PIGMENTED SCARS

BY

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This communication is concerned with those scars, usually of the face, which follow injuries in which pigmented material becomes embedded in the skin and often in the subcutaneous tissues. Those which follow road accidents are the most common, and they are considered in some detail; reference is also made to pigmented scars following injury in coal-miners. Although scars are inevitable after such injuries, most of them would be inconspicuous, and some almost invisible, but for their contained pigment. It is not appreciated by many of those responsible for the initial treatment of these patients that the pigmentation of scars can be prevented by methods which do not require special experience for their application.

There are few references to the methods of preventing the pigmentation of scars, but short accounts are given by Matthews (1946) and Straith and Pilling (1947). In the American literature Iverson (1947) and Sheehan and Swanker (1950) refer to the treatment of established pigmented scars, but I have been unable to trace any work on this subject in the British literature.

Cases of injury in which pigmented material has been forced into the tissues can be divided into two groups—a large one in which the injuries are abrasive in type, and a small group in which the injuries follow an explosion.

Abrasive Injuries

Most of the cases in this group are the result of injury to exposed skin when the subject is flung forward along a road surface as the result of an accident. Motor-cyclists, cyclists, and pedestrians who are poorly protected—especially about the face—are most likely to sustain this type of injury. The skin is lacerated and abraded as it slides over the rough surface of the road, and loose particles of road grit become embedded in the wounds. Those parts of the face which are rendered prominent by the underlying bony skeleton—namely, the upper part of the nose, upper lip, chin, malar and supraorbital regions—usually sustain the severest damage, the lacerations running in various directions owing to the fact that the skin, which is stretched over the bony prominences, is split by impact with the irregular road surface. In these areas the lacerations usually penetrate as far as the subcutaneous fat and may reach the underlying bone, but in areas less firmly supported—for example, the cheek below the level of the malar prominence, and the neck—they take the form of multiple parallel abrasions of the skin which run in the direction in which the patient was travelling during the injury.

Immediately adjacent to these lacerations and abrasions there may be little or no evidence of damage to the skin, although foreign particles are embedded in it in large numbers. Lesions of the lower half of the nose, other than trivial ones, are uncommon, because this portion has a cartilaginous framework which allows it to be thrust aside at the moment of impact; this exposes the upper lip, which, no longer protected by the nose, is injured with unexpected frequency. The lower lip becomes everted as the head slides in a forward direction during the accident, exposing the buccal aspect to direct injury by the road surface, and in many cases the mucosa is split transversely just above the floor of the buccal sulcus. After a severe injury all the areas mentioned above may be damaged; in most cases, however, only one or two of them are found to be involved,

but in practically all cases the lesions are confined to one side of the face.

Exposed skin surfaces other than those of the face—for example, the hands and knees—may also be affected; the knuckle regions of the hands are commonly involved, and in addition similar lesions of the anterior aspect of the knees may be seen in women and children.

In coal-miners lesions almost identical with those due to road accidents are seen as a result of coal falling from the "roof." Sometimes the face is directly damaged, but more often the back receives the force of the impact; the face is then injured if the miner is thrown forward on to it.

Explosive Injuries

In civilian practice pigment-contaminated wounds due to injury by high explosives are rare, and are most likely to be encountered as a result of accidents in industry.

In coal-mining, barriers of stone or coal are sometimes removed by shot-firing, in which a charge of T.N.T. or nitroglycerin is placed in a prepared hole, which is then filled or "stemmed" with a mixture of clay and sand. If the charge explodes before the worker takes cover the skin of exposed areas is tattooed by coal, shale, and stone fragments, with the addition of the materials used in "stemming." Identical injuries may follow the explosion of a compressed-air cylinder in a coal-mine.

