Analysis of posture and its impact on performance in women’s water polo

Abstract

Purpose: The study examines the postural effects on the wellness and the performance of fourteen professional female water polo athletes. There are no written studies on water polo, probably because it is assumed that there is no pain because Archimedes’s formula opposes the force of gravity. Currently athletes carry out exercises to compensate and to avoid any eventual pain that then disappears when they are out of the water according to motor control and learning theory. The aim is to understand the phenomenon in professional athletes using a tridimensional analysis of the surface of the torso and the baropodometric platform.

Methods: This consists in examining the “3D” surface of the torso of fourteen professional water polo athletes, and the data of the baropodometric platform. This data highlights curves that will then be considered with regards to athletic performance and well being. The data of performance and well being of the athletes is collected by a trainer for each single athlete. The study was carried out at the specialized center CORPORA of Gricignano (CE) with the following apparatus: “Formetric Spinometer”. The postural Formetric check-up supplies a series of indicators which together give a detailed evaluation of the subject’s posture. For each athlete, a summary chart was processed, showing a 3D reconstruction of the surface of the torso and the individualization of specific postural parameters with the data collected by the trainers on the athlete’s performance and well being. This data was elaborated using a statistic model of linear regression.

Results: The evaluation of the data did not reveal that there is no correlation between pseudo pathological curves and sports performance, whereas athletes with a perfect exam often complained of pain.

Conclusions: There is a paradox regarding affection, performance and pain; in some cases it is low, while in some cases, it is the opposite. It is to consider that these athletes carrying their water activities are subject to the principle of Archimedes.

Keywords: spinometria formetric, postura, performances

Introduction

This study has analyzed the effects of postural aspects on the state of well being and performance of 14 high level water polo athletes. The tri dimensional analysis of the surface torso and the baropodometric platform supplied specific data collection that was useful to better understand the effects that posture has in sports performance, and especially on the capability of the athlete’s body to modify and correct posture in order to compensate the presence of any eventual pseudo pathological curves. The Formetric data collecting method is the most widespread in the world, offering a tridimensional optic system screening of the spinal cord and posture. Data on morphological appearance of the athletes were detected thanks to Spinometro Formetric Diers, an optical analysis system of the spine, designed in Germany thanks to a project of the European Community (for screening and the study of scoliosis in children to prevent risks related to ‘high number of exposures to x-rays), and spread throughout the world in major centers dedicated to spinal pathologies.

It ‘the first system designed to perform the analysis of posture and three-dimensional morphology of the back method with Non-Invasive and Non-ionizing. The Formetric system offers a non invasive screening system and an extensive optical scan of the vertebrae (for a static image screening, with a time of 40 milliseconds to exclude the effects caused by spontaneous postural variations), with the possibility to graphically represent numerous problems of clinical nature inherent to objective analysis and in quality of corporal statics and posture, scoliosis and of all the possible alterations of the spinal cord. The morphological screening system of the spinal cord automatically collects the points (C7, sacrum, lumbar), the meridian line and the rotation of the vertebrae. The result is the creation of a tri dimensional model of the spinal cord, or rachis, in its entirety, representing morphological rotation and positioning of the pelvis.

Thanks to numerous possible uses, the spinometer is particularly useful to: screening programs for children;

I. Analysis and monitoring of scoliosis patients, with the advantage of avoiding radiological exams as a first means of testing.

II. Measuring, analysis and monitoring of patients affected by lordosis.

III. Planning and verifying medical supplies, such as conventional prosthesis, insoles for proprioceptive correction, dental braces.

IV. Therapeutic support and intervention and control of results obtained.
V. control, quality verification and documentation in rehabilitation
VI. Legal medicine evaluation, for example, cervical distortion trauma.

The functional principle of Formetrics is based on triangulation. The active triangulation and the superficial reference points and the bone structure, it is possible to build a highly precise tridimensional model and derive reliable evaluation parameters. Given the existing correlation among the spinal process line, the saggital median plane, and can be considered coincidental with the symmetrical line. The symmetrical line of the subject with ideal posture coincides with the median line of the body independently from the position of the subject with respect to image acquisition. Such anatomical points are VII cervical vertebrae, right and left lumbar and the symmetrical line. The symmetrical line of the subject with ideal posture coincides with the median line of the body and the sagittal median plane, and can be considered coincidental with the spinal process line. Given the existing correlation among the superficial reference points and the bone structure, it is possible to build a highly precise tridimensional model and derive reliable evaluation parameters. The morphological evaluation passes through the following phases:

a. Automatic localization of spinal cord process line through calculation of symmetrical line;
b. Measurement of the superficial rotation with respect to the spinal process lines and vertebral rotation measurement;
c. Localization of the center of the vertebrae through evaluation of the anatomical dimensions.
d. Few seconds after the measurements are taken the examiner will have the following information.
e. Sagittal profile of the dorsal structure and the spinal cord
f. Lateral frontal deviation of the spinal cord
g. Transversal superficial and vertebral rotation
h. Complex tridimensional view of the spinal cord.

