

A Way to Improve the Efficiency of Fingerprint Identification in Forensic Medicine

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Abstract Methodological recommendations are intended for forensic doctors. These methodological recommendations present the results of the method of taking fingerprints, both in living people and in corpses, by staining the surface of the skin, using a sponge impregnated with stamp mastic, which is located in a specially designed case, in which the lower edge is specially designed to conveniently position the brush hands on a soaked sponge. Conducted research methods allow to obtain a more complete picture of the pattern of fingers, palms and evaluate the diagnostic information content of their number in a short period of time.

Keywords Methodological, Ophthalmology

1. Introduction

As the results of various studies cited in the modern scientific literature show, dermatoglyphics is considered a source of complete and extremely reliable information [1,3,4,6,7]. Recent studies have shown that dermatoglyphics, in addition to determining the quantitative and qualitative characteristics of individuals, can help in determining (to a probable extent) the sexual and nosological characteristics of the object under study [2,9].

In recent years, a number of articles on the study of palm finger patterns have been published in the literature. In particular, it is possible to cite the results of research in the field of anthropology, biology, medical genetics, ophthalmology, neurology, criminology and forensic medicine for early diagnosis [1,2,4]. The basis for this study is that the papillary patterns of the hands and feet are hereditary, i.e. They are associated with race, gender, functional asymmetry of the legs and arms and some hereditary diseases, have a certain age stability and do not undergo significant changes during life. [3,8].

The morphogenetic nature of the signs of finger and palm dermatoglyphics determines their high objectivity and informativeness as markers of particular and general manifestations. This is very important in the field under study, since it will be important to use the dermatoglyphic method as an additional system of signs, taking into account the possibility of solving the problem, in addition to the basic identification methods.

Taking into account the differences in dermatoglyphic

indicators revealed in published studies depending on nationality [5], as well as the importance of determining these indicators for both clinical and forensic medicine [2,3,4,6], the study of these indicators in the population becomes an urgent and important task.

The purpose of the study: to increase the accuracy of the determination of finger and palm dermatoglyphics by an easily accessible method of staining.

2. Materials and Methods

The study is based on data from the study of the effectiveness of the proposed method of staining the skin surface among 150 people aged 18 to 55 years. This group of individuals was divided into 2 groups by blind sampling.

The main group consisted of 100 persons to whom fingerprinting was performed using the developed method of fingerprinting, by staining the skin surface, using a sponge impregnated with stamp mastic, which is located in a specially designed case in which the lower edge is specially designed for the purpose of conveniently placing the hands on the soaked sponge.

The comparison group consisted of 50 persons who used the roller method of applying printing ink.

Technical conditions: when pressing simultaneously on a sponge impregnated with stamp mastic, separate finger, palm prints on the hands are obtained.

With the help of this method, the quality of the drawing of skin lines is ensured due to the uniform distribution of stamp mastic over the entire surface of the fingers.

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Figure 1. Optimized method of fingerprinting

As a result, a patent for a utility model was obtained (Fig. 2)



Figure 2

After that, fingerprints are applied on the form in order to create a fingerprint card.

3. Results and Discussion

The use of the invention makes it possible to obtain a more complete picture of the pattern of fingers, palms and soles and to assess the diagnostic informativeness of their number in a short period of time.

With the widely used method of printing ink for fingerprinting, it is necessary to have forms of fingerprint cards, black printing ink of the highest quality, two smooth metal or glass plates for rolling out paint and a paint solvent (turpentine or gasoline). The fingerprinting table has a height of 1 m 10 cm (under the elbow of a person of average height), equipped with a drawer for storing the necessary equipment. The top cover of the table, measuring 50-60 cm, has edges cut at right angles to the plane of the lid. The printing ink is rolled out evenly with a roller on a plate (glass) (Fig. 3).



Figure 3. Roller method of applying printing ink when taking fingerprints

With the same roller (without additional application of paint on it), a thin layer of paint is rolled out on the second plate (glass), on which the fingers of the fingerprinted are rolled. On the edge of the table on the right side of the plate, a blank fingerprint card is placed, folded along the upper inflection line.

The results of our own research. During the evaluation of the effectiveness of the proposed method of fingerprinting, we found that when using this method in 98% of cases it was possible to obtain smooth and clear fingerprints, whereas in the comparison group in 86% of cases.