Clinical Features of Pigmented Scars

The patients complain of conspicuous scars which excite unwelcome attention, particularly if they are on the face; those with pigmented scars on the upper lip, for example, complain of the frequency with which they are told that their nasal toilet is incomplete. The pigmented scars which follow injuries of the abrasive type are found in one or more of those areas which sustain damage in the way described, their depth and direction varying, like those of the original wounds, with the site of injury. Pigmented scars overlying bony prominences are almost invariably deep and run in various directions; scars in other situations are usually superficial, the pigmentation lying in parallel lines which are generally vertical in direction. The colour varies from light grey to black, depending on the concentration of pigment in the skin.

Multiple blue-black scars in exposed areas (scalp, back, and extremities) are extremely common in coal-miners, who rarely complain of them; indeed, they are usually proud of these marks of their trade. Those of the face which may follow explosive injuries, however, are most disfiguring (Fig. 1). They present a blotchy appearance, as most of the pigmented material lies in scattered pockets of deep damage.

During the first few months after injury many pigmented scars are raised, indurated, and erythematous, and it is remarkable that after this period the scars gradually become flat and supple, in spite of the fact that they still contain a great deal of foreign material.

Pathology

Examination of a wound or abrasion of the skin within a few hours of the injury will reveal an exudate of serous fluid which soon dries to form a surface coagulum. In the case of wounds or abrasions impregnated with pigmented foreign particles, the coagulum is found, on naked-eye and microscopical examination, to contain large numbers of foreign particles. These have also been found to be present in cases in which the surface had previously been freed of contaminants by swabbing and irrigation. It is therefore inferred that pigmented scars contain only those foreign particles which have remained embedded in spite of this natural attempt at extrusion.

A number of pigmented scars removed from a variety of cases were sectioned and examined by Dr. J. L. Edwards, who reported the presence of three types of foreign body: (1) doubly refractile material with sharp edges—possibly

FIG. 1.

FIG. 2.

FIG. 1.—Pigmented scars in a coal-miner resulting from a shot-firing accident.
FIG. 2.—The same patient as in Fig. 1, one year after treatment by the method described in the text.

silica; (2) black fragments which resemble carbon particles; and (3) scanty yellowish fragments, not anisotropic, which are possibly vegetable matter. The tissue reaction is a mild chronic inflammation without obvious giant-cell formation.

Chemical analysis of two typical samples of road grit taken from the outskirts of an industrial town show a high content of silica, tarry material, and carbon (see Table).

Chemical Analysis of Road Grit

	Sample A	Sample B
Siliceous grit	66.75%	56.10%
Tarry matter	1.50%	2.70%
Free carbon	3.73%	5.51%

The remainder consists almost entirely of calcium salts, of which the carbonate predominates. Samples A and B were collected three miles and two miles respectively from a town centre.

The results of these two methods of investigation suggest that the pigmentation of scars which follows road accidents is due to carbon particles and possibly also to tarry material. It seems probable that the sharp-edged particles of siliceous grit are forced into the tissues during the injury, carrying the pigmented materials with them. The high silica content of the foreign material may account for the early induration of some of these scars, which, however, become supple within six to twelve months of their infliction, although they remain pigmented. Rarely is the tissue reaction excessive, producing a granuloma in the form of a hard subcutaneous nodule, which on section shows a giant-celled foreign body reaction around particles of silica.

The pigmentation of scars seen in coal-miners is due to coal and possibly also to shale.

Prevention of Pigmentation

Absolute prevention is possible only by the use of masks or screens, and these might be usefully employed by those engaged in shot-firing. In practice, the pigmentation of scars is prevented by the removal of all pigmented foreign particles from wounds before healing occurs. Early treatment gives the best results, but in cases seen for the first time on the third or fourth day after injury the removal of foreign particles can still be carried out satisfactorily.

Local analgesia is recommended for the treatment of small lesions and also for extensive injuries in which the patient is regarded as unfit for general anaesthesia. Most cases are

treated under general anaesthesia, and an intratracheal tube and a throat pack are inserted in all cases of extensive facial injury.

