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PROGRAM FOR THE ANALYSIS OF THE STRUCTURAL ALIGNMENT OF THE LEGS TO DETERMINE DEFORMITIES

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Abstract: Provectors is a system that performs automated image processing analysis to determine structural pathology in the legs, which are called X-legs and club legs. The software or technological development presented offers an analysis of the human body, replacing the traditional tests that are done with plumb lines, kinegrams, grids, etc. Provectors allows analyzing the normal outline of the human body with respect to its center of mass and with a comparative analysis of the descriptive vector of the structure of the legs, determines the level or degree of alteration, quantitatively. The information is provided to the software, by entering a traditional or medical image of the user or patient, to determine the distances, strokes and angles corresponding to their morphology, to determine any alteration or structural and bone deformity that the user retains. This development has applications in the clinical and sports field, allowing the specialist and/or physical therapist to issue a qualitative, quantitative, precise and reliable diagnosis, in comparison with the traditional rustic methods that are used for this technique.
Keywords: Image processing, leg deformities, Genu valgum and Varus, Cobb method.

INTRODUCTION

Both children and adults can suffer from joint and muscle pain, especially in the legs and back. To analyze these problems, visual observation is usually used, or devices such as goniometers are used. Scientific studies show that the reliabilities of these systems are low. To solve this problem, more precise instruments or systems based on infrared or 3D technology are required.

The present technological development work is based on the analysis of automated image processing, to determine a pathology in the legs, which is called X-legs and club legs.

DEVELOPMENT

As a result of various disorders, in the lower extremities, where there is an inward or outward arching of the vertical line of the legs, the spine and the hip can be affected, presenting pain in the back or muscles, product of the alteration in the alignment of the legs, which has as a consequence not only the physical aspect, but also the formation of abnormal curves of the spine as a result of the vertical imbalance and position of the body. In disorders: It is produced by homeostatic imbalances, genetics, poor posture and/or being overweight, the causes that present the abnormal alterations of Genu valgo and Genu varo. [1]

THEORETICAL FRAMEWORK

The causes of Genu valgum and varus are multiple. In overweight children, a false genu valgum can be observed because the thighs prevent the ankles from touching and the legs separate, giving a false valgus situation.

Physiological genu varus and valgus in children correct spontaneously with growth. In pathological deformities, the Genu valgum or varus is not corrected and, when walking on a crooked load axis, overloads the inner or outer part of the knee. In this situation, it is appropriate to correct the load axis to prevent progression to early osteoarthritis.

Neither insoles nor traditional physiotherapy nor orthoses correct the axis of the legs. They have no place in the treatment of an axial deformity. Long orthoses not only do not correct but can be harmful. [4]

STATEMENT OF THE PROBLEM

Determine by means of surface markers, which will be placed by the specialist, the angle formed between the different selected structures, where the software, through its processing algorithm, will obtain an analytical assessment.

It is proposed to process the images in order to determine the spatial coordinates of each marker and their relationships, obtaining with this technique the different lines and traces, and with it the angles that will allow us to obtain specific measurements in an automated way, unlike the traditional method that it is done in a subjective and estimated way (using manual methods such as conveyors). [1]

METHOD

For the measurement of the angles of the legs and their subsequent diagnosis of the degree of deformation, the insertion of points in the extremities and bony unions (where the union points from the hip to the ankles are presented) was used, by means of this marking, allows to process and measure insertion angles between parallel and perpendicular lines, drawn through a series of calculations by means of markers.

The measurement of the curvature and the quantitative result of the process, the shape and structure of the lower extremities analyzed are subsequently performed. To verify our technique, it was necessary to obtain the opinion of a specialist in physical therapy. For our measurements we use the Cobb method, which is the universal method for measuring malformations and is based on the exact determination of the upper and lower structures of the anatomical object under analysis.

COBB METHOD

A horizontal line is drawn at the upper border of the upper terminal vertebra. Another horizontal line is drawn at the lower border of the lower terminal vertebra. Perpendicular lines are drawn from each of the horizontal lines and the intersecting angles are measured. An advantage of this method is that the measurement of results is more likely to be consistent.

