rate; oxygen consumption; blood pressure; and the like are withdrawn from research data as at 22. These normal curves are derived from past research test data which is used to generate an equation of the curve. The equation for these parameters in terms of height above a coordinate axis and time can be expressed by the following equation:

\[ B = a_1 t + a_2 t^2 + a_3 t^3 + \ldots + a_n t^n \]  

Where:
- \( B \) = functions of the significant patient parameters
- \( a \) = coefficients which are a function of the basic patient statistics and research statistics
- \( n \) = indication of the complexity of the curve
- \( t \) = elapsed time from start of test

The alphas are derived from research data and are continually updated as more data is accumulated.

In addition, dynamic physical data will be obtained from the patient during the test for each significant parameter such as heart rate; oxygen consumption; blood pressure; and the like as at 28 and will generate a curve of actual values versus time. This results in two curves as at 34 for each of the significant parameters; one curve the patient has exhibited during the test and one nominal curve from research data. These curves are constructed on the same time base and are plotted during the test for comparison purposes.

All of the significant parameters can be combined into one performance summary curve. The value of performance at a particular time in the test is determined by equation of the form of equation 2. The usage of equation 2 is similar in that two curves are constructed from its results; one curve based on the data exhibited by the patient during the test and one nominal curve:

\[ Y = B_1 + C_1 t + B_2 + C_2 t + \ldots + B_n + C_n t^n \]  

Where:
- \( Y \) = performance summary value
- \( B \) = functions of the significant patient parameters from equation 1 or actual patient test data
- \( C \) = weighting factors based on the relative importance of the betas with time

The weighting factors \( C \) are determined from accumulated research data and stored as at 22 to solve equation 2 as at 32. The initial treadmill setting is determined from basic patient statistics and research data as at 24.

As the test is started, values for all of the significant patient parameters are obtained from the sensors as at 26 and fed to 28 as the first data point. This first data is associated with a time such as the time of start of the test. The time of all other data points is measured from this point. This point is used in equation 1 to obtain the ideal value for the patient parameter as at 30. This process is simultaneously repeated for all of the significant patient parameters. All of these ideal values for patient parameters are used along with their associated time in equation 2 to obtain a point on the normal ideal summary curve as at 32. All of the actual readings of the patient parameters obtained from the treadmill and sensors are used in equation 2 to obtain a summary dynamic patient curve as at 34. The final composite curve and the dynamic patient curve are compared as at 32 and a difference output obtained and plotted at 34. This difference is an indication of how far the patient deviates from the ideal value. It is recorded as at 36 and may be used to revise the treadmill setting as at 38.

At the end of this process, for each data point, the following parameters may be plotted on the plotter versus time as at 34: results of test data for patient parameters; results of ideal parameters; results of equation 2 for patient parameters; results of or for ideal parameters; and differential values. The differential values are also plotted versus time and can be used to prescribe treatment for the patient, since it is an indication of the patient’s deviation from the ideal which represents that necessary to bring the patient to an optimal state of health attainable for him. The patient data value, its associated time and the treadmill setting are compared to a memory as at 29 for each data point. The current treadmill setting may be altered as at 38 as the data points are produced whenever the patient’s data value from the treadmill and sensors exceeds or approximates a value stored in the memory which would be dangerous for the health of the particular patient. The next data point is obtained from the sensors and the
loop is repeated from the point at which the data point is associated with a time value. Thus at any time during the dynamic test, if a demand is made upon the patient which is in excess or approaching an excessive demand, the data from the sensors by comparison with a value stored in the memory, will reprogram the treadmill to a less severe program to protect the patient. The system of this invention may be used as a research tool, whereby data from many many patients would be made available through a computer system to do various research projects on the development and progression of cardiovascular disease. Thus, the dynamic health evaluation system concept would establish a standardized dynamic testing and evaluating system which could be used throughout the nation. The specific parameters measured by the system may vary with experience but would appear at the present time to include: Heart Rate: The rate of change of heart rate per unit time and intensity of physical exertion is a sensitive and fundamental indicator of cardiac function. It is also currently one of the most dependable and convenient method of limiting physical overexertion potential in normally functioning hearts; thus to say an individual will work or exert himself up to a given heart rate level is a recognized and quite standard limit establishing approach. There are acceptable maximum heart rate levels established and there is a considerable amount of work available on heart rate as an index to cardiac performance. Blood Pressure: The rate of change of blood pressure per unit time and intensity of physical exertion may be used as an indirect indicator of compliance of the cardiovascular system; the systolic blood pressure curve may furnish information on the force and time of ventricular contraction. Blood pressure is important because it gives information relating to the circulatory systems general capacity to adapt to an increased movement or pressure of blood. If the diastolic blood pressure elevates with exercise, the patient may be in the hypertensive or the pre-hypertensive category. If the blood pressure goes down or stays the same, the individuals blood pressure response is probably normal. The blood pressure pulse wave may offer information on the general cardiovascular condition relative to the development of atherosclerosis. ST segment of the electrocardiogram: A bipolar transhoracic lead EKG offers an option to monitor changes in the ST segment of the EKG wave. This segment follows the ventricular contraction or the QRS complex and is considered to be the ventricular repolarization or recovery wave. A good deal of research on this subject has shown that the ST segment is probably associated with cardiac ischemia or a lack of proper oxygenation due to compromised coronary circulation. Some physicians believe that the level of depression of ST segment with exercise even indicates in a quantitative manner the amount of circulatory embarrassment or diminution of perfusion of the cardiac muscle with exercise. It also is an important diagnostic factor in that it gives a good indication of what the patient is experiencing at any time he may complain of chest pain or other discomfort related to cardiopulmonary function. In addition, the EKG wave will furnish cardiac rhythm or evidence of abnormal contractions and rhythms. 

