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Anthroposcopic classification of eye surroundings with eyes closed

Summary

In the analyses for body identification based on visual recordings, differences in the analyzed material may be encountered. The evidence, as opposed to comparative material, usually contains images in which the eyes are closed. The aim of the study was to establish whether it is possible to perform the proper anthroposcopic classification of eye surroundings in such conditions. The study was conducted in a group of 98 subjects. It involved taking a series of photographs (with head positioning in the Frankfurt plane) of the subjects with eyes open and closed, with a possibly natural and unforced manner of closing the eyes. Subsequently, classification of the surroundings of open and closed eyes was performed to reveal any correlations detectable in the images. The evaluation was based on the appropriate sets (montage) of pictures. It was demonstrated that in certain cases, the proper anthroposcopic classification of selected elements of the surroundings of a closed eye is possible. However, usually such an assessment is very difficult and should be approached with great care and a margin of probability.

Keywords anthroposcopic analyses, identification of individuals and bodies based on visual recordings, anatomical structure of the eye, anthroposcopic classification of eye surroundings

Introduction

The human eye and its surroundings are areas of a very high potential for the identification of a person. It is no accident that perpetrators of assaults and theft mask this area by using, e.g. dark sunglasses to minimize the risk of being recognized by witnesses and victims. It is also widely practiced in mass media to cover the eye area with, e.g. a black stripe when publishing the faces of individuals suspected of crime (when publishing their faces has not been permitted). The eyes are one of the essential components of the face. They express human moods and emotions, such as sadness, tension, fatigue, agitation, fear, surprise or joy. They determine the differences in facial expressions in different people and may express friendliness, playfulness or pensiveness. By using eye contact, people can read other people's ideas, initiate interactions, as well as recognize friendly or hostile intentions. Because of the highly complex anatomical structure, the eyes and their surroundings have a large impact on human physiognomy and, more importantly, on the high potential for identifying a person.

Aim of the study

In the case of identification of human remains by means of anthroposcopic analyses, the evidence and the comparative material are usually slightly different as regards the degree of visibility of the eyes. Very often the eyes of dead people are closed, while in the evidence, most often photographs from identity documents and other pictures of the person, the eyes are open. This leads to differences in the analytical material, which should be properly clarified and interpreted by experts in anthroposcopy during identification analyses. The experts are burdened by a great intellectual and moral responsibility. Therefore their work should be founded on objectivity and knowledge which are essential for the correct conduct of penal trial and establishing the material truth. The particulars of anthroposcopic analyses focus their scope on the essential external structures of the person's body, mainly face (as it provides the most discernible features), but also other body parts, and on individual characteristics of external appearance, also occurring in the eye area, however, there is no minimum number of features for the identification of a person. This causes the necessity to perform

particularly thorough research and identify as many features characteristic of the identified object as possible. The more characteristics are determined, the higher the probability of correct identification results.

The aim of this study was to determine the possibility of conducting a correct anthroposcopic classification of eye surroundings with eyes closed. The study was carried out in a group of 98 volunteers (68 women and 30 men).

The classification of eye parameters is directly determined by the anatomical structure of the eye (Fig. 1. Anatomical structure of the eye 1) Upper eyelid – orbital part, 2) Separating groove, 3) Upper eyelid – tarsal part, 4) Upper eyelashes, 5) Lateral angle of eye fissure, 6) Lower eyelashes, 7) Lower eyelid – orbital part, 8) Separating groove, 9) Lower eyelid – tarsal part, 10) Lacrimal caruncle and lateral angle of eye fissure, 11) Eyeball, 12) Iris, 13) Pupil; see Polish version).

Anthroposcopic classification of the eye

The eyes, depending on their shape and mutual position, are of different appearance, size, location and type. The majority of these components can be classified using the parameters in (Fig. 2. Elements of eye classification; see Polish version):

Some of these parameters are difficult, if not impossible, to estimate in the case of a closed eye. The eye size is an unmeasurable feature, assessed subjectively by the observer. In practice, determining the eye size and the degree of opening of the eye fissure with a closed eyelid is difficult and can often be based only on probable findings. Eye size can be properly estimated only in the case of a clearly small eye, as the eye fissure length is relatively short in relation to the height and width of the face (the eye size is usually estimated based on its proportion to face dimensions). However, long eye fissure does not guarantee that the eye will be automatically classified as large. Quite often large eyes can be found in children whose face is smaller than an adult face, therefore the eyes are proportionally larger and are thus estimated as large. The results of eye size estimation and the degree of opening of the eye fissure confirmed that the most common case is an eye of an average size with an average degree of opening (56% of all subjects).

