

**КРИМІНАЛЬНИЙ ПРОЦЕС ТА КРИМІНАЛІСТИКА; СУДОВА ЕКСПЕРТИЗА;  
ОПЕРАТИВНО-РОЗШУКОВА ДІЯЛЬНІСТЬ  
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**SCARRING AND ITS EFFECT ON THE STRUCTURE OF THE PAPILLARY PATTERN,  
REFLECTED IN THE TRACES OF DACTYLOSCOPIC ORIGIN**

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**ANNOTATION:** *Introduction.* Today, there are many statistical sources that show the number of people who have consulted with doctors about own dermatological problems, ie the dynamics of skin diseases is monitored, however, in medical institutions and law enforcement agencies you will not find any forensic accounts or statistics that would contained an array of information about people whose papillary patterns have anomalies (changes) caused by various factors other than congenital. On the one hand, this is due to a specific list of grounds for fingerprinting (part 2 article 26 of the Law of Ukraine "About National Police", paragraph 1.3., 1.4., 1.5. of the Order of the Ministry of Internal Affairs № 785 of September 11 year 2001 "About the validation of the Instruction on the order of functioning of the dactyloscopic account of expert service of the Ministry of Internal Affairs of Ukraine"), on the other hand, by not giving to dactyloscopic information of this kind sufficient weight. To confirm the importance of such information for achieving the objectives of criminal proceedings, by using scientifically confirmed data we analyzed the prints of papillary patterns from the nail phalanges of the fingers on 200 dactylomaps, which were taken into accounting in the Rivne SRFC of the MIA from the different parts of Rivne region from July to September 2019, and, as a result the following is established: 1. From 200 dactylomaps of different persons on 170 these or those structural changes of papillary samples which are not connected with quality and the mechanism of dactyloscopy were detected which makes 85% of sample; 2. On 144 dactylocards out of 200, at least one papillary pattern of the nail phalanx of the finger which was reflected in the fingerprint showed the scarring changes in the structure of the skin, which is 72% of the sample; 3. On 117 dactylomaps out of 200, at least one papillary pattern of the nail phalanx of the finger which was reflected in the fingerprint represented areas without papillary lines, which is 58.5% of the sample.

*Main results of the research:* the article outlines the status of solving the problem of papillary patterns deformations caused by scarring processes reflected in traces. Medical and forensic statistics (which in both cases are directly related to the presence of dermatological problems in humans) with an indication of its practicality for disclosing of crimes is provided. The problem topicality is analyzed, with a proposal of ways to solve it, scientists who are engaged in a deep study of skin deformations with papillary patterns are mentioned, indicated, what amount of dactylomaps of different persons was processed to determine the percentage of probability of forensic expert to obtain information of dactyloscopic origin, which reflects the papillary pattern scar deformities, detailed forensic and medical definition of the scar are provided. Not only their types are described, but also the characteristic features that have a direct impact on the result of reflection. Papillary patterns having scar and non-scar deformities of different nature: lime burn, linear cut, flesh separation, surgery, and shapes: linear,

rounded, curved, etc are illustrated with explanations in this article. Scar differences, criteria for attribution and non-attribution of neoplasms to scars, or rather - manifestations of injured dermis in the formed scars (older than six months), epidermis and traces are described here too. A range of possible signs of scar and scar tissue that may appear in the trace if there are sufficient conditions for such kind of trace formation are outlined. Several types of skin injuries are explained and shown in the figures (with a description of their signs), which may appear in traces and are not scars. As well, the importance of taking into account the data викладеної to enhance the positive performance of fingerprinting and state-implemented electronic systems of personal monitoring/identification is underlined.

*Conclusions.* The result of the research indicates the achievement of its goal. During the research, scientifically proven provisions and methods were used, deformation features of the papillary pattern caused by scars were described and illustrated, details that may appear in traces of this kind are particularized, an algorithm of defining deformed areas of the papillary pattern as scars is explained and mentioned when it should not be done, therefore, a scientifically sound mechanism for examining a dactyloscopic information, which reflects scarring of the skin, has been formed, which, in turn, increases the implementation level of the principles of completeness, objectivity, scientific validity, comprehensiveness, quality and positive resultiveness of dactyloscopic examination of any scarred papillary pattern reflected in the trace.

**KEY WORDS:** fingerprints, traces, scar, rumen, cicatrix, individual features (signs), common features, papillary pattern, friction ridges, papillary lines, identification, skin, disease, regeneration.

## РУБЦЮВАННЯ ТА ЙОГО ВПЛИВ НА СТРУКТУРУ ПАПІЛЯРНОГО УЗОРУ, ВІДОБРАЖЕНОГО У СЛІДАХ ДАКТИЛОСКОПІЧНОГО ПОХОДЖЕННЯ

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**АНОТАЦІЯ:** *Вступ.* На сьогодні існує багато статистичних джерел, в яких відображаються дані про кількість осіб, які звертались до лікарів із дерматологічними проблемами, тобто ведеться моніторинг динаміки шкірних захворювань, проте, у медичних закладах та правоохоронних органах не існує жодного криміналістично-спрямованого обліку/статистики, який би містив масив інформації про осіб, папілярні узорі яких мають аномалії (зміни), спричинені тим чи іншим факторами, відмінними від вроджених. З одного боку, це зумовлено конкретним переліком підстав для дактилоскопіювання осіб (ч. 2 ст. 26 Закону України “Про Національну поліцію”, п. 1.3., 1.4., 1.5. Наказу МВС України № 785 від 11.09.2001 “Про затвердження Інструкції про порядок функціонування дактилоскопічного обліку експертної служби МВС України”), з іншого - не наданням дактилоскопічної інформації такого роду достатньої ваги. Для підтвердження важливості такої інформації для досягнення цілей кримінального провадження, оперуючи науково-підтвердженими даними, нами було проаналізовано відбитки папілярних узорів нігтьових фаланг пальців рук на 200 дактилокартах, які надходили до Рівненського НДЕКЦ МВС з різних районів Рівненської області з липня по вересень 2019 року, в результаті чого встановлено наступне: 1. З 200 дактилокарт різних осіб на 170 відображені ті чи інші структурні зміни папілярних узорів, які не пов’язані із якістю та механізмом дактилоскопіювання, що становить 85% від вибірки; 2. На 144 дактилокартах з 200, хоча б на одному відбитку папілярного узору нігтьової фаланги пальця руки наявні рубцеві зміни структури шкіри, що становить 72% від вибірки; 3. На 117 дактилокартах з 200, хоча б на одному відбитку папілярного узору нігтьової фаланги пальця руки наявні ділянки без папілярних ліній, що становить 58,5% від вибірки.

*Короткий зміст основних результатів дослідження.* У статті описано стан вирішення проблеми дослідження деформацій папілярних узорів, спричинених процесами рубцювання, які відображаються в слідах, зазначено медичні та криміналістичні статистичні дані, які в обох випадках напряму пов’язані із наявністю у людей дерматологічних проблем, з вказівкою на їх практичну значимість для розкриття злочинів. В роботі проведено аналіз причин актуальності досліджуваної проблеми із пропозицією шляхів її вирішення, зазначено ряд науковців, які займаються глибоким дослідженням деформацій шкіри з папілярними узорами, зазначено, який обсяг дактилокарт різних осіб

опрацьовано з метою встановлення відсотку вірогідності отримання судовим експертом інформації дактилоскопічного походження, яка відображає рубцеві деформації папілярного узору, наведено детальне криміналістичне та медичне визначення рубця, описано не лише їх види, а й характерні ознаки, які мають прямий вплив на результат відображення. Проілюстровано з поясненнями папілярні узор, які мають рубцеві та не рубцеві деформації різної природи: опік вапном, лінійний поріз, відрив плоти, оперативне втручання, та форми: лінійні, округлі, вигнуті тощо, описано їх відмінності, критерії віднесення та не віднесення новоутворень до рубців, а точніше - прояви травмованої дерми у сформованих рубцях (старших шести місяців), епідермісі та слідах, окреслено діапазон можливих ознак рубця та рубцевої тканини, які можуть відобразитись в сліді за наявності достатніх для такого слідоутворення умов, пояснено та показано на рисунках декілька видів шкірних травм (з описом їх ознак), які можуть проявлятися у слідах і не є рубцями, зазначена вагомість врахування викладених даних для підвищення позитивної результативності дактилоскопічних судових експертиз та впроваджуваних держорганами електронних систем обліку/ідентифікації осіб.

