AUCTORES
Globalize your Research

International Journal of Clinical Case Reports and Reviews
Sergio Palandri *

Open Access

Research Article

System expanded for postural analysis (s.e.p.a.): a starting point resulting from the evolution of an idea

Sergio Palandri

Radiographer – Umberto I Hospital Ordine Mauriziano – Turin – Italy.

***Corresponding Author:** Sergio Palandri, Radiographer – Umberto I Hospital Ordine Mauriziano – Turin – Italy.

Received Date: June 22, 2024 | **Accepted Date:** July 01, 2024 | **Published Date:** July 05, 2024

Citation: Sergio Palandri, (2024), System expanded for postural analysis (s.e.p.a.): a starting point resulting from the evolution of an idea, *International Journal of Clinical Case Reports and Reviews*, 18(3); **DOI:10.31579/2690-4861/495**

Abstract:

Acalculous cholecystitis (AAC) accounts for only 5-10% of cholecystitis cases, primarily studied in intensive care units (Background/Aim)

Importance and usefulness are characteristics of postural analysis now known and documented in the literature.

The absence of a standard is often a problem and a market offer, although broad and of a high level, is not always able to satisfy the needs of all professionals, also due to the non-negligible costs.

The aim of this article is to describe a new postural analysis system, named System Expanded for Postural Analysis (S.E.P.A.), based on previous experiences and to promote the comparison between professionals which has allowed its realisation.

Materials and Methods

S.E.P.A., analyzing the problems of its previous versions, implements new strategies based on simplicity, essentiality, practicality and completeness.

Added to this is a new possibility of simultaneous acquisition of the feet standing print during video recording of the subject's position, both from the top and from the feet.

Results

Stability and simplicity were immediately found during the preliminary tests carried out on the system both in the hardware and software components, making the operator's work easier.

Conclusions

Although the first findings are encouraging, a direct and intense use of S.E.P.A. is mandatory and essential to consolidate its characteristics and, nevertheless, the contribution of other professionals who want to use it, to be able to suggest new improving aspects.

Key words: posture; analysis; photographic

Introduction

Postural analysis has now produced many evidences in support of its ability to highlight disharmonies, starting from the observation of signs and symptoms that are often poorly or not at all correlated with each other. This shows a preventive character of significant interest, as can be easily inferred from the articles of several authors [1-8] present in the literature.

Searching in literature seem to be equally evident the absence of a univocal standard for postural analysis, whether it is a first analysis or a follow-up one, documented by the lacjk of specific article about this issue.

These two different and complementary areas have specific goals and, accordingly, specific needs. The first is aimed to evaluate the subject in her/his entirety and complexity to document any disharmonies present or hidden and therefore it needs a broad spectrum of investigation to ensure detailed research in all the main systems that intervene in the posture management along with a time limited duration to avoid interference on the subject undder analysis. The second is indtead aimed to monitor the effects of an ongoing or ended therapeutic treatment and therefore needs

high repeatability measurements to compare with certainty resultsd of different analyzes performed at different time on the same subject.

Although the market currently provides increasingly sophisticated and precise systems with multiple potentials, they are sometimes impractical as they are complex, or inflexible, or very specific for some analysis, but not for all, thus forcing the professional to purchase different ones to integrate them or do without some data which could be useful in contextualising the case, even if not immediately connected. Furthermore, it should not be forgotten that these systems often have a very high cost.

In 2021 an article published presented a system that tried to respond to these various needs [9] and at the same time wanted to raise awareness among professionals with the aim of improving the system itself. Being essentially a prototype, the proposed system soon highlighted its various problems and limits, which were also directly detected by the author himself who proposed an upgrade in 2023 [10]. The system was designed to be portable, able to be disassembled and reassembled \wherever the professional needs, so despite the upgrade, several minor and substantial problems prevented adequate use.

A deep redesign of the system was clearly necessary and thanks to the collaboration with a physiotherapist, it has been possible. The new system developed draws its origins from the two previous ones, but which broadens their possibilities and aims to solve the problems they highlight. It has been named *System Expanded for Postural Analysis (S.E.P.A.)*.

The aim of this article is to describe S.E.P.A. both in the parts inherited from the previous release and in the new features and opportunities implemented with this evolution.

Also, the continuing stimulation of comparison with other professionals in order to further improving remains a fundamentl aim of this work, underlining how it is precisely thanks to discussion that this release has been born.