The assessment of another parameter, the contour shape of the eye fissure, also proved that the image of eyes with eyelids closed is similar for either spindle-, almond- or s-shaped fissures, which in practice makes it impossible to correctly assess this parameter. However, it is notable that the s-shaped contour is the rarest (8% subjects), while the most common eye fissure shape is spindle (56%).

During the analyses, eye color was not taken into consideration for obvious reasons – it was impossible to determine with eyelids closed. Nonetheless, there are some correlations between eye color and hair color/race. For example, the Mediterranean race is characterized by dark hair and hazel eyes, but individuals with dark hair and bright eyes can also be encountered, therefore it is difficult to precisely determine the eye color with eyelids closed.

Another parameter of the eye, whose appropriate classification poses a problem in the case of eyes closed, is the position of the eye fissure. When the eye is closed, the upper eyelid partially covers the lower eyelid, causing the lateral eye angle to move down. Thus the position of eye fissure assessed in such circumstances is changed, e.g. from vertical or diagonal pointing upwards to diagonal pointing downwards (Fig. 3. Example of a change in the position of the eye fissure from diagonal pointing upwards (A) to diagonal pointing downwards when the eye is closed (B); see Polish version). In case of this parameter, it is generally easier to exclude a certain position of the eye fissure than to confirm it. When the position of the eye fissure is horizontal (eyes closed), the original position of the eye fissure that may be inferred is diagonal pointing upwards.

It seems interesting that in the analyzed subjects, the diagonal position pointing upwards (62%) occurred almost three times more frequently than the horizontal position (22%), which is contrary to the data presented in the publication by Z. Dębiński, T. Kozieł, Z. Niziałek [3]. The authors claim that in the Polish population, the horizontal position of the eye fissure is the most common. The classification of the position of the eye fissure with eyelids closed is particularly affected by head positioning. As was observed, eyes positioned horizontally can be considered as horizontal, diagonal pointing upwards or diagonal pointing downwards. The horizontal eye fissure is particularly vulnerable to erroneous qualification. For eyes positioned diagonally (either downwards or upwards), small deviations in head positioning from the Frankfurt plane do not cause changes in the position of the eye fissure after closing eyelids.

As regards eye setting, the prevalent type is the medium setting amounting to 65% cases. When analyzing this parameter with eyelids closed, it is relatively easy to assess this element of eye surroundings in extreme cases, i.e. very deep (23%) and very shallow (12%) eye setting, even when only *en face* image is available. To this end, e.g. the

quantity of extraocular fatty tissue should be taken into consideration. It can be estimated based on the visibility of the supra- and infraorbital ridges. In the case of a deep-set eye, these ridges are well visible and more protrusive, while the eyeball along with the eyelid appear collapsed. Moreover, deep-set eyes are usually accompanied by eyebrows located close to the eye fissure (Fig. 4. Appearance of the surroundings of deep-set and shallow-set eyes. The arrows indicate the visible orbital ridge to facilitate the proper classification; see Polish version).

It is possible to properly assess eyes with eyelids closed. In practice, it is preferable to use face images with both *en face* and profile views, which significantly facilitates the assessment of the deepness of eye setting even in non-obvious cases and with eyelids closed.

According to previous observations, the proper assessment of another parameter, interocular distance, does not pose a major problem with eyelids closed. However, similarly as with determining the length of the eye fissure, it is important to properly establish the location of the lateral angles of the eyes, which may be difficult to locate properly with eyelids closed. To determine the interocular distance, it is essential to assess the ratio between the length of the eye fissure and the width of the nasal bones in the nasal root area. The position of the medial angles of the eyes does not change, thus there is no difficulty in their precise localization (Fig. 5. Narrow interocular distance. With the eyelids either open or closed, the distance between the eyes (B) is smaller than the length of the eye fissures; see Polish version).