*Висновки.* В ході дослідження застосовано науково-підтвержені положення та методи, описано та проілюстровано особливості деформації папілярного узору рубцями, деталізовано ознаки, які можуть відобразитись в слідах такого роду, роз'яснено порядок віднесення деформованих ділянок папілярного узору до рубців та зазначено, коли це не варто робити, а отже сформовано науково-обґрунтований механізм опрацьовання дактилоскопічної інформації, яка відображає рубцеві зміни шкіри, що, в свою чергу, підвищує рівень реалізації принципів повноти, об'єктивності, наукової обґрунтованості, всебічності, якості та позитивної результативності дактилоскопічних досліджень.

**КЛЮЧОВІ СЛОВА:** дактилоскопія, сліди, рубці, окремі ознаки, загальні ознаки, папілярний узор, ідентифікація, папілярні лінії, шкіра, хвороби, регенерація, рубцювання.

## РУБЦЕВАНИЯ И ЕГО ВЛИЯНИЕ НА СТРУКТУРУ ПАПИЛЛЯРНЫХ УЗОРОВ, ОТРАЖЕННЫХ В СЛЕДАХ ДАКТИЛОСКОПИЧЕСКОГО ПРОИСХОЖДЕНИЯ

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**АННОТАЦИЯ:** *Введение.* На сегодня существует много статистических источников, в которых отражаются данные о количестве лиц, которые обращались к врачам с дерматологическими проблемами, то есть ведётся мониторинг динамики кожных заболеваний, однако, в медицинских учреждениях и правоохранительных органах не существует ни одного криминалистически направленного учёта / статистики, который бы содержал массив информации о лицах, папиллярные узоры которых имеют аномалии (изменения), вызванные теми или иными факторами, отличными от врождённых. С одной стороны, это обусловлено конкретным перечнем оснований для дактилоскопирования лиц (ч. 2 ст. 26 Закона Украины "О Национальной полиции", п. 1.3., 1.4., 1.5. Приказа МВД Украины № 785 от 11.09.2001 "Об утверждении Инструкции о порядке функционирования дактилоскопического учёта экспертной службы МВД Украины"), с другой – не предоставлением дактилоскопической информации такого рода достаточного веса. Для подтверждения важности такой информации для достижения целей уголовного производства, оперируя научно-подтверждёнными данным, нами были проанализированы отпечатки папиллярных узоров ногтевых фаланг пальцев рук на 200 дактилокартах, которые поступали в Ровенский НИЭКЦ МВД из разных районов Ровенской области с июля по сентябрь 2019 года, в результате чего установлено следующее: 1. из 200 дактилокарт разных лиц на 170 отражены те или иные структурные изменения папиллярных узоров, которые не связаны с качеством и механизмом дактилоскопирования, что составляет 85% от выборки; 2. На 144 дактилокартах из 200, хотя бы на одном отпечатке папиллярного узора ногтевой фаланги пальца руки имеющиеся рубцовые изменения структуры кожи, составляет 72% от выборки; 3. На 117 дактилокартах из 200, хотя бы на одном отпечатке

папиллярного узора ногтевой фаланги пальца руки имеющиеся участки без папиллярных линий, составляет 58,5% от выборки.

*Краткое содержание основных результатов исследования.* В статье описано состояние решения проблемы исследования деформаций папиллярных узоров, вызванных процессами рубцевания, которые отражаются в следах, указано медицинские и криминалистические статистические данные, в обоих случаях напрямую связаны с наличием у людей дерматологических проблем, с указанием на их практическую значимость для раскрытия преступлений. В работе проведён анализ причин актуальности исследуемой проблемы с предложением путей её решения, указан ряд учёных, занимающихся глубоким исследованием деформаций кожи с папиллярного узора, указано, какой объём дактилокарт разных лиц обработаны с целью установления процента вероятности получения судебным экспертом информации дактилоскопического происхождения, которая отражает рубцовые деформации папиллярного узора, приведены детальное криминалистическое и медицинское определение рубца, описано не только их виды, но и характерные признаки, которые имеют прямое влияние на результат отражения. Проиллюстрировано с объяснениями папиллярные узоры, которые имеют рубцовые но не рубцовые деформации различной природы: ожог известно, линейный порез, отрыв плоти, оперативное вмешательство, и формы: линейные, округлые, изогнутые и т.д., описано их различия, критерии отнесения и не отнесения новообразований к рубцам, а точнее - проявления травмированной дермы в сформировавшихся рубцах (старше шести месяцев), эпидермисе и следах, обозначены диапазон возможных признаков рубца и рубцовой ткани, которые могут отразиться в следе при наличии достаточных для такого слеодообразования условий, объяснено и показано на рисунках несколько видов кожных травм (с описанием их признаков), которые могут проявляться в следах и не являются рубцами, указана значимость учёта изложенных данных для повышения положительной результативности дактилоскопических судебных экспертиз и внедряемых госорганами электронных систем учёта / идентификации лиц.

*Выводы.* В ходе исследования применены научно-подтвержденные положения и методы, описано и проиллюстрировано особенности деформации папиллярного узора рубцами, детализировано признаки, которые могут отображаться в следах такого рода, разъяснен порядок отнесения деформированных участков папиллярного узора к рубцам и указано, когда это не стоит делать, а следовательно сформирован научно обоснованный механизм обработки дактилоскопической информации, которая отражает рубцовые изменения кожи, что, в свою очередь, повышает уровень реализации принципов полноты, объективности, научной обоснованности, всесторонности, качества и положительной результативности дактилоскопических исследований.

**КЛЮЧЕВЫЕ СЛОВА:** дактилоскопия, следы, рубцы, отдельные признаки, общие признаки, папиллярный узор, идентификация, папиллярные линии, кожа, регенерация, рубцевание.

#### **Problem statement, its topicality and analysis of recent research and publications.**

Analysis of domestic and foreign scientists works [1-11], including Michal Dolezel, Jaroslav Urbanek, Stěpánka Barotová, Martin Drahanský, Eva Březinová, Filip Orság, Dana Lodrová (Czech Republic), Tai-hoon Kim (North Korea), Roger Haber, Josiane Helou, Joelle Korkomaz, Maya Habre, Antoine Ghanem, Roland Tomb (Lebanon), as well as scientific and methodological literature used by the criminalists proves the availability of: 1) availability of meaningful studies of scarring processes and their final results; 2) the existence of a classified range of causes that lead to inevitable deformations of the skin with an exhaustive list of species diversity of scars, which depend on both the regenerative characteristics of the body and the causes of skin damage; 3) a stable set of individualizing features in the parts of the skin with scars; 4) the lack of a significant share of all specified in the current mechanism of forensic investigation and evaluation of trace information of this kind.

Today, there are many statistical sources that show the number of people who have consulted with doctors about own dermatological problems, ie the dynamics of skin diseases is monitored, however, in medical institutions and law enforcement agencies you will not find any forensic accounts or statistics that would contained an array of information about people whose papillary patterns have anomalies (changes) caused by various factors other than congenital. On the one hand, this is due to a specific list of grounds for fingerprinting (part 2 article 26 of the Law of Ukraine "About National Police", paragraph 1.3., 1.4., 1.5. of the Order of the Ministry of Internal Affairs № 785 of September 11 year 2001 "About the validation of the Instruction on the order of functioning of the dactyloscopic account of expert service of the Ministry of Internal Affairs of Ukraine"), on the other hand, by not giving to dactyloscopic information of this kind sufficient weight. To confirm the importance of such information for achieving the objectives of criminal proceedings, by using scientifically confirmed data we analyzed the prints of papillary patterns from the nail phalanges of the fingers on 200 dactylomaps, which were taken into accounting in the Rivne SRFC of the MIA from the different parts of Rivne region from July to September 2019, and, as a result the following is established: 1. From 200 dactylomaps of different persons on 170 these or those structural changes of papillary samples which are not connected with quality and the mechanism of dactyloscopy were detected which makes 85% of sample; 2. On 144 dactylomaps out of 200, at least one papillary pattern of the nail phalanx of the finger which was reflected in the fingerprint showed the scarring changes in the structure of the skin, which is 72% of the sample; 3. On 117 dactylomaps out of 200, at least one papillary pattern of the nail phalanx of the finger which was reflected in the fingerprint represented areas without papillary lines, which is 58.5% of the sample. A part of our research was published in the magazine of The National University of Ostroh Academy: 'Skin diseases affecting the quality of dactyloscopic information' [1, p. 1-15].