O$_2$ Consumption: Changes in the rate of O$_2$ consumption are an indirect measurement of changes in the rate of metabolism. Maximum O$_2$ consumption may be used as an indication of physiological performance capacity, or aerobic energy output. Oxygen is consumed in metabolism, and if the person's skeletal muscle mass is known, the oxygen uptake may give an idea of how efficiently the muscle mass is functioning. When large muscle groups are involved, oxygen consumption becomes a valid index to a person's ability to perform physically or his aerobic motor power. There may be a necessity for a correction for pulmonary function in that a person may have sufficient metabolic capacity but have deficient pulmonary or ventilatory capacity.

CO$_2$ Production: CO$_2$ production is an additional indirect indicator of metabolism. The CO$_2$ produced is a waste product. A measure of the performance of an engine can be made by the amount of air it takes in, or by the amount and type of air or exhaust that it puts out. One can calculate a respiratory coefficient or an exchange ratio of the amount of CO$_2$ produced related to the amount of oxygen taken in. This measurement offers an index to the efficiency of the skeletal muscle and its output capacity. It is also a good index to the condition of the cardiopulmonary complex, that is, the capacity of the blood to circulate oxygen and the respiratory membrane to exchange oxygen and carbon dioxide.

Respiratory Volume/Min: The mechanical capacity of the pulmonary system to furnish O$_2$ can be the limiting factor in establishing physical capacity. Its evaluation adds to the performance profile. This measurement is used mainly in combination with the others to establish the mechanical capacity of the chest, lungs, trachea, the air distribution system to the respiratory membrane. That is, how well is the person getting air or oxygen to the respiratory membrane and how well is he moving away carbon dioxide.