Other instruments that aid in postural examination are the baropodometric platform and stabilometry. The baropodometric platform is surely a cutting edge instrument in the study of the foot. It consists in a platform with applied sensors which are connected to a computer system. What the system measures are the reactions on the ground, in an exact position and in motion. The findings and measurements collected during the exam are printed with color "photographs" in which an automatic analysis of the pressure values and their comparison to normal parameters. Through the baropodometric exam, various parameters are seen. The correct interpretation of this data allows you to precisely evaluate the general attitude of toned posture in the subject with respect to measurements collected in the norm. The collection of data is precise, instantaneous, repeatable, non invasive and allows the reduction of radiological exams. The stabilometric analysis (posturography) can be carried out be the same baropodometric platform because it is able to function as a stabilizer and measure the postural movements in static position.

Methods

The research method experimented in evaluating the 3D data collection is that of the torso of 14 water polo athletes who participated in the Italian Championships in the A1 series. Such evaluation had the goal to reveal the state of their spinal cord and highlight any eventual pathological curves and their consequences on both their athletic ability and their health. The exam was carried out at the CORPORA Center of Gricignano (CE) with “Formetric Spinometry” equipment. “Formetric Spinometry” allows you to carry out tridimensional morphological data collection of the torso with extreme accuracy, this allows the morphological 3D image of the torso, with extreme accuracy speed (few minutes per procedure), and safety thanks to the radiation like traditional radiological (does not imply ionized radiation) exams free equipment (with a margin of error inferior to 0,02mm). The Formetric postural check up supplies a series of indicators which together allow you to obtain a detailed evaluation of the subject’s posture and complete the clinical examination with various elements. It was possible to carry out such research tank to the cooperation of the CORPORA center (which provided the equipment) and the Volturno S.C. Society (who provided the athletes).

Results and discussion

For each athlete a Formetric Postural Check Up was charted. This includes a 3D reconstruction of the surface torso and the individualization of specific postural parameters. From a detailed analysis of observed data it is noted that the values of the kyphotic curve for the Guillet athlete are much higher than normal (should be less than 40°C) with a (red) alteration of the pelvic inclination, anteroposterior flexion with lateral deviation and left lateral flexion (Table 1) (Table 2). This athlete, after an analysis of her pain measurement form, has claimed that she does not feel rachis pain. Other instruments that aid in postural examination are the baropodometric platform and stabilometry. The baropodometric platform is surely a cutting edge instrument in the study of the foot. It consists in a platform with applied sensors which are connected to a computer system. What the system measures are the reactions on the ground, in an exact position and in motion. The findings and measurements collected during the exam are printed with color "photographs" in which an automatic analysis of the pressure values and their comparison to normal parameters. Through the baropodometric exam, various parameters are seen. The correct interpretation of this data allows you to precisely evaluate the general attitude of toned posture in the subject with respect to measurements collected in the norm. The collection of data is precise, instantaneous, repeatable, non invasive and allows the reduction of radiological exams. The stabilometric analysis (posturography) can be carried out be the same baropodometric platform because it is able to function as a stabilizer and measure the postural movements in static position.

Results and discussion

For each athlete a Formetric Postural Check Up was charted. This includes a 3D reconstruction of the surface torso and the individualization of specific postural parameters. From a detailed analysis of observed data it is noted that the values of the kyphotic curve for the Guillet athlete are much higher than normal (should be less than 40°C) with a (red) alteration of the pelvic inclination, anteroposterior flexion with lateral deviation and left lateral flexion (Table 1) (Table 2). This athlete, after an analysis of her pain measurement form, has claimed that she does not feel rachis pain. Other instruments that aid in postural examination are the baropodometric platform and stabilometry. The baropodometric platform is surely a cutting edge instrument in the study of the foot. It consists in a platform with applied sensors which are connected to a computer system. What the system measures are the reactions on the ground, in an exact position and in motion. The findings and measurements collected during the exam are printed with color "photographs" in which an automatic analysis of the pressure values and their comparison to normal parameters. Through the baropodometric exam, various parameters are seen. The correct interpretation of this data allows you to precisely evaluate the general attitude of toned posture in the subject with respect to measurements collected in the norm. The collection of data is precise, instantaneous, repeatable, non invasive and allows the reduction of radiological exams. The stabilometric analysis (posturography) can be carried out be the same baropodometric platform because it is able to function as a stabilizer and measure the postural movements in static position.