Operation

A good light is essential. The wounds are swabbed with 1% cetrimide to remove surface contaminants, and sterile towels are then draped in the usual manner. Areas in which abrasions have not penetrated deeper than the skin are treated as follows. The coagulum of dried serum which forms on the surface of the wounds within the first few hours of their infliction is removed with the sharp edge of a No. 11 blade, following which the point of the blade is used to tease the foreign particles out of the skin by scraping lightly with a to-and-fro movement. The knife is held at right-angles to the surface, which is put on the stretch. This method causes much less damage to the skin than would be expected, and I prefer it to scrubbing the wounds with a bristle brush, which is often employed. These areas of superficial damage are treated post-operatively by exposure, and the fresh coagulum which spontaneously in 7 to 14 days to leave a

forms separates a healed surface.

In areas in which the continuity of the skin has been broken the foreign particles are best removed by excision of the contaminated tissues (fat, muscle, etc.). Although pigmented particles at this depth do not cause visible pigmentation, they should nevertheless be removed as they encourage suppuration, and, in addition, the silica associated with them may be responsible for hypertrophy of the resultant scars. The amount of tissue excised is so small that the loss passes unnoticed both from the functional and from the cosmetic point of view. The removal of skin is undesirable and rarely necessary, especially on the face, where it has exceptional viability. Loose tags are excised, but the skin edges can often be freed of foreign particles by scraping with the knife point as described above. If this method fails a narrow strip of the affected skin edge is removed by paring with fine scissors. When all foreign particles have been removed, wounds of the deeper tissues are sutured, using a minimal quantity of fine catgut. The orbicularis oculi, for example, is often injured, and should be repaired; sutures may also be required to obliterate dead space. The operation is completed by closure of the skin by direct suture or, if there has been skin loss, by local flaps or free grafts. After operation areas of deep damage are covered by pressure dressings for four to five days.

If a thorough removal of foreign particles has been carried out the routine use of antibiotics is unnecessary, especially in cases of facial injury, in which infection is rare.

Treatment of Pigmented Scars

The use of cosmetics in an attempt to hide pigmented scars is unsatisfactory, but they may be tried in females if treatment has to be delayed. Surgical treatment is advised in practically all cases, and a variety of methods can be employed.

In the technique I use it is important to decide pre-operatively the depth to which pigment has penetrated in each area. *Superficial* pigmentation is usually spread diffusely over an area which has little or no bony support—for example, the cheek and the lower portion of the nose—scarring is slight or absent, and the colour is often light grey owing to the small amount of pigment present. *Deep* pigmentation, on the other hand, is found in localized areas overlying bony prominences, obvious scarring is always present, and the colour is dark and often black.

The treatment of superficial pigmented scars depends upon the fact that the epidermis and superficial layers of the dermis will regenerate if they are removed, leaving little or no evidence of permanent damage. Sheehan and Swanker (1950) advocate the use of sandpaper for the treatment of superficial scars, and I have found this method, which produces excellent cosmetic results, easy to apply. It is unnecessary to obtain the special boilable waterproof sandpaper which they employ, as ordinary sandpaper can be dry-sterilized in sealed glass jars placed in a hot-air oven at 160° C. for one hour.

In areas in which the pigmentation has penetrated as far as the deep layers of the dermis but not beyond the skin, Iverson (1947) removes the affected layers so far as is possible by sandpapering, relying upon the application of chemical coagulants to complete the removal. I have found this method difficult to control, and prefer to apply the one described by Sheehan and Swanker (1950), in which the affected skin is shaved off with a skin-grafting knife or a scalpel blade.

Anaesthesia.—Local analgesia can be used if the lesions are small, but most cases require general anaesthesia. In cases in which a large area of the face is treated, the use of hexamethonium compounds is of great value, as they not only reduce the blood loss but also provide a clearer field in which to work.