Methods

Conceptually S.E.P.A. appears as in the outline shown in Fig.1 in a front view

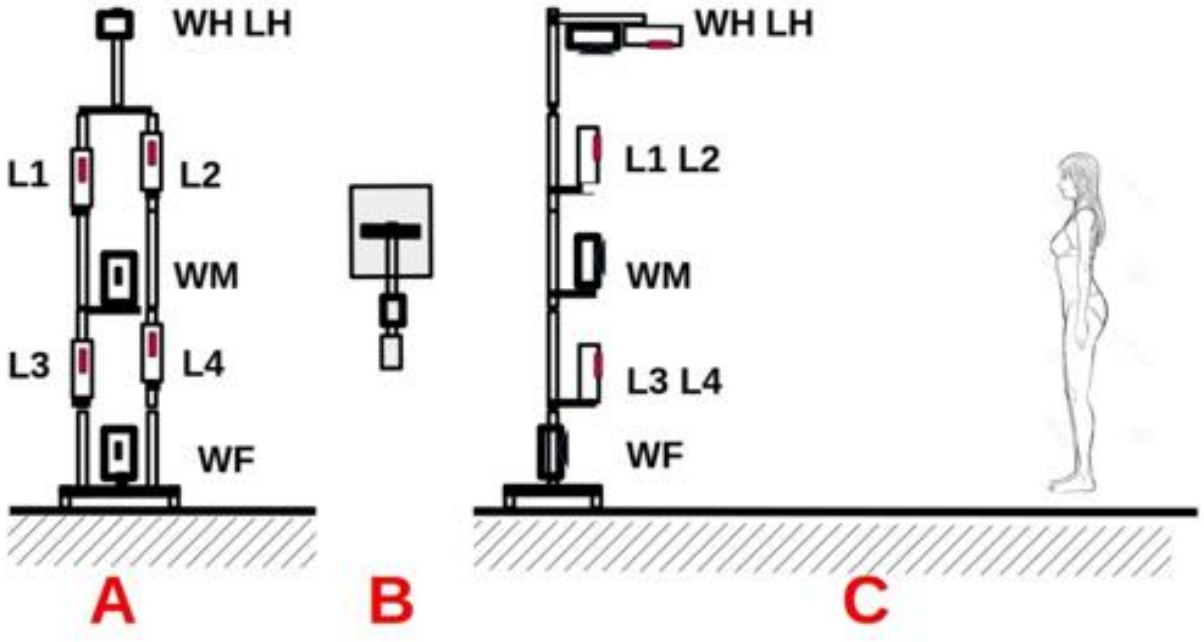

Figure 1: S.EP.A. outline in front view (A) in top view (B) and in lateral view (C)

(A), in a top view (B) and in a side view (C), that physically correspond as in Figure.2 in the same views. In particular Figure. 2 shows a detail of the new upgraded platform that supports the entire frame, providing at the same time, best stability, restrained size and best adptability to each floor.

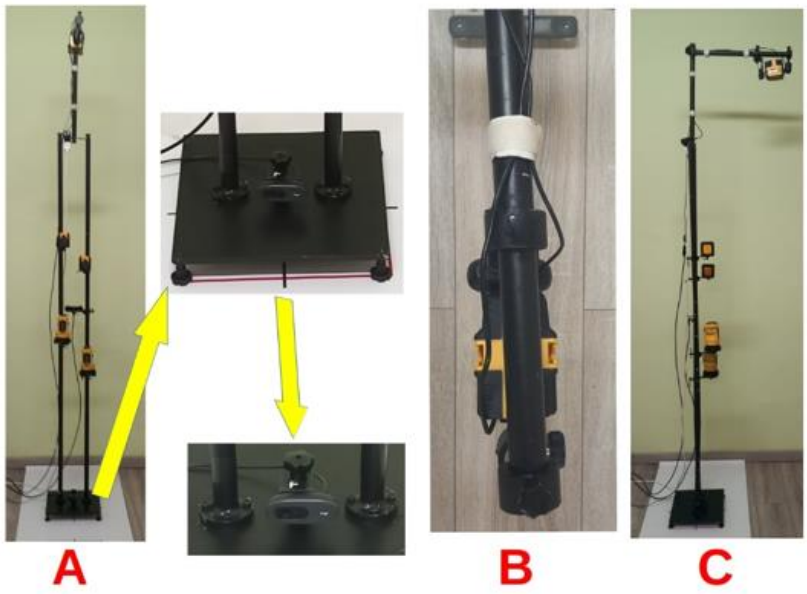

Figure 2: S.E.P.A. Show in front with details (A) in top view (B) and in lateral view (C)

Comparing Figure.1 and Figure.2 is possible to identify the composition of the system and specifically the webcams for the top view (WH), for the feet view (WF), for the central view (WM) and the reference laser levels from top (LH), for the upper part of the subject (L1, L2) and for the subject's pelvis (L3, L4).

In technical detail WH and WF are two Logitech C270 HD 720p webcams, while WM is a Logitech Brio UHD 4K. LH is a red laser level Stanley, L1 and L2 are green laser levels Nikotek while L3 and L4 are red laser lavels Blinky with the option to activate independently the horizontal and vertical trace. All laser lavels have duoble trace horizontal and vertical and are self-levelling.