The dynamic health evaluation system is designed in such a manner that the physical activity type parameters can be changed or modified as additional research data becomes available. For example cardiac output, oxygen saturation in mixed venous blood, systolic ejection time, and others could be included or replace existing parameters as technical progress allows more efficient and reliable sensing devices. Dynamic Health Evaluation System: To further clarify the function of the DHE, an imaginary patient will be taken through the system as illustrated by FIG. 3. As the patient enters the clinic at an appointed time, he will first go through the pre-test history to develop the data as at 40 to be inserted into the central processor or computer 44. The patient's health history is obtained by a technician and an automated electronic questioning system as at 41. The questions would be related to five main categories. The first would be cardiovascular disease. The intention would be to establish any existing disease or past disease state that could limit or affect current dynamic cardiovascular performance capacity. It would also eliminate past diseases that are not pertinent to current performance capacity and help to establish a safe exercise limitation. The second category would be the pulmonary disease area. Here again, the intention would be to establish any existing or past disease which would compromise the pulmonary system and therefore compromise the capacity of the individual for physical work. In this area, physical activity, diet, weight, geographical location, a smoking or air pollution history, etc., could be considered in conjunction with cardiopulmonary conditions as parameters in a variety of research programs. The third category is physical impairment. Such things as arthritis, old leg or back injuries could alter a person's ability to perform and thus influence his physical output capacity. This category of the history would attempt to establish existing and past disease, or injury that might affect the individual performance. The other thing it would do is to establish the best type of exercise system for a particular patient such as a bicycle ergometer, treadmill or a crank ergometer. The fourth category of the history would be physical activity. This would allow the computer to know the type and intensity of exercise to which the individual is normally accustomed. Such information would help to determine the most appropriate exercising device and also provide data for the level of testing intensity to employ. The last category would be general health area. This again would attempt to establish past or present disease, conditions of metabolism, circulation, CNS (central nervous system) function, etc., which might currently limit the person's exercisable capacity. The questions are asked and the answers provided in a coded form so that a digital type output can be placed into the central processor or computer. It will in part program the level and type of exercise to be used. The patient next experiences the physical examination as at 42. This is at least a partially automated system which measures the per...
What is claimed is:
1. Apparatus for use in dynamic health testing, evaluation and treatment of a medical patient, said apparatus comprising:

an exerciser means programmable to provide a selected load to cause a patient to exercise a predetermined amount;
sensing means connectable to the patient to sense at least one body function parameter of the patient while exercising for providing first output signals as a function of the amount of exercise undertaken by the patient;
an information storage means for providing second output signals from information stored therein indicative of the same body function parameters of at least one healthy human body when undergoing the same exercise;
comparison means for comparing said first and second output signals and providing an output indicative of any variation therebetween;
means for programming said exerciser in response to said second output signals; and
means for modifying said exerciser program in response to said first output signals.

2. Apparatus, as claimed in claim 1, wherein said sensing means senses a plurality of body function parameters and said information storage means stores the means for providing second output signals indicative of a corresponding plurality of body function parameters derived from a composite of healthy human bodies when undergoing the same exercise, said information storage means further comprising:
means for storing data from said sensing means;
first means responsive to the information stored on healthy human bodies to provide output signals for generating individual performance curves for each body function parameter being measured and for generating a summary curve of all body function parameters being measured for the patient if he were in a normal state of health;
second means responsive to the data stored from the sensing means to provide output signals for generating individual performance curves for each actual body function parameter of the patient being measured and for generating a summary curve of all actual body function parameters being measured; and
third means responsive to output signals from said first and second responsive means to provide output signals for generating curves representative of the variance between the individual curves generated by the output of said first responsive means and the individual curves generated by the output of said second responsive means and representative of the variance between the summary curve generated by the output of said first responsive means and the summary curve generated by said second responsive means, respectively;
said comparison means further including:
plotting means for plotting said curves in response to said outputs of said first, second and third responsive means respectively.

3. Apparatus, as claimed in claim 1, further including:
means for updating the information in said information storage device as more data is developed.

4. A dynamic testing, evaluation and treatment method for determining the state of health of the body of a medical patient, said method comprising the steps of:
exercising the patient using an automatic processor controlled exercising means;
measuring at least one of the significant health parameters of the patient's body while it is being exercised;
obtaining at least one of the same significant health parameters from a human body of the same characteristics while doing the same exercise and known to be in a good state of health;
feeding the above measured and obtained parameters to an automatic processor means to compare the measured health parameters with the same parameters of the healthy human body; and

