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ARTIGOS

PROCEDURE FOR THE PRODUCTION OF HIGH QUALITY PHOTOGRAPHS SUITABLE FOR THE RECORDING AND EVALUATION OF POSTURE

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ABSTRACTS: This article summarize and analize the procedures for the production of high quality photographs grutable for the recording and evaluation of posture.

KEYWORDS: Posture. Evaluation. Photography.

INTRODUCTION

Photographs can be a useful aid to the assessment of posture and body mechanics. They provide a two-dimensional, static, statement of the subject's posture which can be compared with diagrams and other posture photographs at the examiner's leisure. If of a suitable quality, they can also be used as a basis for linear and angular measurements concerned with posture. Some of these are difficult, or impossible, to take on a living subject: others are extremely time consuming and thus create difficulties for the subject. Posture photographs can be particularly valuable as a record of changes in posture over time. They are able to record subtle changes and inter-relationships between different parts of the body which are difficult to measure or record in any other way. To be useful, posture photographs must be of high quality, and be free from distortions which may mislead the observer.

In the context of the present paper the term "Quality" is used to imply the following: 1) prints from fine-grain negatives; 2) with negligible distortion and of; 3) high sharpness and; 4) sufficient of size and; 5) appropriate density and; 6) contrast, so that small details of the subject's body are visible on the photographic print.

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Distortion implies change, or changes, in the photographic image that give a misleading impression of the subject's posture. In the context of photographs of the human body four types of distortion are important:

1. Distortion produced by the lens used to make the photographic print. Camera and enlarger lenses suffer from a number of different kinds of distortion. In the present context the most important of these are *barrel* and *pin-cushion* distortion in which straight lines near to, and parallel with, the edges of the image are reproduced as concave or convex curves. The amount of *barrel* and *pin-cushion* distortion of a particular lens is a function of its design: but it may also vary with its distance from the object being photographed and the *f-stop* used for the photograph. Certain types of high quality photographic lenses from the best manufacturers limit *barrel* and *pin-cushion* distortion to very low levels and are suitable for producing posture photographs. The amount of *barrel* and *pin-cushion* distortion of a lens can be quantified by analysing photographs taken of a grid of straight lines of known dimensions;
2. Distortion due to the plane of the film and camera lens not being vertical and parallel with that of the subject's body. This distortion results in some parts of the subject's body being magnified more than others. This type of distortion can be eliminated completely if the camera is precisely aligned to the vertical and is parallel to the subject;
3. Distortion due to parallax error. This results in the parts of the subject's body closest to the camera being reproduced larger on the photographic print than body parts of similar size that are further away. For example, if the body is photographed from the left side, the left foot will be reproduced on the print as being larger than the right foot which is further away from the camera. Parallax error cannot be eliminated but is reduced if the subject-to-camera distance is increased by increasing the focal length of the camera lens. For 35 mm cameras, lenses of focal length 50 mm or longer can be used for posture photographs: an 85 mm lens is a good choice and normally results in a camera to subject distance of 16 to 21 ft (5 to 6.5 m);
4. Distortion due to the subject's stance and to clothing distorting the actual or perceived shape of their body. This type of distortion can be controlled by careful preparation and posing of the subject.

Requirements for the production of photographs suitable for the assessment of posture are considered below.

PRINTS

Good quality prints in which the subject is reproduced at a minimum height of 10 inches (250 mm) high are necessary. If made on photographic paper of length 10 inches, the prints must be individually made so that the image of each subject is enlarged to fill the entire size of the photographic paper - with no blank space above the subject's head or below his or her feet. The density and contrast of the photographic image must also be suited to the colour and contrast of the subject's skin. To have such images produced commercially is very expensive and not always satisfactory since a commercial processor is not always aware of which details are most important for the assessment of posture. In our laboratory we produce our own prints on black-and-white 10 by 8 inch photographic paper that has been cut in two lengthways. Thus each sheet of bromide paper yields two prints of size 10 by 4 inches. Colour prints can also be used but we find the production of black-and-white prints easier to control.