It is obvious that the chance to obtain traces with dactyloscopic information that will contain a deformation of the papillary pattern's structure for a forensic expert is close to 80%, and therefore it is important that in the scientific and methodological literature which forensic experts use in professional activities exist as a basis: 1) a detailed description of the persistent changes in the structure of papillary patterns that may occur; 2) criteria for distinguishing traces of papillary patterns, the structure of which is changed due to the mechanism of trace contact or features of the trace-receiving surface from traces, the deformation of the structure of which is due to the influence of other factors, otherwise, the principles of completeness, objectivity and scientific validity of dactyloscopic forensic expertises will be further violated, as forensic experts have the right to use only those features of the papillary pattern' structure that are provided in the scientific and methodological literature registered with the Ministry of Justice of Ukraine.

**Purpose of the research.** To increase the level of implementation of the principles of completeness, objectivity, scientific validity, comprehensiveness, quality and positive effectiveness of dactyloscopic expertises by forming a scientifically sound mechanism for processing dactyloscopic information that reflects scarring of the skin, with individual signs of scarring in traces of scars.

**Special methods:** physical - black magnetic finger print powder (Sweden), offset ink (dactylomaps), optical - Futronic FS50 Fingerprint Scanner, diffused artificial visible white light, microscope MSP-1, lens x4,5.

**Results.** According to the Methodology of dactyloscopic examination of the expert specialty '4.6 Dactyloscopic examinations', the scar with the whole set of features that are inherent in it, can be used for identification purposes as an auxiliary feature. It is allowed to take into account the shape of scars (linear, nonlinear; rectilinear, arcuate, wavy; round, elliptical, triangular, quadrangular, stellar), size (length, width), shape and size of deformation of papillary lines by scar (curvature of bends, angles of fractures, the direction of bends or fractures in the area where scar contacts with the lines). The mechanism, conditions and possibilities of scar tissue reflection in traces, as well as the mechanism of their research is omitted in the scientific literature because of the statement that scar tissue at the time of trace contact is not able to fill the recesses on the trace-taking surface and is reflected only on smooth surfaces [2, p. 33, 40, 69], which is unacceptable accordingly to the statistics we have provided and to the structure of the formed scar tissue.

At this point, the tools of working with scars exhaust their methodologically-fixed and practically-allowed potential.

The concept of 'scar' - the scar (cicatrix) is the result of a compensatory-regenerative process located at the site of pathologically destroyed dermis and subcutaneous fat or connective and submucosal layers of the mucosa, and is formed from collagen fibers. Is a coarse fibrous connective tissue, which has no hair follicles, sebaceous and sweat glands, blood vessels, elastic fibers, skin pattern, follicular and sweat holes, cellular elements. There are: hypertrophic (above skin level) scars – pathological formation of connective tissue at the site of a deep skin defect, which does not go beyond it and formed from a large amount of dense fibrous tissue; atrophic scars (below skin level) - with thinning of the skin, which when compressed gathers into thin folds – tuberculous lupus; normotrophic (flat, same with skin level) - deep folliculitis; keloid - hypertrophic tissue, like a 'claw', extends beyond the skin defect (acne-keloid, post-burn scars); Scar atrophy (formed without an ulcer defect) - discoid lupus erythematosus. The scar may be smooth or uneven. Fresh scars have red or pink color, older ones become hyperpigmented or depigmented. Formed after cuts, burns, ulcers, deep pustules, bumps, nodules, cracks. If the scar arose after wounds inflicted by a sharp cutting tool as a result of a rectilinear incision of the skin, the formation of a rectilinear scar is not a regularity. It will often have an elongated or elliptical shape, which depends on the degree of elasticity of the skin, its tension and other reasons. It follows that the shape of the scar directly depends on the regenerative characteristics of a particular individual [3, p. 20; 4, p. 37].

As for the features of scarring on areas of skin with a papillary pattern, at the end, there will be a violation of the normal course of the lines in the form of their displacement, interruption of its flow (separation, breaking), compaction, rarefaction, also, the ends of the papillary lines in the flow will be thicker directly at the border of its interruption (before scar tissue), papillary lines will be absent [5, p. 11].

When the wound is tightened by the epithelial cover, the formation of the scar is not completed. In the scar tissue there are a number of phenomena associated with the compaction and contraction of the scar, as well as the restructuring of its structure, due to the functional adaptation of the scar tissue. The direction of connective tissue fibers and bundles in the scar tissue coincides with the direction of the greatest stretching of the adjacent to the scar area of the skin.

A characteristic feature of scar tissue in comparison with normal skin is the primitive structure. The epidermis, which covers the scar, has approximately the same structure and thickness as normal skin, occasionally, in the area of the scar, it is thicker. Dermal papillae are not expressed.

Features of postoperative scars that have healed without complications (primary healing), which have evolved (6 months have passed), become, in ideal condition, smooth, filamentous, almost uniform in color and density of the surrounding tissues. Dense, uneven, 'star' scar, often made of whitish or crimson tissue, indicates the presence of a complicated course of healing (secondary healing). Formation of dense, crimson, protruding over the surrounding skin scar - keloid depends on the peculiarities of reparative processes of the patient. The

presence of several small scars, in addition to the main - a sign of drainage. Their number indirectly indicates the extent of the intervention, and the condition (signs of secondary healing) - the severity of the postoperative period, possibly burdened by wound infection [6, p. 2].

Given the practical component of our study, further statements will be illustrated.

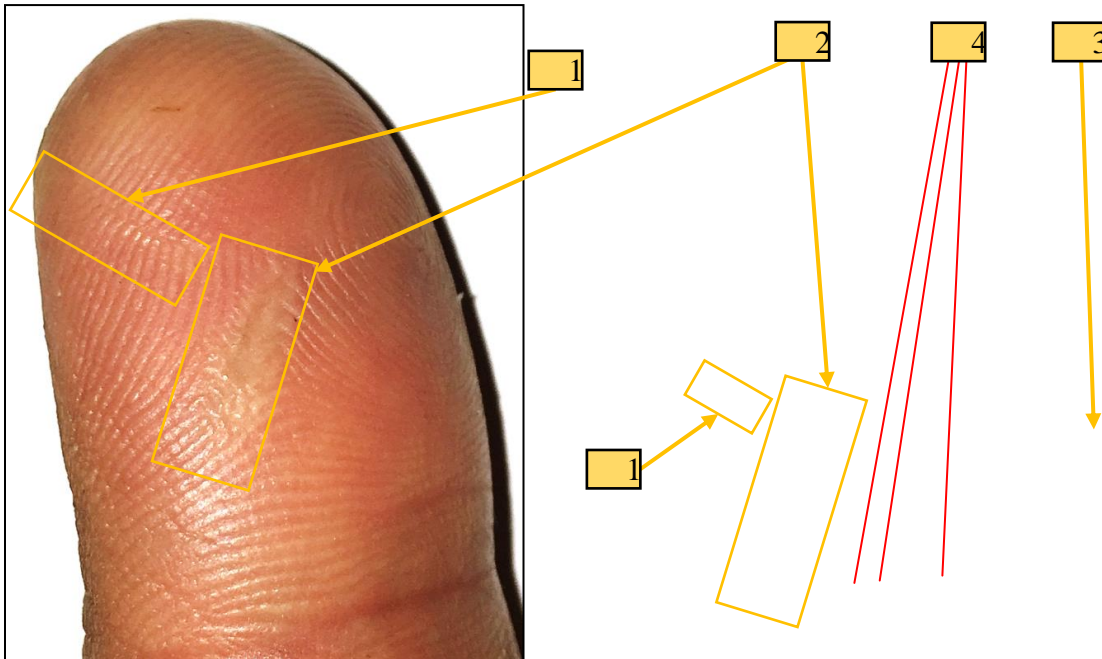


Fig. 1. A finger with scars which were formed in a result of a cut (1) and a cut off (2), respectively.