The main structure described above is completed by two mats visible in Figure.3

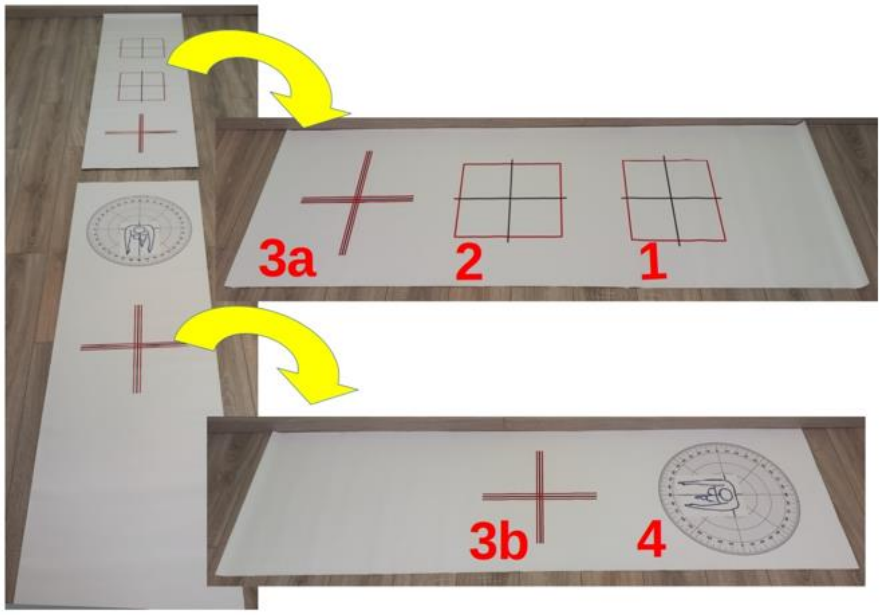

Figure 3: mats and specific positions

where are shown in particular the specific positions reported for the base of the structure support (1), for the feet standing print acquisition scanner platform (2), for the subject under examination (3a,3b) and for the execution of the Fukuha test (4). In technical detail the scanner is a Canon Canoscan Lide 300. It should be underlined that both LH and the lights present in the acquisition scanner platform are remote controlled by the operator, autonomously and conveniently. The system brain is a miniPC provided with an Intel Core i3 4130T CPU @ 2.90 GHz, 8GB of RAM, 250GB of HDD SSD and a *Windowa 10* embedded OS on which run the programs to manage WM (Logitech CAPTURE), WH and WF simultaneously (OBS *Studio)*), the scanner (NAPS2), the spreadsheet for reporting the acquired data (Libreoffice 6.4.7.2) and the post-processing graphic editor (GIMP for Windows). All peripheral devices are connected to the mini-PC via USB 3.0 with a 4-port hub.

Figure 4: total view of S.E.P.A

Figure.4 shows a complete view of S.E.P.A. in all its components. Note that S.E.P.A. has been designed to be easily transportable as shown in

Figure 5: S.E.P.A. disassembled and packaged

Figure.5 in which S.E.P.A. is disassembled and packaged. To support professional in his worrk, S.E.P.A. is also provided with a protocl to collect acquired data and professional observations. It is made up of a *Libreoffice Calc* file, equipped with two sheets: one to include data/observations and one with all the references necessary for their interpretation, such as e.g., the position of the markers used by the professional differentiated by gender or e.g., the convention used in the Fukuda test. An ezample of the sheets is showen in Fig.6 (data/observcation) and Figure.7 (references).