A metric grid can be superimposed on the print at the printing stage. This has the following advantages over photographing the subject against a background that consist of a grid: 1) a background grid is obscured by the subject; 2) since the background grid is further away from the camera than the subject, its size

is reduced in the print due to parallax error. When superimposing a metric grid onto the photographic print it is necessary that a plumb-line, or similar object, be included in the negative for alignment purposes.

PHOTOGRAPHIC EQUIPMENT

A good quality camera fitted with a high quality lens is necessary for the production of the images. We normally use a 35 mm camera fitted with a 50 mm or 85 mm lens from a top manufacturer. The camera is mounted in portrait mode on a high quality tripod that is fitted with two spirit levels at right angle to each other. The lens and film plane of the camera are aligned to be precisely vertical using the two spirit levels.

The subject is illuminated with a single electronic flash-gun. In order to ensure even illumination of the subject, and to avoid shadows, the flash-gun is mounted in portrait mode, precisely over the centre of the camera lens and as close as possible to it.

A high quality medium-format camera has also been used for the production of posture photographs. It is possible to obtain high quality prints with such equipment but there are a number of disadvantages: 1) The extremely high cost of medium-format equipment; 2) The cost of film: only 12 exposures are produced on each film; 3) The square format of the film is wasteful for posture photographs since the image of the subject occupies only a small part of the central portion of the film; 4) The maximum height of the image of the subject is 56 mm as opposed to 37 mm on "35 mm" film. This represents an increase in image size of only 50% over "35 mm" film while the costs of medium-format photography can be 10 or more times that of 35 mm photography; 5) It is more difficult to locate the flash over the centre of the camera lens since with most medium-format cameras focusing is carried out on a ground-glass screen.

Medium-format cameras are capable of producing very high quality results but in the case of posture photographs the gain in quality does not seem to justify the considerable extra cost.

PHOTOGRAPHIC MATERIALS

Photographs were taken on fine-grain black-and-white film and developed in fine-grain developer. Extra development of the film was used in order to compensate for the inherent low-contrast of posture photographs. In our laboratory we normally use Ilford Pan F film rated at 25 ASA and developed in Perceptol developer diluted 1:1. Development for 14 minutes at a temperature of 21 degrees centigrade produces negatives of appropriate contrast.

ENVIRONMENT FOR POSTURE PHOTOGRAPHS

High quality posture photographs require a dedicated location that allows: 1) the photographic equipment can be precisely set-up and; 2) to remain permanently in the same position without; 3) danger of interference or; 4) theft, other requirements are; 5) warmth and comfort and; 6) privacy, for the subject who is being photographed and; 7) adequate lighting to allow the camera to be precisely focused.

The room in which the photographs are taken should contain the following in addition to the photographic equipment:

- Two plumb-lines, one on each side of the subject. These are included on the photographic negatives for alignment purposes. They are placed a known distance apart (in our laboratory 1.2 m apart) and in order to avoid parallax error are position at the same horizontal distance in front of the camera as the centre of the subject's body;
- A surface, or box, on which the subject stands while the photographs are taken. This should be of sufficient height to allow the lower end of the two plumb-lines to extend below the level of the subject's feet;
- A plain white, non-reflective, surface to act as a background to the photographs.

