

Postural Analysis: Description of a Dedicated System

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Abstract

Background

Despite postural analysis is a fundamental tool for evaluating the neuromusculoskeletal structure of a subject a unique formal analysis process has not yet been determined.

The aim of this work is to propose a postural analysis protocol to promote discussion with other practitioners so as to make continuous improvements in the proposed protocol to provide a tool that can serve the needs of specialists even more efficiently.

Materials and Methods

The proposed system consists of four subsystems: medical history data, photographic references, overall observations, and tests.

Results

Even though the initial results are encouraging, additional use of the described analysis system is considered essential to improve the technique and the skills of the operator.

In this light, specific requests and observations from other professionals are essential, and obtaining these requests and observations is one of the purposes of the present article, as initially declared.

Conclusions

The proposed postural analysis system represents a good balance of various, often opposing needs, being easily completed and reasonably fast and repeatable, making it possible to compare time series data.

Keywords: posture; analysis; photographic

INTRODUCTION

Postural analysis is a fundamental tool for evaluating the neuromusculoskeletal structure of a subject and can provide useful indications about the presence and possible origins of imbalances that may occur using symptoms and signs, often with little or no relationship, as indicated in many related studies [1-5].

Although it is an important tool, a unique formal analysis process is not yet findable in literature, and looking in daily practice shows that single experts combine the several tests involved, which are available in the literature, integrated with the many different measuring systems available on the market, in a broad and various way to satisfy their needs.

The aim of this work is to propose a postural analysis protocol for (1) initial investigations, wherein the essential characteristics are the broad viewing spectrum, as a guarantee of accuracy and short analysis time, as a guarantee of exclusion of biases being attributable to the negligible interference of the observed measuring system, and for (2) ongoing monitoring of the effects of therapeutic treatment in the field, wherein the main characteristic is the capacity to guarantee comparability among analyses of the same subject conducted at different times, so that observed differences, or the absence thereof, that could be related to errors introduced by the measuring system can be reasonably excluded.

A second aim of this work, equally important in the opinion of the author, is to encourage debate with other professionals so that the proposed protocol can be further tested, continuously improved and serve the needs of specialists even more efficiently.

MATERIALS AND METHODS

The proposed system consists of four subsystems, each of which has a precise goal that complements the goals of the other subsystems, resulting in a complete postural analysis of the subject under examination. They are: *Medical History Data*, *Photographic References*, *Overall Observation* and *Tests*. Each of them will now be described in detail.

To frame, in a suitable way, the values and results that are obtained from the postural analysis, it is fundamental that current data and medical histories be collected for each subject. The list of items considered essential, shown in **table 1**, arise from comparing and integrating various work each one focused on some of them considered by the authors [6-10]. From another point of view, they stand for the main factors which may condition posture.

MEDICAL HISTORY DATA
Age [aa]
Weight [Kg]
Height [m]
BMI
Childbirth type
Four-footed infant walking
Scars description
Dental bracing
Spine diseases
Ocular diseases
Vestibular diseases
Feet diseases
Particular notes

Table 1: Medical history data

It should be noted that the collection of medical history data should not be considered as an attempt to search for a condition or its diagnosis or to develop a rehabilitation plan, because of its aim is to acknowledge existing behaviours and conditions that could influence the posture of the subject. Furthermore practice shows that some physicians use postural analysis like a aid in decision-making processes and in our Contry no law sets off physicians as the only ones to whom it is allowed to perform it.

None of the items listed in table 1 need explanations since they are inherently clear and easy to understand. However, relating to "scar description", it is believed that some explanations may be useful. Indeed Caiazzo [6] warn that "every scar may be source of disturbance" and from his teaching and his experience can be deduced that it is always advisable to consider not only the exterior aspect of the scar, but also the viable

activity using the Vascular Autonomic Signal (VAS) test, also known as R flexe Arteriel de Nogier (RAN). Similarly it should be understood that the same test can also be used to investigate parts of the same scar to understand whether the produced activity is linked to specific segments thereof.

As it is rightly taught, experience and observation, free of prejudice and judgment, are essential and fundamental tools in postural analysis and specific contributions of the operator [6-10]. But also the need to objectify the findings is equally essential and fundamental. In this light, a set of photographic references is useful and reliable as reported in different works [11-14]. Furthermor photographic references enables precise postprocessing without the need for the patient to be present and concretizing of personal observations using simple graphic tools.