Methods

The research method experimented in evaluating the 3D data collection is that of the torso of 14 water polo athletes who participated in the Italian Championships in the A1 series. Such evaluation had the goal to reveal the state of their spinal cord and highlight any eventual pathological curves and their consequences on both their athletic ability and their health. The exam was carried out at the CORPORA Center of Gricignano (CE) with “Formetric Spinometry” equipment. “Formetric Spinometry” allows you to carry out tridimensional morphological data collection of the torso with extreme accuracy, this allows the morphological 3D image of the torso, with extreme accuracy speed (few minutes per procedure), and safety thanks to the radiation like traditional radiological (does not imply ionized radiation) exams free equipment (with a margin of error inferior to 0,02mm). The Formetric postural check up supplies a series of indicators which together allow you to obtain a detailed evaluation of the subject’s posture and complete the clinical examination with various elements. It was possible to carry out such research tank to the cooperation of the CORPORA center (which provided the equipment) and the Volturno S.C. Society (who provided the athletes).
### Table 2 & 3 Linear regression

| Surname   | Kyphosis angle | Lordosis angle | Pelvic inclination right (Mm) | Pelvic inclination left (Mm) | Antero-posterior bending(°) | Lateral deviation (Mm) | Lateral bending right (Mm) | Lateral bending left (Mm) | Surface rotation (°) |
|-----------|----------------|----------------|-----------------------------|-----------------------------|-----------------------------|------------------------|---------------------------|--------------------------|----------------------|
| Masciandaro | 49.50          | 45.70          | 1.50                        | 1.00                        | 2.60                        | 12.00                  | 6.10                      |                          |                     |
| Ciampichetti | 52.80          | 29.10          | 0.00                        | 0.00                        | 4.50                        | 1.60                   | 7.50                      | 1.80                     |                     |
| Starace    | 59.20          | 42.00          | 0.00                        | 0.00                        | 3.80                        | 3.00                   | 8.20                      | 3.30                     |                     |
| Anastasio  | 55.00          | 55.80          | 0.00                        | 0.00                        | 2.00                        | 4.70                   | 4.50                      | 1.40                     |                     |
| Cicciariello | 57.80         | 46.10          | 0.00                        | 0.00                        | 0.40                        | 5.90                   | 1.80                      | 4.00                     |                     |
| Giuliani   | 60.40          | 47.50          | 9.00                        | 4.40                        | 3.50                        | 12.00                  | 4.10                      |                          |                     |
| Guillot    | 61.00          | 41.10          | 12.00                       | 5.80                        | 10.70                       | 9.00                   | 3.60                      |                          |                     |
| De Simone  | 53.40          | 64.00          | 3.00                        | 1.90                        | 4.50                        | 1.50                   | 3.00                      |                          |                     |
| Stellato   | 56.60          | 44.50          | 11.80                       | 4.00                        | 2.10                        | 2.50                   | 1.80                      |                          |                     |
| Ventriglia | 58.50          | 52.10          | 3.00                        | 0.70                        | 6.90                        | 19.50                  | 2.90                      |                          |                     |
| Di Monaco  | 53.40          | 49.60          | 3.00                        | 2.50                        | 7.50                        | 13.50                  | 2.10                      |                          |                     |

| Cognome   | ETA | Angolo Cifosi | Xy  | X2  | Y2  | Y'  | E  | E^2 | (Y-M)^2 |
|-----------|-----|---------------|-----|-----|-----|-----|-----|-----|---------|
| Valkai    | 33  | 47.50         | 1567.5 | 1089 | 2256.25 | 4.070,805 | -359.58 | 129298,1 | 5.430,556 |
| Pellegrino | 18  | 48.20         | 867.6 | 324  | 2323.24 | 2,220,439 | -173.84 | 30221,7  | 4,447,864 |
| Masciandaro | 25  | 49.50         | 1237.5 | 625  | 2450.25 | 3,083,943 | -258.89 | 67026,27 | 2,882,864 |
| Ciampichetti | 20  | 52.80         | 1056  | 400  | 2787.84 | 2,467,155 | -193.92 | 37603,2  | 4,281,716 |
| Starace    | 31  | 59.20         | 1835.2 | 961  | 3504.64 | 382,409  | -323.21 | 104464,1 | 1,875,556 |
| Anastasio  | 24  | 55.00         | 1320  | 576  | 3025.00 | 2,960,585 | -241.06 | 58109,22 | 0,017101 |
| Cicciariello | 24  | 57.80         | 1387.2 | 576  | 3340.84 | 2,960,585 | -238.26 | 56767,13 | 8,589,408 |
| Giuliani   | 32  | 60.40         | 1932.8 | 1024 | 3648.16 | 3,947,447 | -334.34 | 111786,4 | 3,058,941 |
| Guillot    | 28  | 61.00         | 1708  | 784  | 3721.00 | 3,454,016 | -284.40 | 80884,29 | 3,758,633 |
| De Simone  | 24  | 53.40         | 1281.6 | 576  | 2851.56 | 2,960,585 | -242.66 | 58883,17 | 2,158,639 |
| Stellato   | 22  | 56.60         | 1245.2 | 484  | 3203.56 | 271,387  | -214.79 | 46133,45 | 2,995,562 |
| Ventriglia | 23  | 58.50         | 1345.5 | 529  | 3422.25 | 2,837,228 | -225.22 | 50725,3  | 1,318,249 |
| Di Monaco  | 17  | 53.40         | 907.8  | 289  | 2851.56 | 2,097,081 | -156.31 | 24432,23 | 2,158,639 |
| Somma      | 321 | 713.30        | 17691.9 | 8237 | 39386,15 | 856334,5 | 2,479,277 |                     |                     |