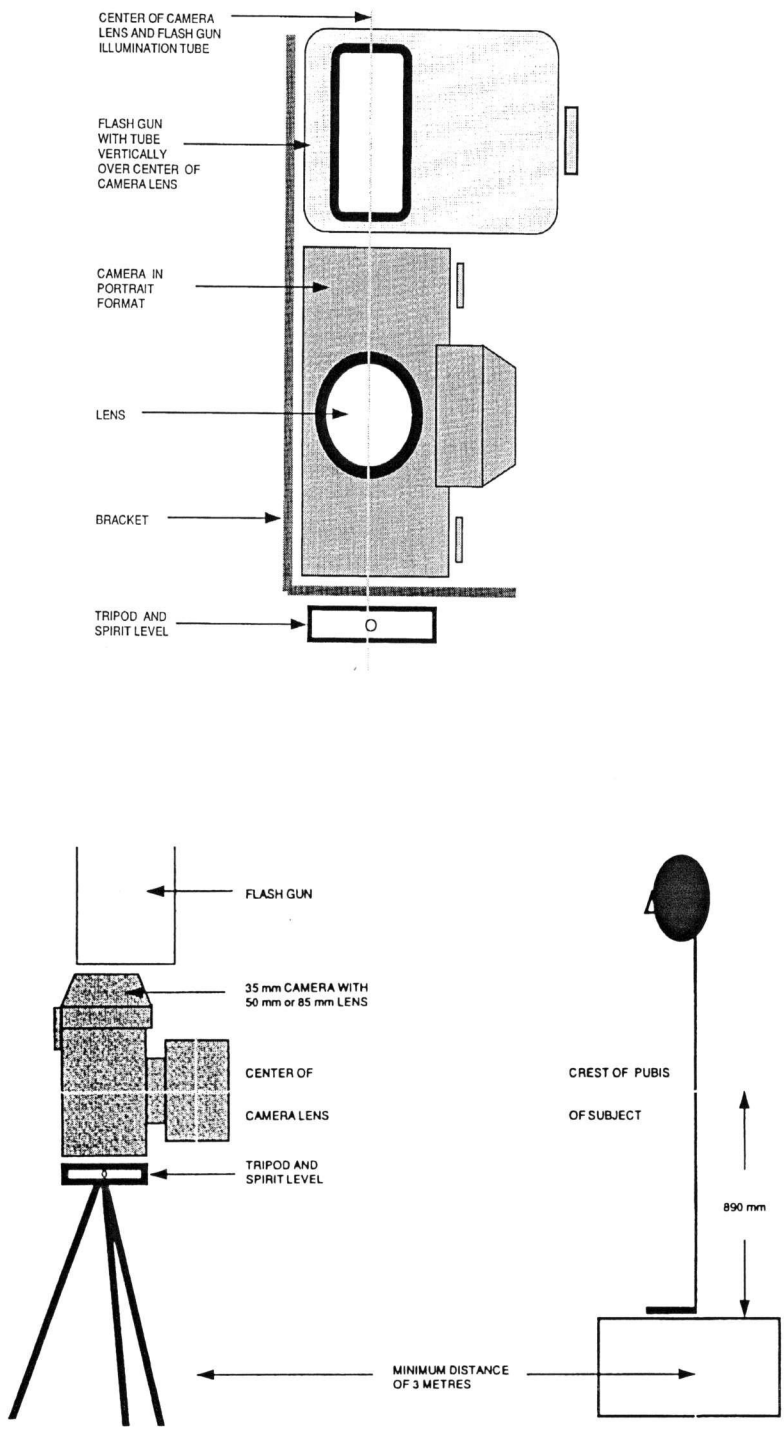

FIGURE 1 - PREPARATION OF THE SUBJECT FOR THE POSTURE PHOTOGRAPHS

DRESS

For the posture photographs the subject should wear no more than brief swim-wear or under-wear. The sides of such garments should not be longer than 1 inch. They should be sufficiently close-fitting so as to follow the contours of the subject's body but not so tight as to distort the shape of the body. It is important that trunks and other garments be worn symmetrically by the subject. If any such garments are asymmetrical (this normally means one side being higher than the other) subjective estimates of posture may be distorted: subject's with symmetrical posture may appear to be asymmetric, or certain asymmetries may be masked.

In order to avoid compression marks from clothes, subjects should undress and/or change 10 to 15 minutes before any photographs are taken.

POSE

A variety of different poses can be used for posture photographs: some are suitable for specific purposes. The subject can be photographed standing "normally" or "relaxed", and this provides a record of the individual's normal stance. However, if measurements are to be taken from the photographs, or if they are to be compared with standards, it is necessary that the subjects adopt a standard pose. Different types of standard pose are possible: the one which we find easiest for the subject, and most useful for the assessment of posture is described below.