Fig. 2. A papillary pattern reflected in the trace (position reversed) from a nail phalanx Fig. 1, obtained by using an optical scanner.

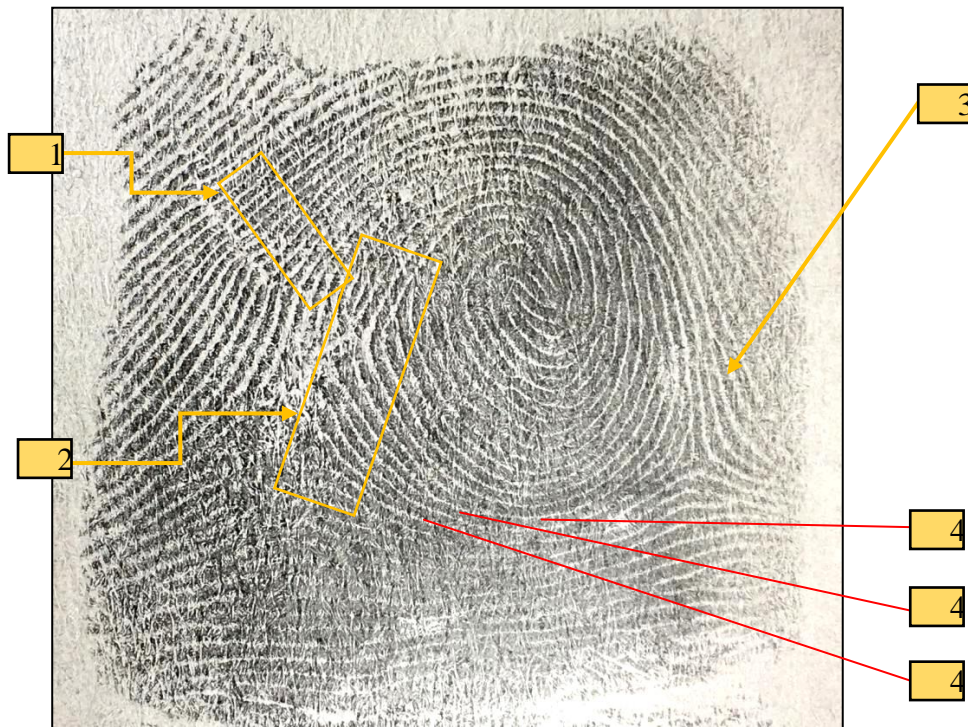


Fig. 3. A fresh papillary pattern reflected in the trace (position reversed) from a nail phalanx Fig. 1, detected on paper by the physical method - rolling dark magnetic fingerprint powder.

In Figures 1, 2, 3, the arrow from the number 1 indicates the area of the scar after the cut, the number 2 - the scar after the cut off, the number 3 - the papillary line with a smaller height (directly after the branch of a papillary line), 4 - individual features, which in Fig. 2 are shown as endings and the beginnings of papillary lines, and in Fig. 3 - as mergers and branches, respectively.

The results of the experiments illustrated in Fig. 1, 2, 3 confirm that some trace-receiving surfaces, as well as a number of trace detecting methods are able to make adjustments to the quality of dactyloscopic information - traces, which were formed by papillary patterns on these kind of surfaces, might display a curved structure of own individual features (scar tissue was included) - in our case, the so-called 'noise' from paper's structure.

It should be noticed that optical scanners are also dependent on the mechanism of trace formation. (check Fig. 4).

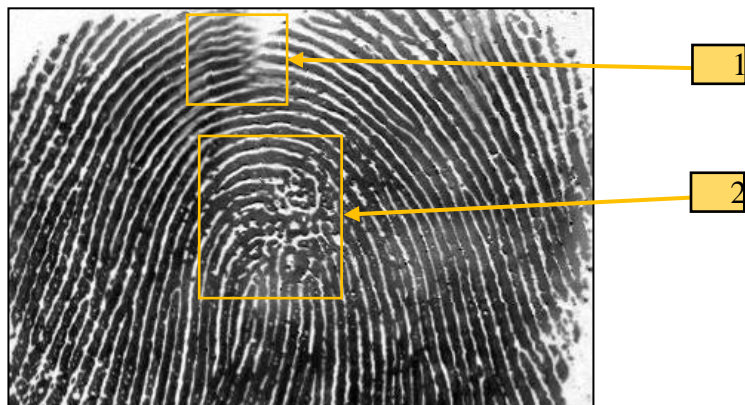


Fig. 4. A papillary pattern reflected in the trace, obtained by using an optical scanner.

In Fig. 4, the number 1 indicates the area with smeared papillary lines, the distorted image of which is due to the mechanism of 'trace contact' and the scanning algorithm, and the number 2 - the area with a scar formed by a nonlinear cut in which pores are visible on parts of intact papillary lines.

It is well known that none of the forms of trace contact (including experimental conditions) provides a display of signs that are completely free from distortion [7, p. 188].

Depending on the mechanism of trace formation, deformations can occur due to the following components of trace formation: pressure; direction of movement; angle of motion; features of the contact surface of the trace-forming object and trace-receiving object [7, p. 192].

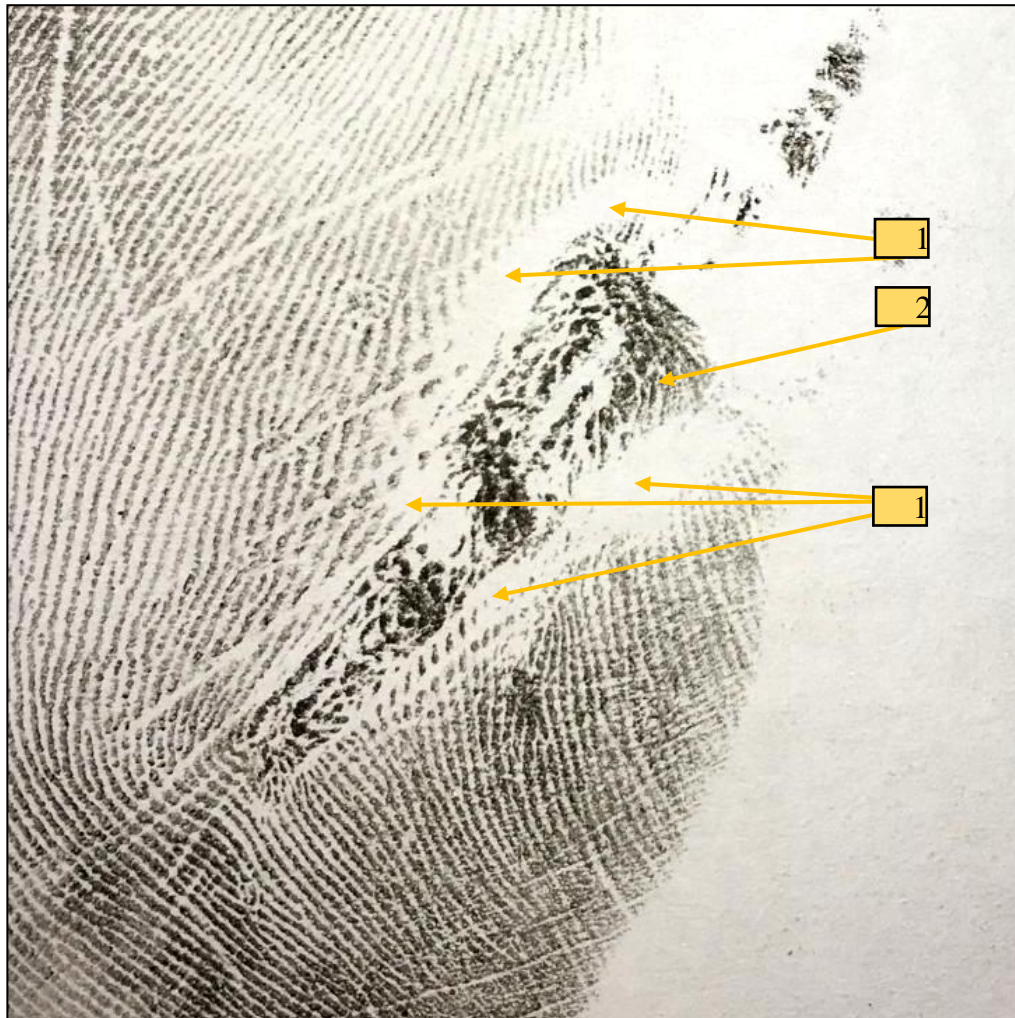


Fig. 5. Imprint of the thenar and main phalanx of the thumb with a hypertrophic scar, obtained in the classical way (offset ink).