The proposed photographic set is made up of three parts, each of which has a particular purpose.

The first part concerns the whole structure of a person and consists of five pictures in an orthostatic position, from antero-posterior, postero-anterior, left lateral, right lateral and top view, after positioning the markers on the subject. Markers positioning [15] requires the subject once supine and after being prone, to arrange markers on the front and lateral sides and subsequently on the back side. The position and the number of markers are reported in **figure 1**, differentiated according to sex. The letters indicate the distances between two markers. These distances are used to verify the conversion from pixels to millimetres, achieved using markers with known lengths that are positioned to the front, back and sides, on both the right and left sides, on a surface as flat and orthogonal to the floor as possible (e.g., the thigh).

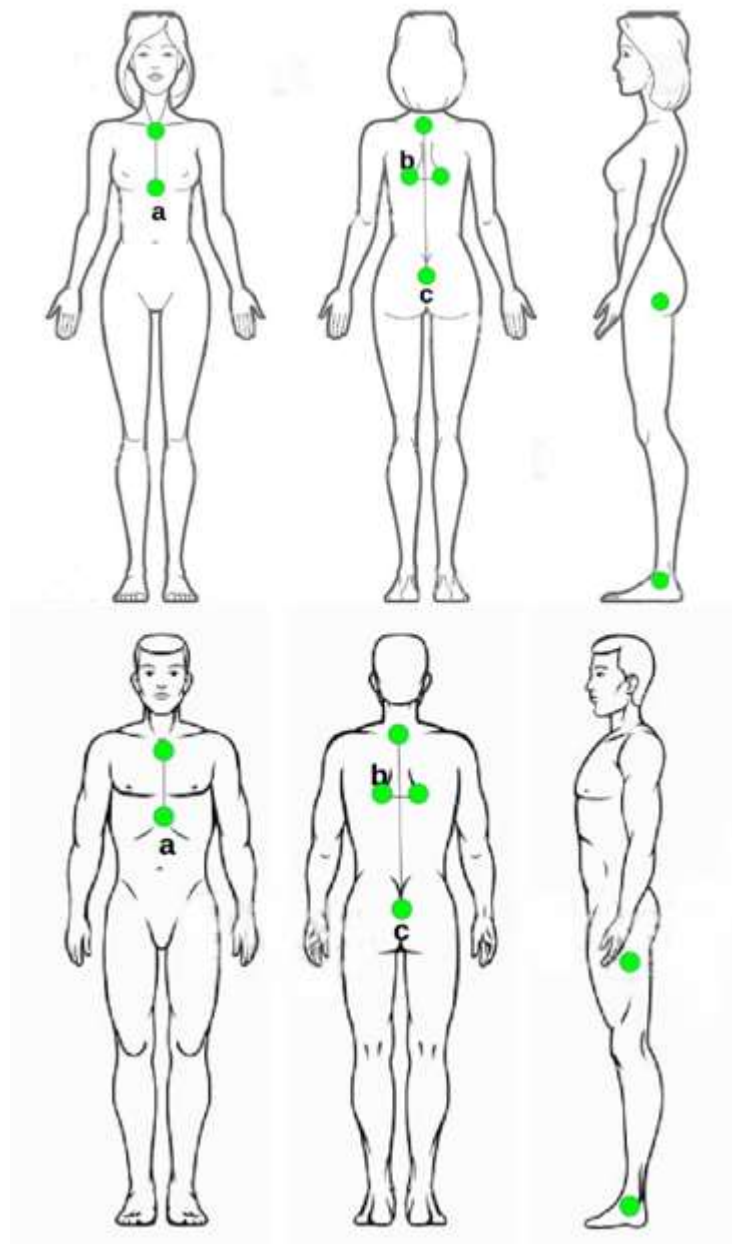


Figure 1: Marker positions

The anterior superior iliac spine (ASIS) and posterior superior iliac spine (PSIS) are manually highlighted, i.e., without the use of markers, for better precision using a simple cosmetic make-up pencil. The equipment, built to obtain the described photographic references, is visible in **figure. 2**, while in **figure. 3** the obtained results are displayed. As highlighted in figure. 3, in the antero-posterior view, only the horizontal laser is used, centred on the inter ASIS line to create a fixed reference for future

analyses; vertical laser off is a further safety for patient. In the other views, the lasers, horizontal and vertical, are both activated: the first one is still centred on the interASIS line in the antero-posterior view, while the second one is centred according to Barre's vertical [6] in both the postero-anterior and latero-lateral views.