Operation.—If the pigmentation in a given area appears to be superficial, but the exact depth cannot be decided upon, the surface layers should be removed by sandpapering. If this is ineffective the remaining pigmented skin is then removed by shaving, using a skin-grafting knife, or a scalpel blade if the area is small. In the treatment of pigmented scars which involve the deep layers of the dermis (Fig. 1) successive thin layers of skin are shaved off until a point is reached when the only remaining pigment consists of small areas of fine discrete black dots. At this stage all that is required is the removal of these areas by shaving with a small scalpel blade. In order to reduce to a minimum the amount of skin removed, these areas are picked up in turn between finger and thumb, or by means of a fine hook, and successive fine shavings cut from them until all pigment has been removed. In the event of small pockets of pigment having penetrated deeper than the skin, they are excised at the risk of causing a small amount of scarring, and the defects so caused are closed by suture, care being taken to arrange that their long axes lie parallel to the lines of Langer. Although a perfect cosmetic result is not obtained, the final appearance in suitable cases (Fig. 2) is better than that which follows the use of free grafts to replace the excised pigmented areas.

Many deep pigmented scars which involve the skin and subcutaneous tissues are linear, and can be treated satisfactorily by excision and suture. If after excision of a deep pigmented scar it is found that direct suture is impracticable, the defect is covered either by a local flap or by a free graft, as the case demands.

Summary

Pigmented scars are a common cause of disfigurement after injury. The pigmentation can be prevented by early and vigorous treatment of the initial wounds, and the attention of those concerned with the management of accident cases should be drawn to this fact. The treatment is relatively easy to carry out, in contrast with the treatment of established pigmented scars, which is often difficult.

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ANALYSIS OF 50 CASES OF PERSISTENT DUCTUS ARTERIOSUS

BY

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The possibility of surgical cure of persistent ductus arteriosus was first suggested by Munro in 1907 (see Gross, 1939). Although some unsuccessful attempts had been made before 1939, it was not until that year that Gross successfully accomplished this. Since then several large series have been reported from the U.S.A., but so far there have been relatively few publications on the subject in this country.

Between October, 1947, and September, 1951, 53 patients were admitted to the Thoracic Surgical Unit, Leicester, for ligation of a persistent ductus arteriosus. Operation was performed in 51 instances. Of the remaining two, spontaneous obliteration of the ductus had occurred in a child aged 6 while she was awaiting admission to hospital. The second case was that of a boy aged 12 whose ductus became infected and as a result appeared to have become obliterated by fibrosis; this incidentally cured his infection. One patient who had the classical signs and symptoms of a persistent ductus arteriosus was found at operation to have an obliterated ductus, and an alternative diagnosis of a ruptured sinus of Valsalva was made. The following analysis is concerned with the remaining 50 patients on whom ligation was actually carried out.

Analysis of Cases

Incidence.—In this series there were 45 females and 5 males—a ratio of 9:1. This confirms the well-known preponderance of females in this condition, and in fact represents a higher proportion of females than is usual. Brown (1950) collected the figures of several series and obtained an incidence of 2.5:1. No selection in favour of females was carried out, and it is difficult to know why the preponderance in this sex was so much higher than usual. The average age at operation was 9 years; the oldest was 40 and the youngest 3 years old.

History.—The age of the parents was known in only 12 instances. In these the fathers' ages averaged 33 years and the mothers' ages averaged 31 years. There were no cases of rubella or other known significant disease during pregnancy, but two of the children were born prematurely. Three patients had a significant family history. In one case the mother had a persistent ductus arteriosus; in another a twin sister (identical twins) also had a persistent ductus arteriosus; and in a third a younger sister died as a baby of congenital heart disease. It is interesting to note, on the other hand, that one of the children with a persistent ductus arteriosus had an identical twin who was quite normal. The affected child was poorly developed compared with her twin, but made rapid progress after ligation of her ductus. In most of these patients the ductus was first diagnosed on routine examination, commonly when first entering school. In only four cases was attention drawn to the ductus by symptoms, although other cases developed symptoms after diagnosis.

Symptoms.—Nine patients complained of dyspnoea at the time of operation; of these, two were in failure and two were infected. Only the patients in failure showed cyanosis; they also had oedema of the legs and palpitation. Those who presented with infective endarteritis had fever, headache, chest pains, enlarged spleen, and in one case aphasia and ataxia. Peripheral manifestations of the end-