- *General.* The subject stands on a smooth, flat surface. He or she is told to stand upright and as "well" as possible with their arms by their sides and to look straight ahead;
- *Arms and hands.* The subject's arms are held straight with the elbows fully flexed, and by their sides. The arms are rotated so that the subject's palms are facing their thighs with the thumbs to the front and in front of the fingers. The subject's hands are held symmetrically to 4 inches from the side of the thighs. In the lateral-view photograph it is important that the subject's arms do not obscure the outline of his or her body;
- *Legs and feet.* If the subject has a positive knee-interspace (a space between the knees when their heels are touching) they are asked to stand with their heels touching and the remainder of their feet in the position that is most comfortable for them. If their is no knee interspace the subject is asked to stand with their knees touching.

POSTURE ASSESSMENTS FOR DIFFERENT PURPOSES

Posture assessments need to be tailored to suit the needs of the subject. For example, for the screening of average school children without injury problems a photographic assessment of posture may be unnecessary. On the other hand, a top-level athlete who trains intensively every day, and who needs to take every precaution to avoid injury, should be examined very thoroughly. Posture assessment should be combined with other forms of physical and medical examination and the results combined.

Five levels posture assessment are outlined below.

Screening assessment

Visual assessment of the subject only with no photographs taken.

Basic photographic assessment

Visual assessment of the subject plus rear-view and lateral-view photographs of the subject.

Standard photographic assessment

Visual assessment of the subject plus the four standard posture photographs: rear-view, oblique-view, lateral-view, front view. The aspects of posture assessed from each photograph are summarised in Table 1.

TABLE 1 - ASPECTS OF POSTURE ASSESSED FROM EACH OF THE FOUR STANDARD POSTURE PHOTOGRAPHS

ASPECT OF POSTURE	REAR-VIEW PHOTOGRAPH	OBLIQUE-VIEW PHOTOGRAPH	SIDE-VIEW PHOTOGRAPH	FRONT-VIEW PHOTOGRAPH
Shoulder symmetry	♦			♦
Scapulae abduction	♦	♦	♦	
Back symmetry	♦			♦
Scoliosis	♦			
Forward head			♦	
Kyphosis			♦	
Chest mechanics			♦	
Lumbar lordosis		♦	♦	
Sway back			♦	
Knee interspace				♦
Knee hyper-extension			♦	
Tibial torsion				♦
Ankle mechanics	♦			

Full photographic assessment: used for high-level athletes

Visual assessment of posture plus seven photographs:- the four standard posture photographs plus: 1) photograph with grid imposed of subject's trunk from jaw to superior-anterior iliac-spines: photograph taken without trunks or swim wear; 2) photograph with grid imposed of back from base of skill to base of spine: photograph taken without trunks or swim wear; 3) photograph of plantar surface of the subject's feet.

Special assessment: used for individuals with injury problems

As for the *Full Photographic Assessment* plus a special photograph is taken for the measurement of "Q" angle. The subject also undergoes complete physical and medical assessment. Close-up photographs are taken of any injuries or structural abnormalities.

DISCUSSION AND CONCLUSIONS

Posture is a complex phenomenon and difficult to quantify. This may, perhaps, explain why there are so few definitive reports linking posture defects to specific physical problems such as lower back pain or the incidence of sports injuries. Two recent reports that *have* found such associations (between posture defects and the incidence of sports injuries) have both used precise photographic techniques similar to that described in the present paper (WATSON, COWAN et al.)[2,1]. This suggests that when the effects of posture are being examined a photographic technique, similar to that described in this paper, should be considered.

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RESUMO: Este artigo resume e analisa os procedimentos para a produção de fotografia de alta qualidade para o registro e avaliação da postura.

DESCRITORES: Postura. Avaliação. Fotografia.

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