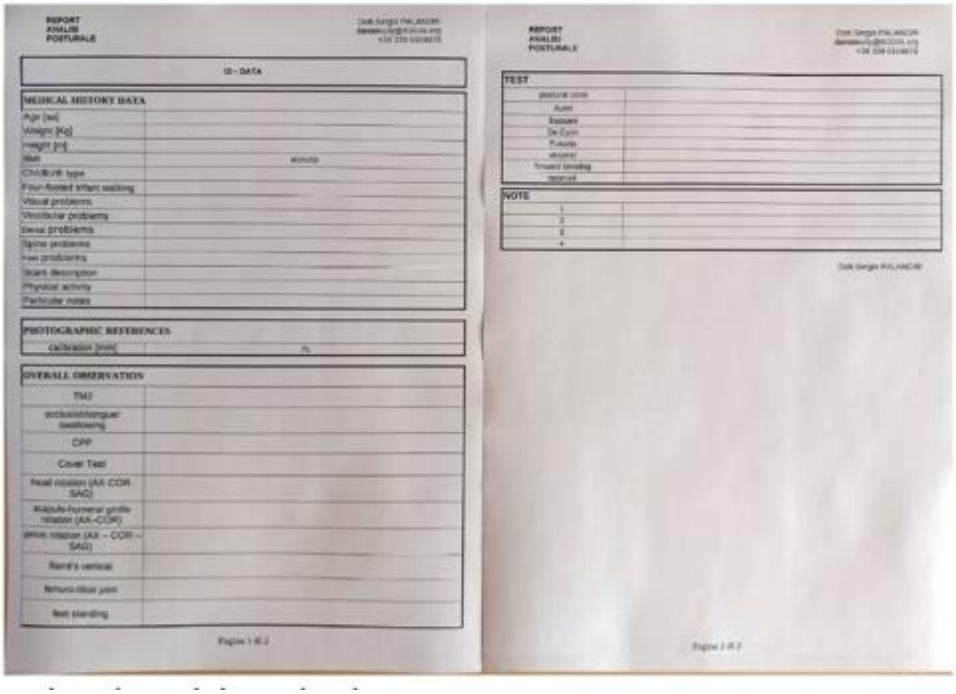

Figure 6: Data and observation sheet

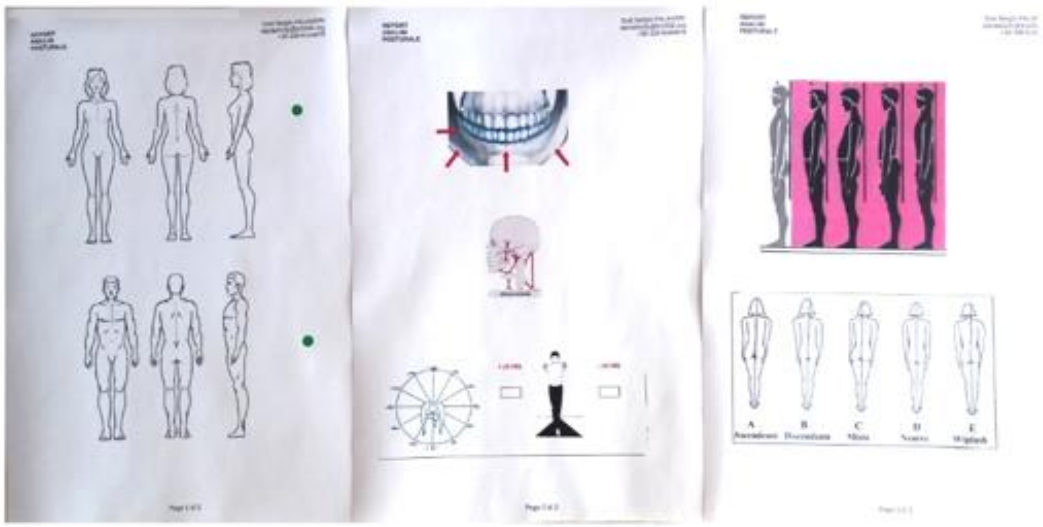

Figure 7: References sheet

Note that both sheets are printable and customizable with the professional references to create the final report of the analysis and. Also note, in particular, that the sheet to include the acquired data and the operator's observations has been designed to dynamically adapt to the operator's needs in the current analysis and divided in four dedicated sections integrated each other that reflect four distinct aspects of the analysis. Now these sections will be described individually in detail.

Medical History Data [11]

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 is shown in Table 1.

MEDICAL HiSTORY DATA
Age [aa]
Weight [Kg]
Height [m]
BMI
Childbirth type
Four-footed infant walking
Visual problems
Vestibular problems
Dental problems
Spine problems
Feet problems
Scars description
Physical activity
Particular notes

It is important to highlight that postural analysis is not exclusively performed by physicians as well as is used to aid physicians in decision-making processes; thus, the collection of medical history data should not be considered as an attempt to search for a disease or its diagnosis or to develop a rehabilitation plan. Indeed, the purpose is to acknowledge existing behaviours and conditions that could influence the subject posture.

None of the items listed in Table 1 need explanations since they are inherently clear and easy to understand. However, relating to "*scars description"*, it is believed that some clarification may be useful: as reported by Caiazzo in 2007 [11], *"every scar is potentially a source of disturbance"*, it is always very important to consider not only the exterior aspect of the scar, but also the inside activity using the *Vascular Automatic Signal* (VAS) test, also known as *Réflexe Arteriel de Nogier* (RAN). Further, 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.

Photographic References [11-18]

Experience and observation free of prejudice and judgment are essential and fundamental tools in postural analysis and a specific contribution of the operator.

Sometimes the needs of this statement may crash with the previously described goal of making the analysis as limited in time as possible.

In this light, a set of photographic references enables precise postprocessing without the need for the subject to be present. This requires the possibility of carrying out real measurements from the aquired images. So, it is necessary to have a calibration system that easily allows the pixels measured on the acquired image to be converted into the corresponding millimeters on the subject.

This has been achieved by applying a rectangular label of known size (we use labels with the long side equal to 75mm) positioned on the thigh in the planes of the four main views (AP, PA, LL SN, LL DX). This choice allows to have the label always as flat and orthogonal to the floor as possible to obtain the best precision in measurement. A note remembering the label type used is included in the report form as in Table 2.

PHOTOGRAPHIC REFERENCES
Calibration [mm]

In the same light is the objectification of the pelvis rotations (described later). To let it in a off-libe mode, is firstt necessary to highlight Postero Superior Iliac Spine (PSIS) and Antero Superior Iliac Spine (ASIS) to make them easily visible in post-processing image.

This has been obteined using a bright colored eyeliner that ensure a better precision then an adhesive marker.

Note that other markers can be positioned on particular points of the subject's body for particular needs identified by the professional. In this case round-shaped adhesive markers with a diameter of around 15mm can be validly used.

Once this preliminary phase of preparing the subject has been completed, it is now possible to carry out the planned photographic surveys.