In Fig. 5, the arrows from the number 1 indicate the white (“empty”) areas of the imprint, which do not display the structure of the thenar due to the rigid and dense structure of the scar, which protrudes above the level of the skin. In such cases it is necessary to make three-dimensional copies of traces. The number 2 indicates the scar. There is a cluster of white lines, directed almost in one direction, around the scar, which indicate the skin density, its roughening, the dependence on the individual features of scarring processes after surgery, dependence on suturing and reparation processes of a particular person.



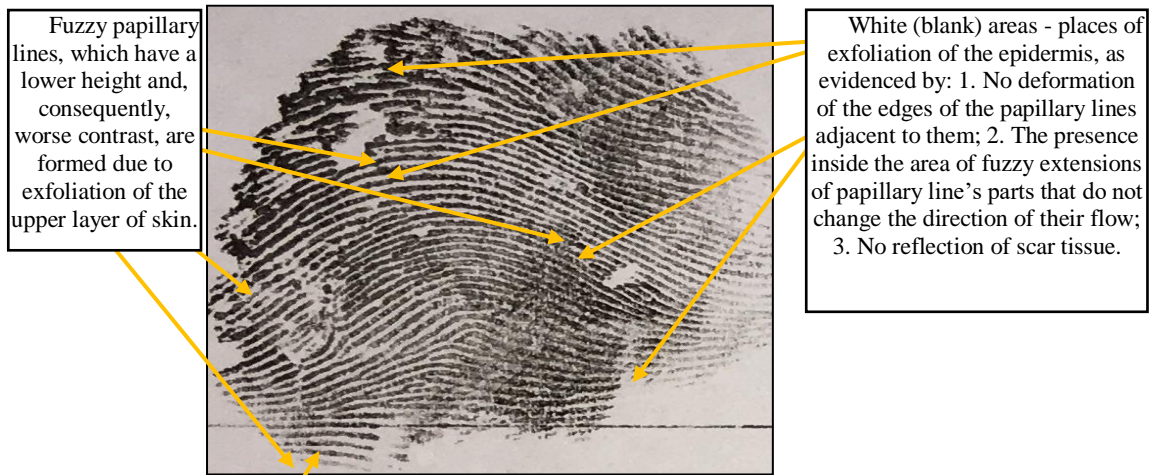


Fig. 6. Papillary pattern reflected in the trace obtained in the classical way (offset ink).

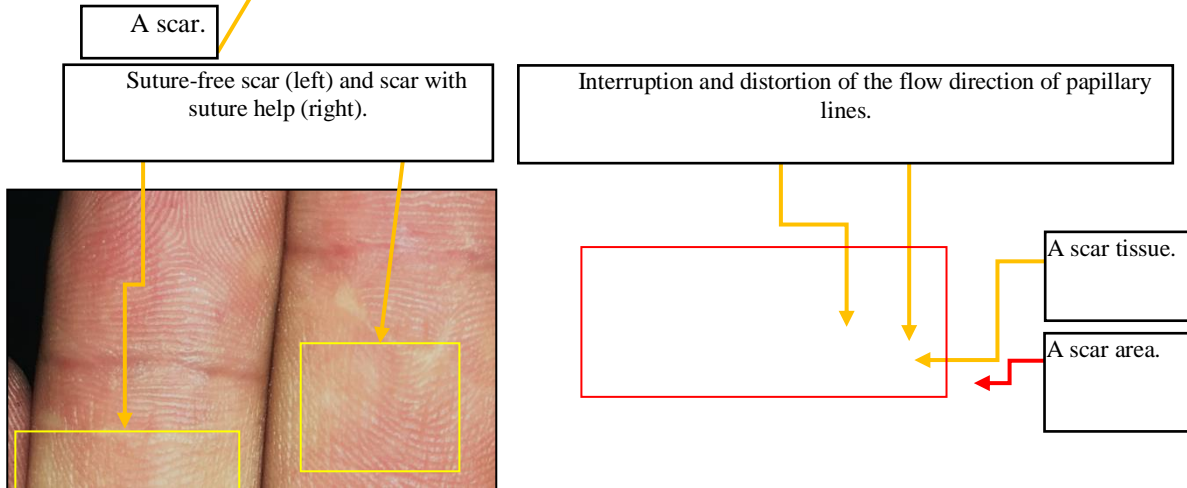


Fig. 7. Scars on the middle phalanges of the ring finger and middle fingers of the left hand.



Fig. 8. Fresh imprint of the middle phalanx of the ring finger from Fig. 7, detected by the physical method on paper - dactyloscopic magnetic powder and magnetic brush.

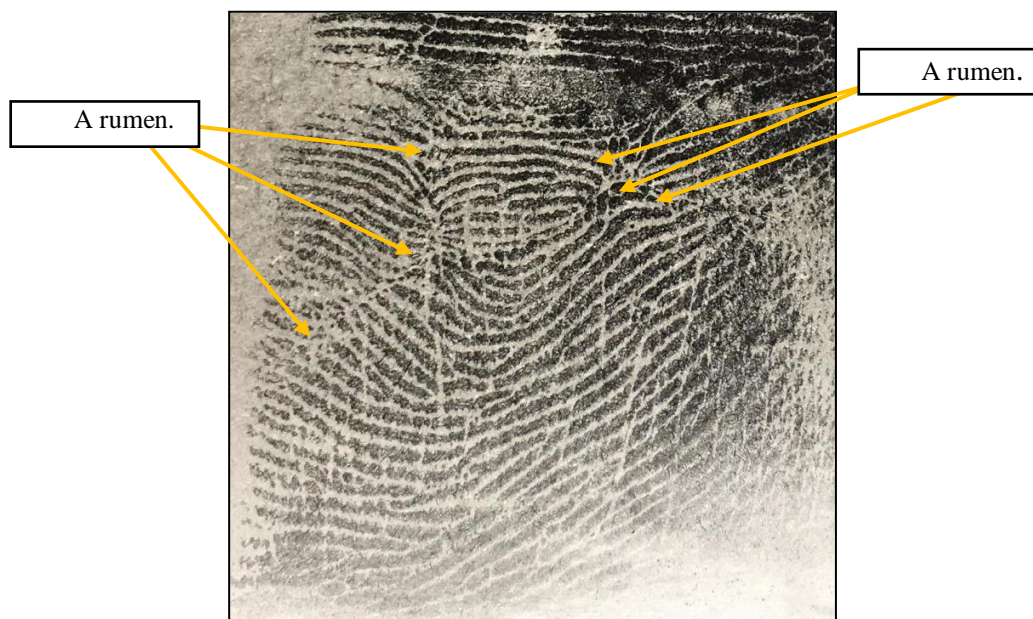


Fig. 9. Imprint of the middle phalanx of the middle finger from Fig. 7, detected by the physical method on paper - dactyloscopic magnetic powder and magnetic brush.