Figure 2: Details and aggregates of equipment used

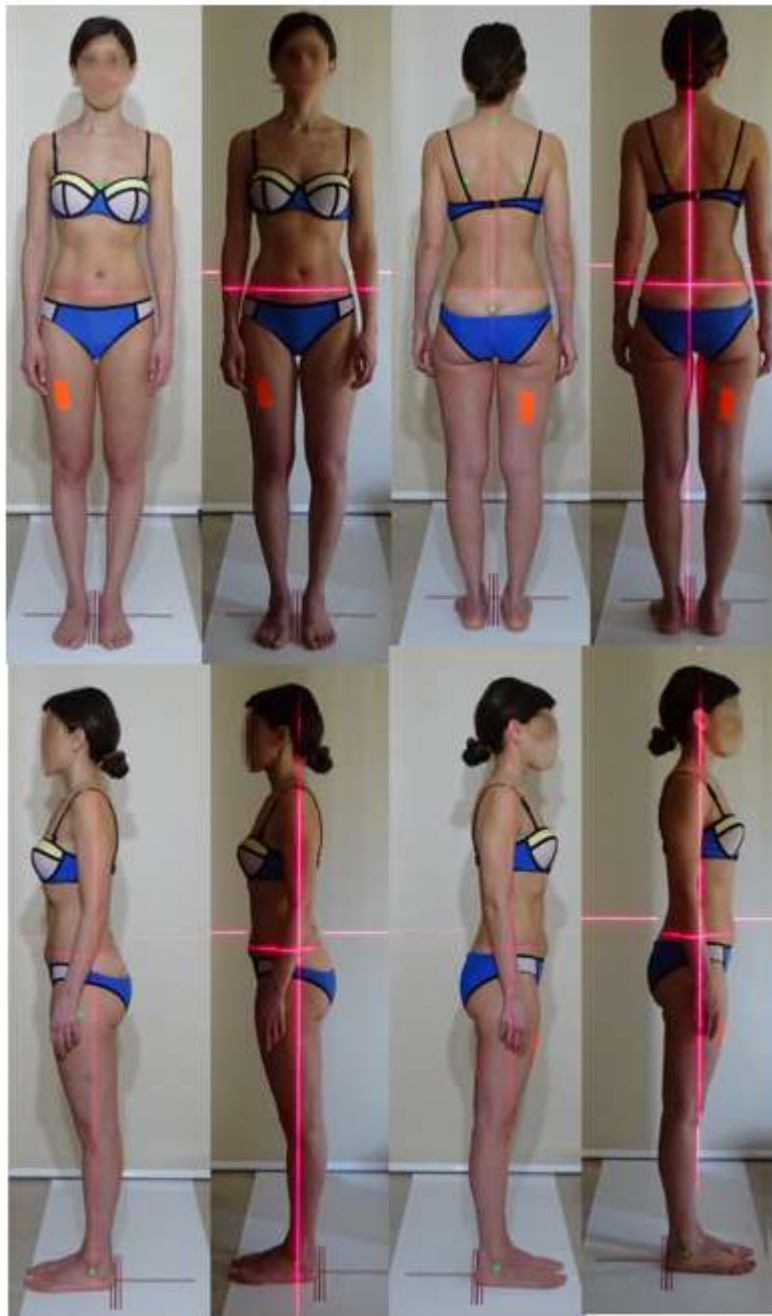


Figure 3: Pictures of the main planes and related laser traces

Three pictures are added to what is described above; they are used in postprocessing to objectify rotations of the pelvic girdle in the coronal and sagittal planes (see **figure 4**).