A first set of images that will be acquired consists of the four main views of the subject in its entirety: AP, PA, LL SN, LL DX.

It is highlighted that in the AP view, only L3 or L4 is on with its horizontal trace centered on the interASIS line to create a fixed reference for future analyses. Vertical trace is off to further safety for patient, as well as L1 and L2.

In the PA views the L3 or L4 horizontal trace is still centered on the interASIS line and is off as well as its vertical one, while the other is on with its horizontal trace centered on the interPSIS line and its vertical one according to Barrè vertical. L1 and L2 are on with the horizontal trace positioned on the intermeatal line, on the line joining the lower edges of the scapulae, or where professional considers relevant, while their respective verticals are generally out of the FOV or on particular vertical axes deemed of interest by the professional as before.

In LL view only L3 or L4 vertical trace is on according to the Barrè vertical. May be the horizontal trace corresponding can be on. L1 and L2 are off or can be used for particular references the operator deems necessary.

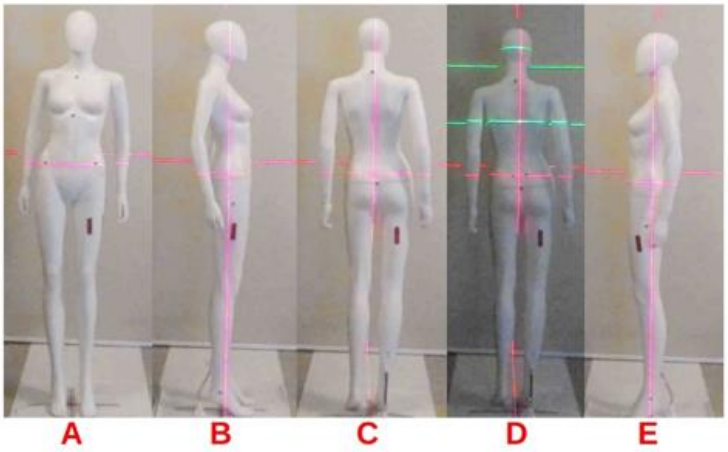

Figure 8: Sights example in AP view (A) LLDX view (B) PA view (C) PA view with intermeatal line and under scapular line (D) LLSN view (E)

An example is shown in Figure.8, regarding to which, an important clarification must be made: we are well aware of the limits that the use of a mannequin introduces, but it is also, at the same time, the simplest and most effective way to immediately give the idea of how the subject relates to the system of postural analysis and how this in turn relate to the subject. The same observation is also valid for the other figure where the mannequin has been employed. Note that to acquire these images the subject must remain in position 3b of the mat.

A second set of images, again with the subject in the same position 3b, will be added to the previous one in order to objectify he rotation of the pelvis on the coronal and sagittal plane.

To obtain a picture enabling quantification of the pelvis rotation in the coronal plane, it is necessary to use L3 and L 4 (L1 and L2 are off), one with its horizontal tarce centred on the right ASIS, the other with its horizontal trace centred on the left ASIS (vertical traces are off) and then take a picture of both traces with the patient in orthostasis in the AP view. The measurement of the rotation is therefore given by the vertical distance between the two traces.

To obtain a picture enabling quantification of the pelvis rotation in the sagittal plane, it is necessary to use again L3 and L4 (L1 and L2 are still off), one with its horizontal trace centred on the right ASIS (in the AP view), the other with its horizontal trace centered on the right PSIS (in the PA view) and then take a picture of both traces (vertical traces are still off) with the patient in orthostasis in the right lateral view.

In this picture, the trace centred on ASIS crosses the anterior body profile at a specific point (A). Analogously, the trace centred on PSIS crosses the posterior body profile at a specific point (P). The measurement of the rotation is therefore given by 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 will be compared according with Guigui *et al.* finding [18].