On figures 2, 3, 4, 5, 6, 8 and 9 we can see a set of stable morphological details, which in appearance resemble to us well-known individual features, but reflect either parts of the deformed papillary lines, or structural features of a scar tissue and adjacent areas of the papillary pattern such as:

1. Distortion (displacement) of the flow direction of papillary lines, which in each case is reflected in the form of their bending to the scar tissue;
2. Sudden interruption of the flow of papillary lines, which is due to the damaged papillary layer of the dermis;
3. Reflection of the structure of cicatrix tissue (with a slightly larger area) in the form of an abnormally thickened "papillary line" without any configuration of pores, around which / to which the papillary lines bend and white (blank) areas without any signs of papillary lines are present;
4. Closely arranged details of morphology, similar in their trace appearance to such individual features of the papillary pattern, as: fragments, beginnings, endings, mergers, branches, bends, fractures, interruptions, counter positions of papillary lines, dots, hooks;
5. Thickening of the ends of papillary lines directly at the point of their flow interruption on the verge of a deformation caused by scarring.
6. Empty areas or partially empty areas within the scar tissue..

In figure 10 you should pay attention to:

1. Reflected rudiments of papillary lines, which are visible more intensely and clearly between the damaged papillary lines - the height of which is less than the normal or which are partly destroyed due to certain reasons (dysplasia etc);
2. The presence of systemic (at least 3) thickening of the papillary lines endings on the limit with the scar;
3. Offset of the flow of papillary lines up / down;
4. A white line, which can not be declared as a scar for only one sign - the absence of papillary lines.

The placement of white lines with a grid, as well as their density, is a normal occurrence, especially for the lateral areas, palms, therefore, to distinguish the white line from the scar, each totality of signs should be examined separately and in combination with others. Reflection of clogging on the parts of papillary pattern in the trace (with a trace-forming substance) steamed with numerous white lines, is also not a sufficient set of features for a conclusion about the presence of a rumen in this area. This is due to the fact that the rumen, as a rule, has a higher level of rigidity than a normal skin, so its embossed parts may accumulate a trace-forming substance in higher concentrations (classical fingerprinting), as well as others similar to stiffness of skin tumors.

Pores and pore-like details of the papillary pattern's structure and a system of their configurations, should be examined exclusively in the complex of their relevant features, by applying, for example, the algorithm aimed for classifying traces to negative or positive, by distinguishing the details, a presence of which were caused by the mechanism of a trace-forming contact, by taking into account peculiarities of reflection of other skin

neoplasms in traces, by comparing the dimensional characteristics of pores and patterns of their placement, ie, by implementing these well-known methods, the results of which are always an enough reason to conclude objects of research are pores or other specific details of the skin.



Figure 10. Imprint of the papillary pattern from the nail phalanx of the finger, obtained by using an optical scanner.

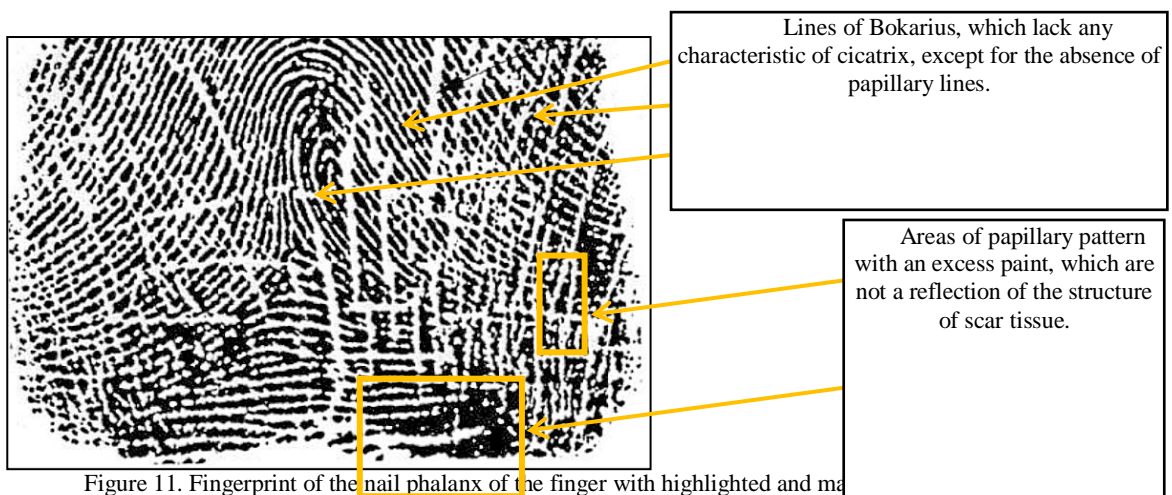


Figure 11. Fingerprint of the nail phalanx of the finger with highlighted and marked areas.



Fig. 12. A part of a hypothenar with a scar who was formed after a burn with lime.



Fig. 13. Imprint of the hypothenar (inverted), from Fig. 12, obtained by using an optical scanner.

On Fig. 13 is easy to see the boundaries of the scar - locations of the papillary pattern without papillary lines and zones where the papillary lines begin to stop its flow, bend, systematically change direction of its flow, width, etc., indicating the stability of a scar tissue morphology. Such signs of a rumen is seen: distortion of the papillary lines flow – they seem to be drawn into the scar, which indicates a rigid, inelastic structure of the scar, its structural difference from the surrounding skin; a fairly clear reflection of a scar tissue is seen: dense and chaotic (different from the direction of the general papillary lines flow) location of a large number of similar to papillary pattern signs with a high identification weight such as points, fragments, counter positions, bends, fractures, breaks of papillary lines, bridges or islands that are located within the scar zone, which is uncharacteristic for typical papillary patterns and represent, if not a scar, then an anatomical features of the papillary pattern structure of a particular person; sudden (unexpected) and successive changes in the width of the "ends" of papillary lines and grooves, alternating with each other; small details in the trace structure which have different shapes, located on parts of the scar tissue with the intensity of the accumulation, which is not identical to the possible distance between the pores and does not reflect the linear arrangement of pores.

Typically, if scarring occurs on areas of skin that are not in constant tension, during which a bandage or suture is applied, the wound is fixed and has a small area, hypertrophic and keloid rumen should not be formed at all (see Fig. 14 ), that is why Fig. 5 and 13 illustrate hypertrophic scars that were created after the influence of a special destructive process on a skin, after the affectation of high temperatures, erosion - those that entered not only into physical but also into chemical reaction with the skin, and illustrate a scar caused by a surgery intervention.

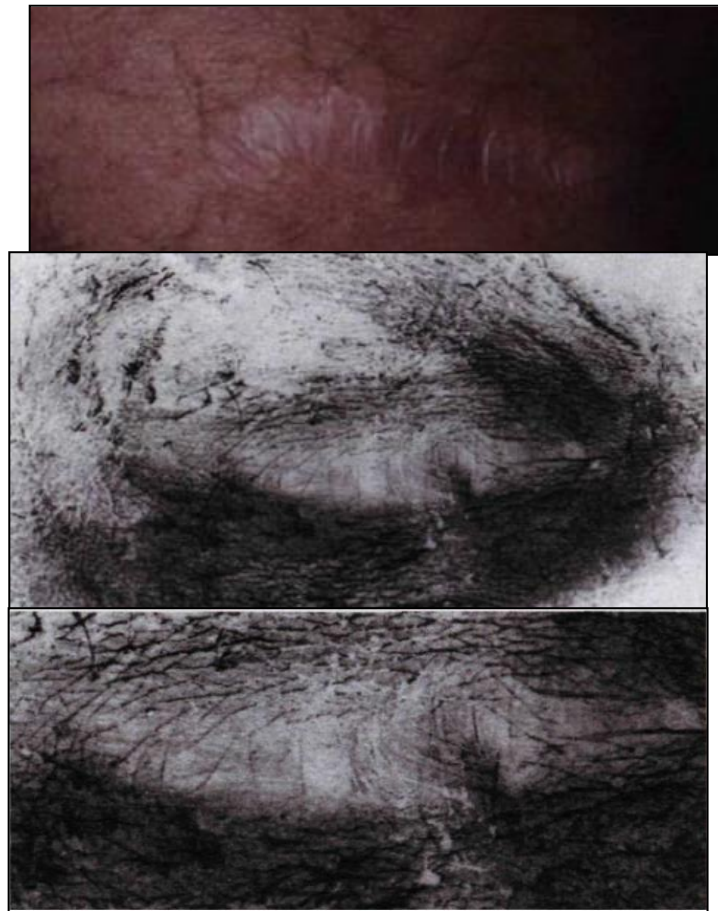


Fig. 14. Imprint of the knee with a pronounced normotrophic scar, which has a reticular structure [9, p. 75].