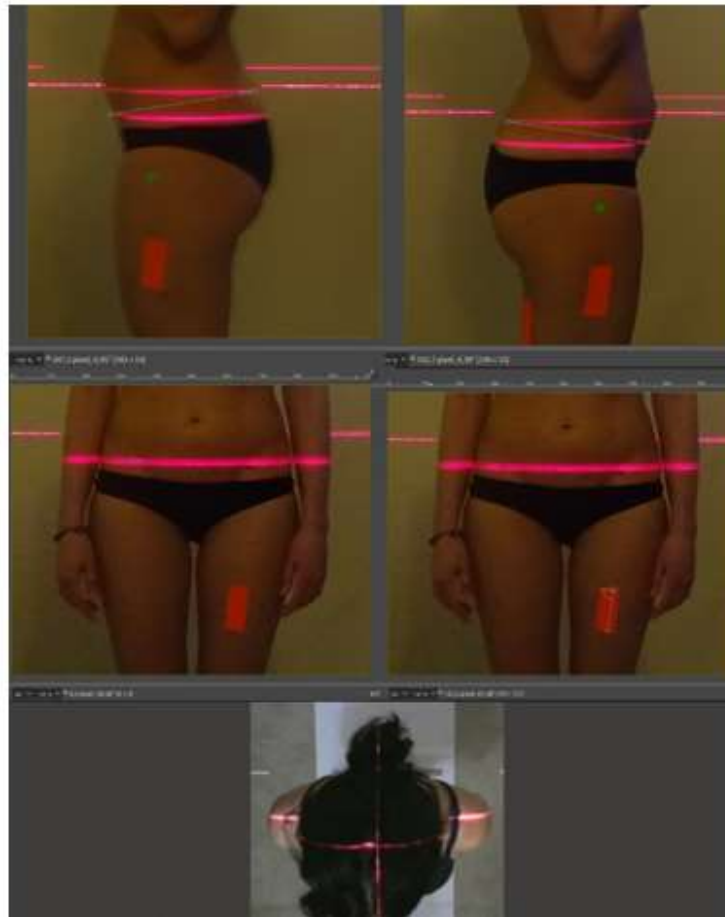


Figure 4: ASIS and PSIS markers, related laser traces and top view

Trigonometry shows that a rotation may be referred also to a distance in relation to the horizontal line, as applied in Diers Formetric system [16]. Based on this, to obtain a picture enabling quantification of rotation in the coronal plane, one horizontal laser has been centred on the right ASIS and one horizontal laser has been centred on the left ASIS. Then a picture of both traces with the patient in orthostasis in the antero-posterior view has been taken. The measurement of rotation is then indicated by the gap, on the order of millimetres, between the two traces.

Relating to quantify rotation in the sagittal plane, one horizontal laser will be centred on the right ASIS (in the antero-posterior view) and one horizontal laser will be centred on the right PSIS (in the postero-anterior view). Then a picture of both traces with the patient in orthostasis in the right lateral view will be taken. In this picture, the laser trace centred on ASIS crosses the anterior body profile at a specific point (A). Analogously, the laser trace centred on PSIS crosses the posterior body profile at a specific point (P). The measurement of rotation is the angle between the horizontal line and the line joining A and P. The procedure

is repeated in the same manner on the left side. The results has to be compared to Guigui findings [17].

The second part of the photographic references concerns the stomatognathic apparatus and the occlusal class that are fundamental in posture layout, as reported by Caiazzo, Bricot and Mossi [6,7,9]. For this purpose four pictures that describe the reciprocal layout of the dental arches in the antero-posterior, latero-lateral, left oblique, and right oblique views, will be acquired to show the position of the upper canine and first upper molar teeth respect to the lower arch. A fifth picture at the largest buccal opening with the tongue on the palatal spot will be also acquired to evidence the ability of the tongue to reach the palatal spot. **Figure 5** shows this schematically and directly. Additionally, a video in the latero-lateral view is included in this group of pictures and highlights atypical movements observed during swallowing. In the case of atypical swallowing movements, it is more useful to perform at least three-four consecutive swallowing actions, possibly interrupted by a rest break.