son's body weight, his height, etc., which goes into a digitized form to be used directly by the computer 44. The body type such as endomorph, mesomorph, ectomorph; the per cent overweight or underweight; body temperature; the resting blood pressure; resting pulse rate rhythm from resting EKG derived from the pretest resting state are also programmed in. Secondarily, there would be included some pulmonary measurements such as vital capacity, expiration time, maximum breathing capacity, and a further point is to physically examine any areas of real or suspected physical conditions relative to exertional capacity which were uncovered during the history taking session. At this point, the individual steps into the exercising area or room. He then has the various dynamic body sensors 46 applied, such as transtracheal cardiac electrodes placed on his chest, a blood pressure cuff or other blood pressure device attached, the oxygen consumption and CO₂ production mask (or tube) put in place, and respiratory volume rate sensors activated. There is first a pretest resting state (see above), the individual simply sitting or standing, then he is subjected to a pre-programmed exertional or exercise test on the exercise machine 48. This test will vary depending on the history and physical examination data fed into the computer 44. The computer 44 then supplies updated data to the storage 50 of the clinic records relative to this particular patient and this data is also accumulated in the storage 52 of the research machine which generates a normal population storage 54. The data from the normal population storage is fed back into the computer 44 to continuously normalize the comparative data. The data from the patient is compared with the normalized data by the computer and performance curves are plotted for the normal patient and the actual patient by plotted 56. These curves are compared by computer 44 and the curves as well as the differences are presented by plotter 56 and printer 60. As is necessary, the exercise test will run from 6 to 10 minutes programmed at different levels of intensity, resting periods, and so on. At the end of the test, there is a cool off or recovery period during which parametric information would continue into the computer. With its preload of history and physical information, the computer inputs the information into computer 44 as well as the exercise machine is adapted to be reprogrammed to a different level of stress at any time the sensors 46 detect a condition being approached which the computer recognizes as being detrimental to the health of the patient being exercised. The computer compares the exertional output in terms of individual parameters and also in terms of a summary cardiac curve. At the end of the dynamic performance test, the system prints the readouts as at 60 which are then available to the physician. The readouts include separate written curves, summary curves, and also an optimum reconditioning program with 60 which the physician may counsel the patient for implementation and return visits.

The dynamic health evaluation system of this invention is believed to be the only such system available that can safely and accurately establish a patient's level of dynamic physical performance capacity or cardiopulmonary health and evaluate changes in functional capacity. It is further believed that the performance levels will become accurately more indicative in the event of unaltered trends in dynamic cardiopulmonary performance curves. The computer will also supply performance information to a paper punched tape writer 62. This information is thus available for feeding into computer 44 on a return visit of the patient and is also for each readout 60 to be available for comparison with newly developed data. Thus it is seen that all of the objects of the invention are accomplished.
automatically compiling data in said processor means representative of any variation of the measured health parameters of the patient from the same parameters obtained from a human body of the same characteristics and known to be in a good state of health.

5. The method, as claimed in claim 4, including the further step of: developing a therapy program for the patient based on the data representative of any variation which program is designed to rehabilitate the body of the patient under test to a more optimum state of health.

6. The method, as claimed in claim 4, including the further step of: compiling data representative of the maximum rate of change of each measured parameter which the body under test may be subjected without physical danger from the significant health parameters of the human body of the same characteristics and known to be in a good state of health; and modifying the patient's exercise rate in response to any measured significant parameters undergoing a rate of change greater than the predetermined rate of change during the testing.

7. The method, as claimed in claim 4, wherein: said measuring step, said obtaining step and said comparing step include measuring, obtaining and comparing a plurality of significant health parameters.

A dynamic testing, evaluation, and treatment method for the purpose of determining the state of health of a human body of a medical patient, said method comprising the steps of:

exercising the patient using an automatic processor controlled exercising means;

measuring the rate of change of at least one of the significant health parameters of the patient's body while it is being exercised;

obtaining at least one of the same significant health parameters from a human body of the same characteristics while doing the same exercise and known to be in a good state of health;

feeding the above measured and obtained parameters to automatic processor means to compare the rate of change of the measured health parameters with the rate of change of the same parameters of the healthy human body; and automatically compiling data in said processor means representative of any variation of the rate of change of the measured health parameters from the rate of change of the same parameters obtained from a human body of the same characteristics and known to be in a good state of health.

9. The method, as claimed in claim 8, including the further step of:

developing a therapy program for the patient based on the data representative of any variation of the rate of change designed to rehabilitate the body of the patient under test of a more optimum state of health.

10. The method, as claimed in claim 8, further including the steps of:

compiling data representative of the maximum rate of change of each measured parameter which the body under test may be subjected without physical danger from the significant health parameters of the human body of the same characteristics and known to be in a good state of health; and modifying the patient's exercise rate in response to any measured significant parameters undergoing a rate of change greater than the predetermined rate of change during the testing.

11. The method, as claimed in claim 8, wherein: said measuring step, said obtaining step and said comparing step include measuring, obtaining and comparing a plurality of significant health parameters.