When analyzing the structure of the eyelids, it should be noted that their diversity and relatively complex structure cause considerable difficulties in any attempt to determine their parameters with eyes closed, in the case of both lower and upper eyelids. There are three basic types of the lower eyelid:

- normal,
- thickened,
- drooping,

with the normal and thickened types occurring more often in young people (also children). The drooping type is more frequent in mature and elderly people. This is reflected in the conducted study, in which 27% subjects, mature people above 40 years of age, had drooping (or slightly drooping) eyelids. Lower eyelids of the normal type were present in 37% subjects, while the thickened type was present in 36% subjects (relatively younger). A strongly drooping eyelid can be classified correctly even with eyes closed, as in such cases the "saggy" and convex orbital part of the eyelid is still visible, though to a lesser degree (Fig. 6. Strongly drooping eyelids with eyes open and closed. The arrows indicate the visibly convex region of the lower eyelid; see Polish version).

Unfortunately, in the cases in which the lower eyelid is drooping to a smaller extent, its proper classification may be impossible. The reason is that with eye open, the drooping eyelid still exposes the eye. The eyelid relaxes and, in the case of low elasticity, forms a characteristic "saggy" region. During the closing of the eye, the eyelid moves upwards and the skin is stretched over the eyeball, which makes the loose region hardly noticeable. In practice, such a drooping eyelid may be confused with a normal eyelid, as once the eye is closed, a relatively smooth transition of the tarsal part into the orbital part is formed and the convex region is reduced (Fig. 7. Comparison of the profiles of the lower eyelid open and closed; see Polish version).

In the case of thickened and normal eyelids, their proper classification with eyes closed is affected by the degree of thickening of the tarsal part, the visibility of the groove, as well as the density and length of the eyelashes covering fragments of the eyelid when the eye is closed. If the eyelashes are not very long or thick, they do not cover the lower eyelid to a great extent and the correct classification is possible. In the case of women, make-up, such as mascara, artificial thickening or extensions, may be a major obstacle which can effectively prevent the proper assessment of lower eyelids.

In the case of normal eyelids, additional factors may complicate the proper eyelid classification with eyes closed. Eyelashes may obscure a part of the eyelid, preventing the proper assessment of its shape and structure; moreover, some study subjects with normal eyelids presented an image of thickened lower eyelids with eyes closed (8% subjects). The tarsal part can be seen as clearly thickened and separated by a groove from the palpebral part. When the eye is closed, the upper eyelid slightly rests over the lower eyelid and bends, forming a small crease observed as a groove separating the tarsal part from the palpebral part (Fig. 8. Example of eye structure with normal lower eyelids (the arrows indicate the groove separating the tarsal part from the palpebral part); see Polish version).

This poses a risk of confusion in an attempt to classify this parameter, as a normal eyelid may be considered as thickened. The assessment of a normal eyelid is generally possible only if no groove separating the tarsus from the orbital part of the eyelid is observed.

In the study group, most subjects (65.7%) had eyes with the upper eyelid fold present. Eyes without the upper eyelid fold were observed in 34.3% subjects. No upper eyelids with the tarsal part covered laterally along with the eye angle or eyelids with an epicanthic

fold were found. Types of upper eyelids observed in the study subjects are presented in (Fig. 9. Results of the classification of upper eyelid types; see Polish version).

It was found that asymmetry or diversity in eye structure observed in 5 subjects prevented an unambiguous classification of their eyelids to a specific type.

During the analysis of eyelids for the possibility of their proper classification with eyes closed, a series of repeating correlations was noticed:

- In the case of relatively shallow-set eyes (especially in young people), the closed eyelids stretch over the eyeballs quite smoothly and the surface of the eyelids is clearly visible. It can be noted that it is fairly smooth, free from deep sulci or grooves. In many such cases, the groove in the upper eyelid was absent or insignificant.
- As the eyelid fold begins to form, a tendency for deepening the eyelid sulcus occurs.
- When analyzing the orientation, the shape and the course of the groove, or its lack in the case of an eyelid without a fold, it is difficult to precisely determine the type of the eyelid, i.e. whether the tarsus is of constant or variable width. The orientation of the groove may be very similar for tarsi of both constant and variable width.