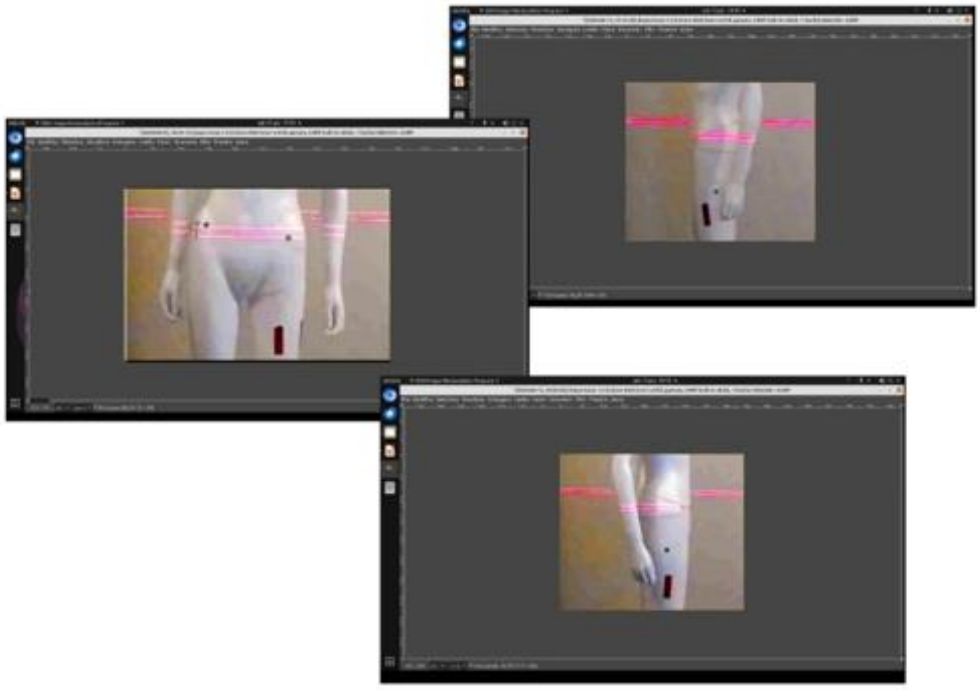

Figure 9: pelvis rotation assessment in AP and LL view

Figure.9 shows an example.

The third set of images to be acquired needs the subject in 3a position of the mat. From this position, with the aid of the zoom software made available by the WM management program it will be possible to acquire in AP the mutual position of the dental arches, the maximum buccal opening, the subject's ability to bring tongue to the palatine spot and, in LL, a video of at least 2-4 consecutive swallowing acts, to detect possible atypical swallowing. The video may include interposition of a rest break for the subject if necessary for her/him.

An example of the result of this type of acquisition is shown in.10.

Figure 10: Images acquired with VM relative to the dental arches (top) mouth opening (bottom left) tongue mobility (bottom right) swallowing position (lateral right)

The fourth and final set of acquired images sees the subject positioned on the acquisition scanner platform, with her/his back facing the system support frame.

In these conditions the feet standing print will be acquired while WH and WF will record simultaneously a video with the subject's movements during the scans. The acquisitions of the feet standing print will be performed with eyes open and teeth open (OEOT), eyes closed and teeth open (CEOT), eyes open and teeth closed (OECT), eyes closed and teeth closed (CECT).

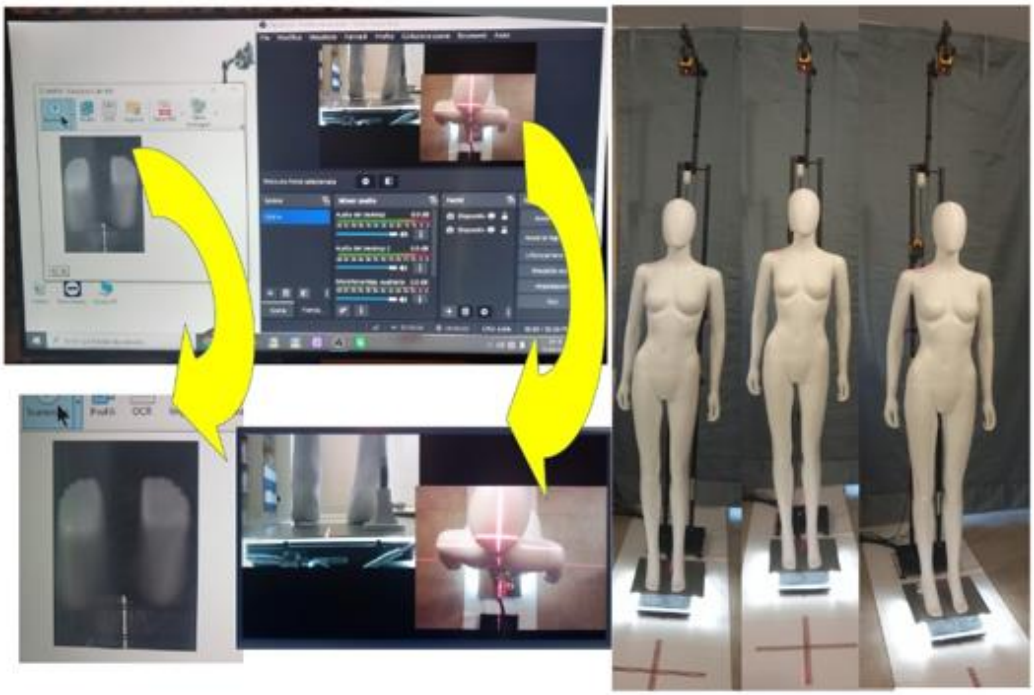

Figure 11: breech support acquisition with top and feet video recording

Figure. 11 shows an overview example.

Two important features have to be noted about the feet standing print acquisition scanner platform: first, the housings for the LED bars that provide the necessary light are directly placed inside the surface on which the subject will place his feet, thus simulating a conventional podoscope in all respects and, second, the same surface has been designed to be in direct contact with the scanner acquisition surface for a better acquisition condition.

These features are shown in Figure.12.