Figure 5: Descriptive views for dental arches and tongue relative to the palatal spot

Finally, the third part of the photographic references concerns the feet during standing that is an aspect of great importance, as well documented by Moro [8]. Pictures of the feet during single- and double-leg standing in the postero-anterior view will be therefore taken; the pictures may be supplemented by or replaced with a video that captures all of these aspects. The addition of a picture of the feet during double-

leg standing in the cranial-caudal view is useful for highlighting deformities in the 1st radius (e.g., hallux valgus). In summary, with the system reported in **figure 6**, pictures can be acquired of the feet during standing with eyes both open and closed, and with the dental arches separated and in contact.



Figure 6: System for detection of feet during standing

Considering the importance of the photographic references, as already remarked above in this paper, operator observations play a fundamental role in postural analysis and concerns all the apparatus involved to define

postural arrangement [6-9,18-19]. From this, a list of the item useful to describe how the person holds himself in the space in a general manner, has been built and is showed in **table 2**.

OVERALL OBSERVATION
TMJ
dental implications (Meersseman)
dominance
CPP
pursuit
cover test
head rotation (AX)
scapulo-humeral girdle rotation (AX – COR)
pelvic rotation (AX – COR – SAG)
femuro-tibial joint
feet stand

Table 2: Analyses executed in the overall observation

For better convenience and even more clarity, the organization of the item has been inspired to analysis following a directional logic in a cranial-caudal sense, starting from the temporomandibular joint (TMJ) and ending with the feet during standing as documented by the photographic references.

This overall observation is not meant to be an exhaustive evaluation of the subject, but rather to be an examination of a wide spectrum of possible receptor influences on posture within a limited amount of time to avoid disturbing the postural system of the patient examined. Thus, if some

findings are suggestive of disharmonies, it is possible beneficial to consider having a specialist in the field (ophthalmologist, odontostomatologist, otolaryngologist, orthopaedic, physiatrist or podiatrist) conduct a more detailed evaluation based on what was objectively found, as measuring system disturbances have been avoided.

Without frustate what discuss above, one of the most important targets in a postural analysis, remains to highlight the presence of a possible *disharmonic syndrome*, as described by Caiazzo [6]. Depending on this, a list of focused tests has been achieved and shoed in **table 3**.

TEST
postural cone
Autet
Bassani
De Cyon
Fukuda
visceral
forward bending
taperulè

Table 3: List of proposed tests

To avoid possible interferences, is better to perform the first five tests initially and then perform the last three in the given sequence. It should be observed that, as is common in posturology, it is not the result of a single test that indicates the presence of disharmony, but congruent results from multiple tests to indicate its probable presence.

In the indicated references, tests are widely described and do not need further explanation. However, for the “visceral” test, additional details can be needed. This test examines the possible influences of the visceral apparatus on postural disturbance, and after it is performed, the previously described items must be re-evaluated, especially if abnormal results have been found.

The two final tests aim to analyse the mobility of the vertebral column, in particular the possibility of shifts in the coronal plane, and the layers of torso-lumbar region musculature.

RESULTS

In comparison with prior versions, the described postural analysis system exhibited improvements in data collection and the possibility of more extensive and objective postprocessing, enabling inclusion of more detailed and comparable reports for a given subject at different times and improved usability for specialists of other professions.

DISCUSSION

Although the initial results are encouraging, further use of the described analysis system is considered essential for improving the techniques and the practice of operators.

In this light, specific requests and observations from other professionals are essential, and one of the purposes of the present article, as initially declared, is to obtain this input.

CONCLUSIONS

The proposed postural analysis system represents a good balance of various, often opposing needs, being easily accomplished, addressing the main contributors to postural control; reasonably fast, due its overarching approach; and reasonably repeatable, making it possible to compare time series data.

Further confirmations will be derived from systematic use of this system over time, which will also lead to the possibility of further improvements.

ABBREVIATIONS

ASIS: anterior-superior iliac spine

PSIS: posterior superior iliac spine

DECLARATIONS

- **Ethics approval and consent to participate**

Not Applicables

- **Consent for publication**

The young ladies involved, free agree verbally to be depicted in figures as long as they were not recognisable, as don

- **Availability of data and materials** data referred to the postural analysis performed for this article, are available contacting author.

- **Competing interests**

The author declares that he has no conflicts of interest

- **Funding**

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- **Authors' contributions** Not Applicable

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- **Authors' information (optional)**

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