Fig. 14 shows that a scar have its own individual relief morphology, who has a sufficient set of physical and biological parameters for self-reflection on some surfaces after a trace-forming contact has happened, but only in cases of presence on its surface an able for trace-leaving substances or in cases where an optical detection methods are used.

We can speak about the presence of stability in a scar tissue structure only concerning scars whose evolutionary period has ended (more than 6 months have passed), if there are doubts about the presence of scarring in the papillary pattern structure, and the only sources of information about the time of injury are the date of traces removal and the date of fingerprinting, it is necessary to remember that the stratum corneum and viable epidermis are renewed within 6 - 30 days [11, p.5], this means if a comparative examination is conducted within the specified above time period, during which it is established that in the papillary samples reflected in imprints of fingers / palms on the dactyloscopic map have disappeared / not reflected, have changed the dimensional characteristics, shape and structure on the significant parts of papillary pattern deformation who materially fixed in the trace, and even more so, friction ridges have appeared there where they did not show themselves in the trace (within the deformation), we can safely say regenerative processes are in progress, which are differ from the functional adaptation of scar tissue and their complex is insufficient for conclusions about cicatrix presence, moreover, they can not be taking into account as a weighty signs during formation of categorically positive or categorically negative conclusions about identification.



Fig. 15. Imprint of palm's papillary pattern with a cut caused by glass, reflected in the trace who was detected on the paper with a dactyloscopic powder. The cut did not reach dermal level.

Fig. 16. Papillary pattern, already illustrated in Figure 15, but obtained as a result of fingerprinting by classical method.



In both traces with papillary patterns, in contradistinction to white lines and scars, cuts have a sign, similar to the stroke of the inner contour. This is caused, primarily, by its relief, greater rigidity and loss of elasticity of the cut epidermis, on which the trace-forming substance is concentrated more concentratedly.

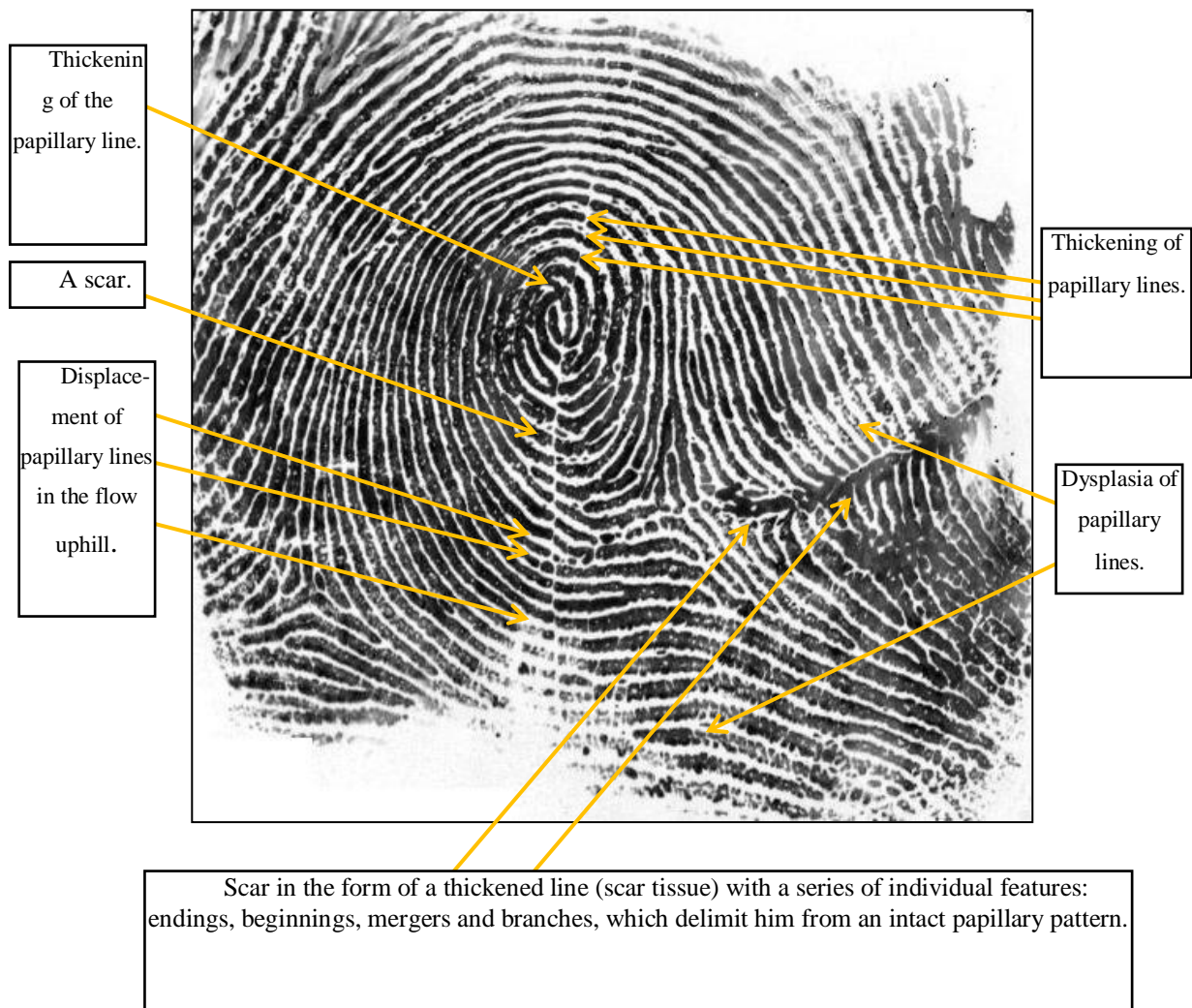


Figure 18 shows, as offset ink, in the process of its causing, centralizes more concentrated on more relief and rigid areas.

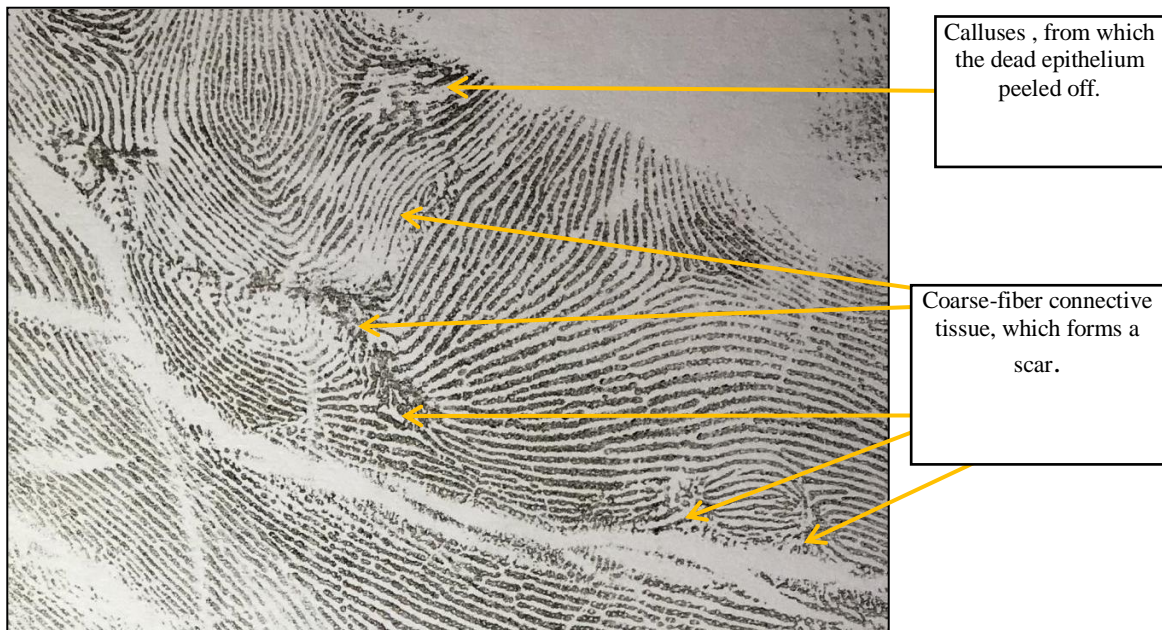


Fig. 18. The palm print obtained in the classical way.