**XY** Product of Variables  
**X2** Square of Variable X  
**Y2** Square of Variable Y  
**Y'** State of X  
**e** Diff. between our Valued Yarn and which was Recommended with Regression Parameters Y'  
**E^2** Sum of Square Errors  
**(Y-M)^2** Proportion of Spare Parts  
Slope = b = 0.25381188  
Intercept = a = 48.6020297

---

**Figure 1** Kyphosis angle.
Analysis of posture and its impact on performance in women’s water polo

Figure 2 Lordosis corner.

Figure 3 Pelvic inclination.

Figure 4 Bending front - rear.

Figure 5 Lateral deviation.

Figure 6 Lateral bending.

Figure 7 Rotation of the surface.

Figure 8 Linear regression.

Figure 9 This includes a 3D reconstruction of the surface torso and the individualization of specific postural parameters.

Citation: Napolitano S, Ascione A. Analysis of posture and its impact on performance in women’s water polo. Open Access J Sci. 2017;1(3):91–95. DOI: 10.15406/oajs.2017.01.00018
Conclusion

After careful evaluation of the observed data, we can state that there is no direct link between pain, performance and posture wrong. We have also to underline that this sport is practiced in the water so the up thrust, that is equal to the force of gravity, facilitates the support of the body. The human body can adapt in a morpho-functional and compensatory way but we cannot deny that a prolonged wrong posture can damage the good health of the athletes especially at the end of their sport career.

Acknowledgements

None.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Ángyán L, Téczely T. Investigation of postural stability, reaction time and body measures in basketball players. 2006.
2. Tursi D, Napolitano S, Raiola G. Assessment the technical execution in archery through video analysis. Buletin Stiintific-Universitatea din Pitesti. Seria Educatie Fizica si Sport. 2013;17:41–43.
3. Napolitano S, Di Tore PA, De Miro C, et al. Technical Analysis in High Diving. Buletin Stiintific-Universitatea din Pitesti. Seria Educatie Fizica si Sport. 2012;16:96–99.
4. Napolitano S. Cliff diving: water impact and video-analysis. Journal of Physical Education and Sport. 2014;14(1):93–97.
5. Tursi D, Napolitano S, Di Tore PA, et al. Evaluation of Incidence of ball handling on swimming intensity in female water polo. Buletin Stiintific-Universitatea din Pitesti. Seria Educatie Fizica si Sport. 2012;16:99–103.
6. Tursi D, Napolitano S, Raiola G. Assessment the technical execution in archery through video analysis. Buletin Stiintific - Universitatea din Pitesti. Seria Educatie Fizica si Sport. 2013;17:41–43.
7. Napolitano S, Tursi D. The Assessment of the tactic in women’s water polo: the experience of a team in the Italian championship premier league. Buletin Stiintific-Universitatea din Pitesti. Seria Educatie Fizica si Sport. 2013;17:36–40.
8. Raiola G, Parisi F, Napolitano S. Sports skills in youth volleyball by video analysis teaching method. Procedia: social & behavioral sciences. 2014;117:436–441.
9. Tursi D, Napolitano S, Raiola G. Assessment the technical execution in archery through video analysis. Buletin stiintific - universitatea din pitesti. Seria educatii fizica si sport. 2013;17:41–43.
10. Napolitano S, Di Tore PA, De Miro C, et al. Technical analysis in high diving. Buletin stiintific-universitatea din pitesti. Seria educatii fizica si sport. 2012;16:96–99.