In the case of eyelids with the fold covering the tarsal part, several characteristic lateral elements may often be distinguished in the image of a closed eye:

- Sulci (or one sulcus) of the upper eyelid meet the contour of the upper eyelid edge in the area of the lateral angle of the eye. The sulci are visibly diagonal in relation to the eyelid edge (Fig. 10. The course of the sulci of the upper eyelid in the case of an eye with the palpebral fold covering the tarsal part; see Polish version).
- The palpebral sulcus is concave, especially in the area of the lateral angle of the eye.
- The deepest part of the palpebral groove (sulcus) is located laterally, which indicates the place in which the most prominent fold can be expected (Fig.11. The arrows indicate the lateral area of the eye, in which the palpebral sulcus is the deepest; see Polish version):

In the case of eyelids with the fold slightly covering the middle part of the tarsus, the following correlations facilitating the assessment of the upper eyelid structure were observed:

- The palpebral sulcus with eye closed is often convex (as opposed to the eyelid with the fold covering the tarsus from the side), thus in the mid-eye area, the sulcus is the farthest away from the upper eyelid edge or its course is almost parallel to the eyelid edge (Fig. 12. The shape of the groove of an eyelid with the upper palpebral fold covering the middle part of the tarsus: A—the arrows indicate the area in which the groove is the farthest away from the eyelid edge; B—the course of the groove almost parallel to the eyelid edge; see Polish version):
- As the eyelid fold leads toward the lateral angle of the eye, the course of the groove becomes slightly wavy, S-shaped.

Unfortunately, the above described correlations of the course and the shape of the groove do not guarantee a correct interpretation of the lid type with eyes closed. This was confirmed by the observations made. In 22% cases of eyelids with a lateral fold, deviations from the above mentioned characteristic course and shape were observed. In 4.8% cases of eyelids with a fold covering the tarsus, a differently shaped groove occurred in the upper part. This leads to a rather obvious conclusion that, unfortunately, there are no rules allowing a precise eyelid type determination with eyes closed. Apparently, the classification of eyelids should be limited to the possible presence or absence of the palpebral fold.

In the case of the assessment of the last parameter, possible characteristic features of the eyes (i.e. dropping eyelids, strabismus, corneal opacity and strongly convex eyes), the degree of visibility of the feature and its type are of great importance. Obviously, the presence of strabismus or corneal opacity cannot be established with eyes closed. However, strongly convex eyes enable their proper anthroposcopic qualification by analogy to the described method of determining the depth of eye setting. Among the study subjects, a case of a deeply collapsed eye was encountered, which can certainly be considered as a strongly characteristic feature (Fig. 13. Eye collapsed in its orbit; see Polish version).

In the presented case, the image of the collapsed eye is so clear that this characteristic can easily be noted even with eyes closed. No case of a drooping eyelid was observed among the study subjects. However, numerous asymmetries were found (contour shape of the eye fissure, type of the upper eyelid, course of the palpebral groove). Nonetheless, asymmetries in the contour shape of the eye fissure are very subtle with eyes closed and their correct interpretation is difficult. Differences in the structure of the upper eyelids can be noted by analyzing the shape of the visible eyelid groove (Fig. 14. Upper eyelid asymmetry. The arrows indicate differences in the groove position; see Polish version).

It seems that a drooping upper eyelid should produce a similar image to that of an asymmetrically shaped eyelid. Thus it is likely that the proper interpretation of this feature based on the course of the palpebral groove is possible.

Conclusions

The conducted analysis of the surroundings of a closed eye demonstrated that in certain cases, it is possible to properly classify the parameters of the eye. This is facilitated by the following factors: very high technical and visual quality of the study material, face images in different views, maintaining the images of the head/face in the Frankfurt plane, typical morphological structure of the assessed elements, the presence of strong characteristics, significantly different from "average" values (e.g. eyes strongly convex/very deep-set); in certain cases, it is much easier to exclude a type or variety of a parameter, than classify it properly. In the vast majority of cases, the determination of the parameters of a closed eye may be based only on a certain degree of probability. The morphological properties, the size and the shape of the appropriate areas and elements of the human body-including eye surroundings-are very complex, diverse and not always easily classifiable according to established categories. For most eye parameters, the proper classification is difficult due to the complex structure and requires careful evaluation.

Source

Fig. 1–14: author

Translation *Rafał Wierzchosławski*