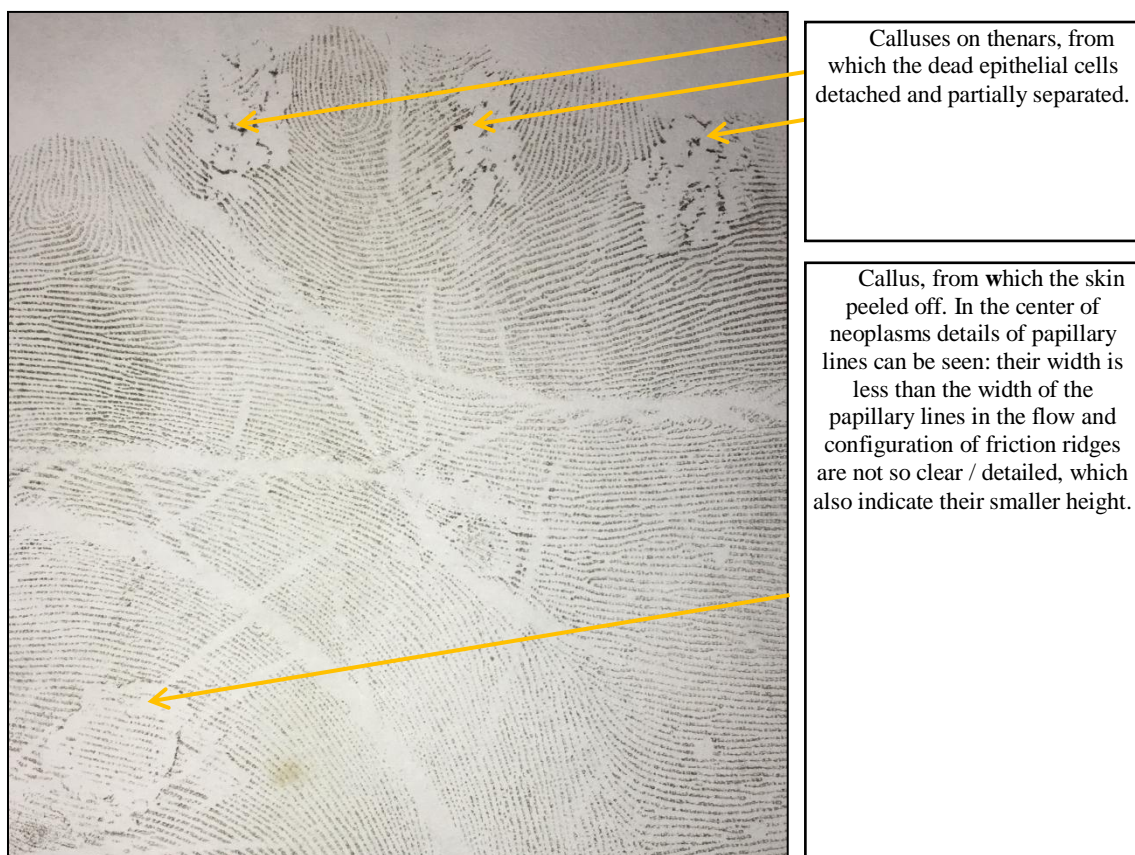


Fig. 19. A palm imprint detected by a dactyloscopic powder.

On the callus, who located on the thenar of the thumb, you can see blank areas without papillary lines. These are areas where the dead epithelium has exfoliated and separated partially from the skin, like a scale. The absence of trace substance on the exfoliated epithelium is due to the fact that the epidermis has no glands that

can secrete it, but only has their excretory ducts (The rumen has no output ducts at all). That is why, only on the basis of the absence of papillary lines in the part of the papillary pattern, it cannot be recognized as a scar.

Callus — it is an acquired limited thickening of the skin. Contributing factor is prolonged mechanical pressure on a certain area (tight shoes). It is dense, clearly limited - 0.1-1.0 cm in diameter, yellowish, without inflammation and peeling. The corneous masses in the form of a cone go deep into the tissues, so the mechanical removal of calluses leads to a crater-like depth, sometimes a drop of blood is released. Such mechanical removal of calluses is accompanied by significant pain. Differential diagnosis with plantar warts. [10, p.216-217]

The results obtained during the research indicate that the scarring process irreversibly changes the structure of the papillary pattern. It is established that in traces of papillary patterns where scars are present, depending on the conditions and mechanism of trace formation, dimensional characteristics of the cicatrix and its shape, causes of its occurrence and conditions of scarring, individual regenerative features, within and on the verge of deformation of the papillary pattern some or all of the following signs may be displayed:

- 1) absence of papillary line and pores;
- 2) atypical system-sequential and sudden bending of papillary lines in the flow, which eventually either break off at the border of the scar tissue, or merge with a scar tissue who looks like a thickened papillary line, reflecting similar on known to us individual signs of low identification weight: merges and branches of papillary lines; or join to the area with tight and chaotically arranged details of the structure, similar in reflection to those well known to us signs of high identification weight: dots, fragments, breaks, counter positions, fractures of papillary lines, which change / do not continue its flow direction, deform its shape (scar deformities of papillary pattern may not allow at all to determine the direction and shape of the flow), less often, - bridges, islands, hooks etc; or borders on an fully or partly empty areas.
- 3) violation of the normal flow of the friction ridges;
- 4) change in the width of the furrows and papillary lines on the border of scar tissue, thickening of papillary lines in places of their flow interruption by a scar;
- 5) atypically located "thickened papillary line" without pores;
- 6) uncharacteristic local changes of contrast in papillary patterns trace structure in the direction of its decrease in areas of the trace, who was formed with a close to static mechanism, until complete impossibility to determine the direction of papillary lines flow in this area and contours configuration of their edges;
- 7) sudden and sequential interruption of the papillary lines flow, the endings of which on the edge of the break are displayed with a slight but sharp atypical and consistent displacement of each torn papillary line up / down (most obvious in papillary patterns with linear scars, in which it is easiest to establish the fact of their displacement);
- 8) the configuration of the pores, similar to their linear, chain dislocation, which coincides with the direction of papillary lines flow is absent, and the very details of the scar tissue structure, which resemble the reflection of the pores, located with a chaotic intensity of accumulation without the only one system of shapes and dimensional characteristics;
- 9) fusion and branching of papillary lines will always bend their own connections / branches at the border of the scarred skin;
- 10) scar tissue is displayed in the trace only if its trace-leaving surface previously had a trace-forming substance (exceptions for three-dimensional traces, an optical scanners etc.);
- 11) modified poroejeoscopic features (they just look like a poroejeoscopic features);
- 12) presence of a mesh structure which is not typical for the system of white lines, who does not reflect the system of density and direction of flows of linear features, who does not reflect configuration of the human skin types of drawings: linear, branched, reticulate, mixed, except for possible, located non-systemically white areas caused by wrinkles, cracks, peeling, dysfunction of the endocrine system, etc.

**Conclusions and prospects.** The result of the research indicates the achievement of its goal. During the research, scientifically proven provisions and methods were used, deformation features of the papillary pattern caused by scars were described and illustrated, details that may appear in traces of this kind are particularized, an algorithm of defining deformed areas of the papillary pattern as scars is explained and mentioned when it should not be done, therefore, a scientifically sound mechanism for examining a dactyloscopic information, which reflects scarring of the skin, has been formed, which, in turn, increases the implementation level of the principles of completeness, objectivity, scientific validity, comprehensiveness, quality and positive resultness of dactyloscopic examination of any scarred papillary pattern reflected in the trace.

We also believe that the existing automated fingerprint identification systems like the: «Papilon», «Sonda», «DACTO 2000» should be upgraded with a software module, who is able to handle a dactyloscopic information of this kind - identify people or narrow the range of search by scars presence, also, it is necessary for each state agency who implements systems of electronic accounting or identification of persons by processing their papillary patterns to take into consideration stability of scar tissue morphological features and its impact on the structure of the papillary pattern.



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