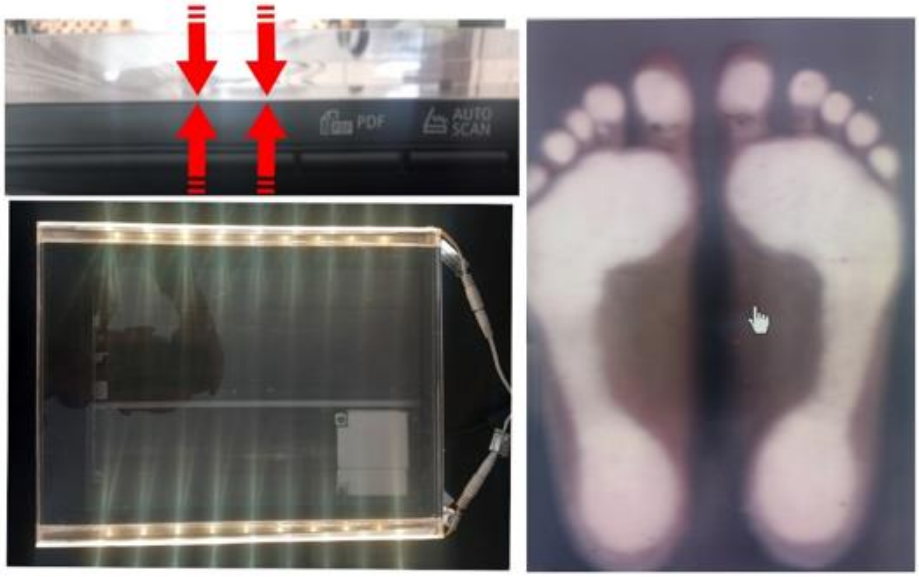

Figure 12: breech support acquisition particular features and result

Overall Observation [11,19-20]

OVERALL OBSERVATION
TMJ
occlusion/tongue/swallowing
dominance
CPP
Cover Test
head rotation (AX-COR-SAG)
scapulo-humeral girdle rotation (AX–COR)
pelvic rotation (AX – COR – SAG)
Barré's vertical
femuro-tibial joint
feet standing print

Table 3 shows the list of the item considered for the analysis to describe how the subject holds herself/himself in the space in a general manner. The first column on the left shows the specific item on each row while the second column on the right will contain the operator's findings and related comments for each individual item.

The organization of the analysis follows a directional logic in a cranial-caudal sense, starting from the temporomandibular joint (TMJ) and ending with the feet standing print as documented above by the photographic references.

The overall observation is not meant to be an exhaustive evaluation, but rather to be an examination of a wide spectrum of possible receptor influences on posture within a limited amount of time. The aim of this set of items is to acknowledge the possibility that each receptor system influencing posture could be a source of postural disturbance, with the minimum interference on the observed system. Thus, if some findings are suggestive of disharmonies, it is possible to consider a specialist consultation like ophthalmologist, odontostomatologist, otolaryngologist, orthopaedic, physiatrist, podiatrist or others for a more detailed evaluation based on what was objectively found.

Note that to aid overall observatin performing, a dedicated tools kit has been especially made and it is visible in 13.

Figure 13: tools kit for overall observation

Also note that the sheet has been designed to be customized by the professional adding or removing item from the list, according to the particular needs of the current analysis.

TEST [11]

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

Table 4 shows the list of selected tests. The first column on the left shows the specific item on each row, while the second column on the right will contain the operator's findings and related comments for each individual item.

The first five tests must be performed initially and their main purpose is to identify the presence of a possible *disharmonic syndrome* according to Caiazzo 2007 [11].

It should be observed that 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, as is common in posturology.

All tests are widely described in the literature and do not need further explanation. However, for the "*visceral*" test, additional details can be

useful: 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 if abnormal results have been found.

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

Results

The first experimental tests of S.E.P.A. immediately highlighted overall its greater simplicity and practicality of use, both for the hardware and software parts.

The system is now more stable from a mechanical point of view and the webcam and laser levels are consequently more stable, thus allowing greater precision in positioning and also greater speed in their management.

Even the assembly of the system is simple and easy, thanks also to the positions traced on the mats. Please note in this context that all the characteristics of the system in its "*in door*" configuration are maintained and usable as well in the "*outdoor*" configuration.

On the other side, the greater stability of the system is paid with an increase in its weight which is particularly felt "*outdoor*" use, as expected.

Discussion

Undoubtedly a particular upgrade of this new version is provided by the possibility of simultaneous acquisition from WH and WF during the scanning of the feet standing printt.

The increase in the structure weight is a non-negligible problem still to be solved without reduce the achieved great stability, although the benefits obtained in this sense right now attenuate its severity.

The preliminary test of S.E.P.A. are encouraging, but it is clear that a intense use in daily practice is to be considered the real test to measure its true potential and highlight its problems and now this represent its fisrt big limit.

In this light, specific requests and observations from other professionals are essential,

Conclusions

The proposed postural analysis system represents a good balance of various and often opposing needs being simple, reasonably complete, flexible and capable of providing comparable analysis over time.

Further confirmations will be derived from systematic use of this system over time, which will be necessary for its improvement and overcoming its current limits.