GENU VALGO AND GENU VARO METHOD

This method is for the measurement of possible pathologies in a user where it involves calculating the Q angle, a value used in practice to detect the presence of a misalignment of forces in the patellofemoral joint.

The angle Q measured is the angle of intersection between the lines that go from:

· The center of the patella to the anterior superior iliac spine.

· The center of the patella to the anterior tuberosity of the tibia.

Once the angles are obtained, said measurement is compared with the normal and abnormal values of the angle measurements, taking into account a margin of error, where the processing software will automatically show the result of the diagnosis.

RESULTS

The results obtained in the present technological development, is a method capable of accurately, analytically and quantitatively measuring the Q angles and alignments of the lower extremities, to determine any muscular or structural bone alteration of the user.

Once the analysis was performed on the study images, as shown in Figure 1, we were able to compare the calculated values and parameters, obtained by our method, with the opinion and assessment of a physical therapist. [3]

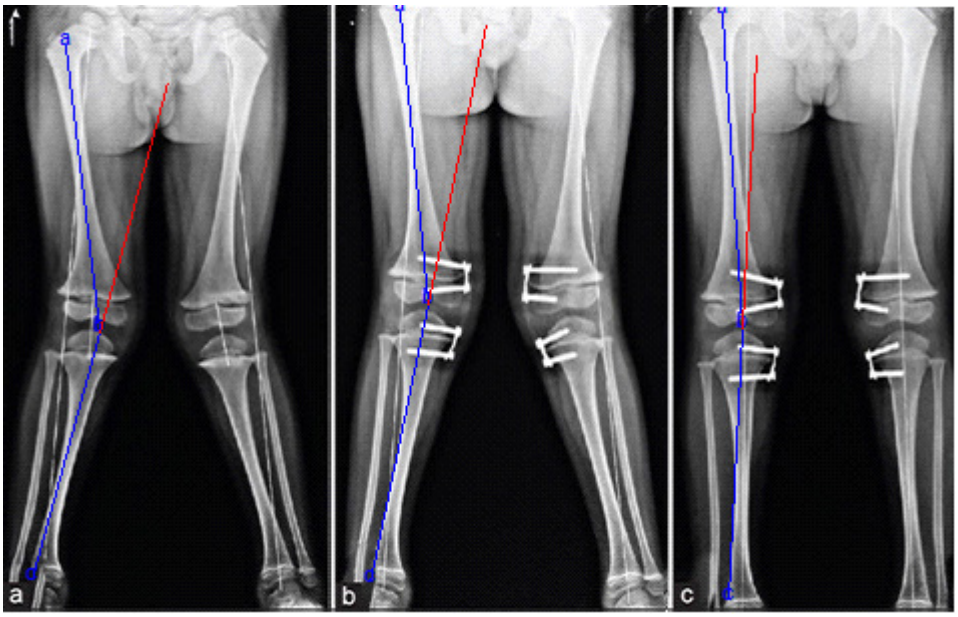

Figure1 – Image resulting from image processing of the angle Q [4]

DISCUSSION

This project allows the integration of several sciences for its development, integrating science, engineering, software and health (physical therapy).

In the logical field of programming, the challenge in development was to find a simple and optimized algorithm, but one that was robust and reliable, allowing with this algorithm to generate a project that can be transferred to the market or to the health sector as a support method. diagnosis.

CONCLUSIONS

In conclusion, the analytical evaluation of the alterations related to muscular pathologies in the user, where a quantitative value is provided, is very useful for the therapist and consequently for the user, because with this process of analytical exploration, it is It is possible to apply corrective therapies to the patient and see the degree of progress obtained in the sessions applied. During the development of this processing and analysis software, we observed that there are a number of people who have some muscular or posture alteration, and the users had not been aware of said alteration, until the software evaluated their records and delivered the result, where said alterations are related to a bad posture in the user without knowing the affectation that this produces.

This study describes, implements and evaluates a method for measuring and estimating leg deformation from medical or traditional images, of a specific area of the body (legs), to obtain quantitative physiological measurements. [3]

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