Repeated fingerprinting in the comparison group was carried out in 15% of cases. Whereas in the main group only 2%, which is 7.5 times less (Fig. 4).

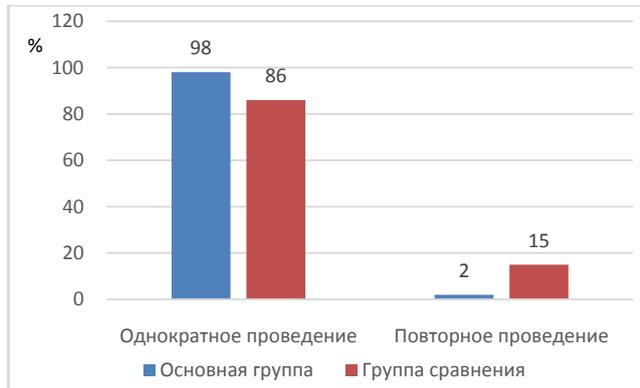


Figure 4. Frequency of single and repeated fingerprinting

After receiving fingerprints, the stamp mastic is easily washed off with ordinary running water. Whereas the printing ink is erased with a special solution, which is economically more expensive.

The time spent on fingerprinting in the main group averaged 1.51 ± 0.05 minutes, while in the comparison group it was 5.9 ± 0.12 minutes, which is 3.9 times faster ($P < 0.01$).

Also cost-effective is the cost of purchasing the paint material, since the cost of stamp mastic is 2200 soums per 100 people, while printing ink costs 7000 soums per 100 people. Thus, the cost of the proposed method of fingerprinting is 3.2 times cheaper.

Thus, the use of the method of printing ink is time-consuming, allows you to get a not very clear and complete print. Whereas with the developed method of fingerprinting using a sponge impregnated with stamp mastic in a specially designed case, papillary lines are clearer and clearer, and prints can be made within a few minutes.

Economic efficiency

To assess the economic efficiency, we calculated the following parameters: sensitivity, specificity and accuracy of the proposed dermatoglyphic method.

When assessing the sensitivity and specificity of traditional methods and the proposed modified method, it was found that the sensitivity of these methods was 86% and 98%, respectively, the specificity was 90 and 95%, respectively, and the overall accuracy was 86 and 98%, respectively (Table. 1) etc.

Table 1. Informative definition

Diagnostic methods	Comparison Group	Main group
Sensitivity	86%	98%
Specificity	90%	95%
Accuracy	86%	98%
Prognosticality of a positive result (+VP, positive predictive value),	86%	95%
Prognosticality of a negative result (-VP, negative predictive value)	86%	95%
On average	86,8%	96,2%

Thus, the proposed method of finger dermatoglyphics is

a more specific diagnostic method and increases the objectivity and evidentiary value of forensic medical reports and gives an appropriate economic effect.

The calculation of the financial efficiency of the diagnostic test was carried out according to the method of calculating the cost efficiency coefficient (Jefferson T., 2003): $K_{eff} = \text{Cost}/\text{Eff}$, where Cost is total costs, Eff is efficiency (diagnostic accuracy, %).

According to the traditional method (printing ink) for determining fingerprints, the total cost of 1 forensic examination amounted to 72100 soums with an efficiency of 86%, where $K_{eff} = 838.4$. Whereas when using the method developed by us, $K_{eff} = 562.2$ with a total cost of 55100 soums and an efficiency of 98%. At the same time, the difference in K_{eff} between the traditional and developed methods was 276.2, which indicated a lower cost per unit of effect according to the developed method.

The results of the study will increase the objectivity and evidentiary value of forensic medical reports and reduce the cost of fingerprinting.

4. Conclusions

The technical result is that when pressing a sponge soaked in stamp mastic at the same time, separate finger, palm prints are obtained, both on the hands and on the feet.

With the help of this method, the quality of the drawing of skin lines is ensured due to the uniform distribution of stamp mastic over the entire surface of the palms and soles. After that, fingerprints, palms and soles are applied on the form in order to create a fingerprint card.

The use of the invention makes it possible to obtain a more complete picture of the pattern of fingers, palms and soles and to assess the diagnostic informativeness of their number in a short period of time. After receiving fingerprints, the stamp mastic is easily washed off with ordinary running water.

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