Abbreviations

AP: antero-posterior

ASIS: anterior-superior iliac spine

DX: right

FOV: field of view

LL: latero-lateral

SN: left

PA: postero-anterior

PSIS: posterior superior iliac spine

Acknowledgement

A heartfelt thanks to Dr. Daniela Fandavelli for her indispensable professional contribution to the enhancement that led to the S.E.P.A. as well as her precious friendship.

Declarations

The author declares to have no conflict of interested.

All figures were created personally by the author and whereas been necessary they represent himself.

References

1. Pizzigalli L, Micheletti Cremasco M, Mulasso A, Rainoldi A. (2016). The contribution of postural balance analysis in older adult fallers: A narrative review. J Bodyw Mov Ther. ;20(2):409-417.
2. Gouleme N, Ezane MD, Wiener-Vacher S, Bucci MP. (2014). Spatial and temporal postural analysis: a developmental study in healthy children. Int J Dev Neurosci. Nov; 38:169-177.
3. Zipori AB, Colpa L, Wong AMF, Cushing SL, Gordon KA. (2018). Postural stability and visual impairment: Assessing balance in children with strabismus and amblyopia. PLoS One. 18;13(10):0205857.
4. Rasmussen LJH, Caspi A, Ambler A, Broadbent JM, Cohen HJ, d'Arbeloff T,Elliott M, Hancox RJ, Harrington H, Hogan S, Houts R, Ireland D, Knodt AR, Meredith-Jones K, Morey MC, Morrison L, Poulton R, Ramrakha S, Richmond-Rakerd L, Sison ML, Sneddon K, Thomson WM, Hariri AR, Moffitt TE, at all. (2019). Association of Neurocognitive and Physical Function with Gait Speed in Midlife. JAMA Netw Open. Oct 2;2(10): 1913123.
5. Bruno G, Melissa S, Natalia C, Francesco G, Francesco F, Rocco B, Patrizia L,Antonella P, Ettore C, Zhang D, Gianlorenzo D, Francesco G, at all, (2020). Posture and dysphonia associations in patients undergoing total thyroidectomy: stabilometric analysis. Updates Surg. 72(4):1143-1149.
6. Rafeemanesh E, Khooei A, Niroumand S, Shirzadeh T. (2021). A study on musculoskeletal complaints and working postures in pathology specialists in Iran. BMC Musculoskelet Disord. 3;22(1):1012.
7. Niaradi FDSL, Niaradi MFDSL, Gasparetto MERF. (2022). Effect of Eutonia, Holistic Gymnastics, and Pilates on body posture for pre-adolescent girls: Randomized clinical trial. J Bodyw Mov Ther. 30:226-236.
8. Kasović M, Štefan L, Piler P, Zvonar M. (2022). Longitudinal associations between sport participation and fat mass with body posture in children: A 5-year follow-up from the Czech ELSPAC study. PLoS One. 11;17(4):0266903.
9. Palandri S. Postural Analysis: Description of a Dedicated System. 2021 J. Archives of Medical Case Reports and Case Study. 4(3).
10. Palandri S. Postural Analysis: Description of a Dedicated System - an Upgrade. 2022 J. Archives of Medical Case Reports and Case Study, 5(3).
11. Caiazzo P., (2007). TOP Terapia Osteopatico-Posturale, Marrapese
12. Aroeira RM, de Las Casas EB, Pertence AE, Greco M, Tavares JM. (2016). Non-invasive methods of computer vision in the posture evaluation of adolescent idiopathic scoliosis. J Bodyw Mov Ther. ;20(4):832-843.
13. do Rosário JL. (2014). Photographic analysis of human posture: a literature review. J Bodyw Mov Ther.;18(1):56-61.
14. Rosário JL. (2014). Biomechanical assessment of human posture: a literature review. J Bodyw Mov Ther. ;18(3):368-73.
15. Fortin C, Feldman DE, Cheriet F, Gravel D, Gauthier F, Labelle H. (2012). Reliability of a quantitative clinical posture assessment tool among persons with idiopathic scoliosis. Physiotherapy.;98(1):64-75.
16. Fortin C, Feldman DE, Cheriet F, Labelle H. (2011). Clinical methods for quantifying body segment posture: a literature review. Disabil Rehabil.;33(5):367-383.
17. Fortin C, Feldman DE, Cheriet F, Labelle H. (2010). Validity of a quantitative clinical measurement tool of trunk posture in idiopathic scoliosis. Spine (Phila Pa 1976). Sep 1;35(19):988-994.
18. Guigui P, Levassor N, Rillardon L, Wodecki P, Cardinne L. (2003). Physiological value of pelvic and spinal parameters of sagital balance: analysis of 250 healthy volunteers. Rev Chir Orthop Reparatrice Appar Mot. ;89(6):496-506.
19. Scoppa F, Roncagli V, (2002). Valutazione della funzione visiva in posturologia, Terapia Manuale & Riabilitazione, Anno 4, N. 3, luglio-settembre
20. Faini M, Santacatterina S, (2008.). Covert test, Riv It Optom vol.31 n.3 LUG-SET 128-145.

DOI:10.31579/2690-4861/495