Cutaneous hyperpigmentation may be due to a disturbance of the melanin system or to an abnormal presence in the skin of exogenous or endogenous pigment other than melanin. The first condition, or hypermelanosisis, may be due either to an increased number of melanocytes or to an increased concentration of melanin in the epidermis. Often, it is not easy to distinguish between the two conditions, both because of normal variations in the content of melanin in the epidermis and because of regional and age-related differences in the density of melanocytes within the epidermis. Melanin can also be found within macrophages in the dermis, which may impart a grey or blue colour to the pigmentation.

Pigmented lesions due to benign or malignant proliferations of melanocytes (naevi and melanomas), which may appear as pigmented lesions of the skin, are dealt with elsewhere in this handbook. Circumscribed cutaneous hyperpigmentations without apparent proliferation of melanocytes are mainly due to increased concentrations of melanin in the epidermis (which usually produces brown hyperpigmentation). The most common disorders here encountered are:

- freckle (or ephelis): a macule found on sun-exposed skin characterised by melanocytes with a greater capacity for melanogenesis after exposure to sunlight.
- Café au lait spot: a hyperpigmented patch which may be present at birth in the setting of neurofibromatosis or in otherwise normal persons.
- melanotic patches in Albright’s syndrome.
- Becker’s naevus: a malformation of the epidermis and pilo-sebaceous units.

An increased content of melanin in the epidermis can be associated to such conditions as:

- chloasma (syn. melasma).
- urticaria pigmentosa.
- macular amyloidosis.

Localised hyperpigmentation frequently represents the end stage of a prior inflammatory process which involves the dermal/epidermal junctions: localised post-inflammatory hyperpigmentation. Among these, special mention should be made of:

- fixed drug eruption, Berloque dermatitis (phototoxicity induced by topical application of oil of bergamot), “erythema ab igne” a consequence of long-standing thermal injury).

Increased melanin in the epidermis can also be found in a variety of skin lesions characterised by proliferation, whether non-neoplastic or neoplastic, benign or malignant:

- melanosis of the vulva.
- solar lentigo (syn. senile lentigo, liver spot, old age spot), a benign pigmented macule on skin damaged by years of exposure to sunlight, most commonly situated on the face and the backs of the hands and wrists, neck and chest and extensor surfaces of forearms.
- lichen-planus-like keratosis.
- reticulated seborrhoeic keratosis.
- reticulated pigmented anomaly of the flexures (the Dowling-Degos anomaly, symmetrical reticulated hyperpigmentation of the body folds).

Increased content of melanin both in the epidermis and the dermis can be found in the following conditions:
- seborrhoeic keratosis (hyperpigmented keratinocytes and melanin in macrophages in the upper part of the dermis).
- pigmented solar keratosis;
- pigmented Bowen's disease;
- bowenoid papulosis;
- pigmented squamous cell carcinoma;
- pigmented keratoacanthoma;
- pigmented basal cell carcinoma.

Slight extensive hyperpigmentation of the face (e.g. chloasma) is not amenable to timedsurgical treatment; rather, such areas are treated with depigmenting creams, which are applied daily to the affected area. Timed surgery is able to eliminate pigmentation caused by increased concentrations of melanin. If the hyperpigmentation is small and epidermal, superficial timedsurgical coagulation is used (Tab. 26.1). If the hyperpigmented lesions are very evident, or slightly raised, or doubt exists as to whether the pigment is entirely localised in the epidermis, a resorcin solu-

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**Tab. 26.1 Treatment of hyperpigmentation**

<table>
<thead>
<tr>
<th>Superficial timedsurgical coagulation</th>
<th>Direct - Coag microelectrodes 1 Watt - EM 15</th>
<th>Small facial lentigines (epidermal hyperpigmentation)</th>
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<tr>
<td>Pulsed superficial timedsurgical coagulation</td>
<td>Direct pulsed 4/9 hundredths of a second - Coag microelectrodes 1 or 2 Watts - EM 15</td>
<td>Lentigines of the hands (two sessions)</td>
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<tr>
<td>Pulsed timedsurgical de-epithelialisation</td>
<td>Direct pulsed 4/9 hundredths of a second - Coag microelectrodes 1 or 2 Watts - EM 10 (bent at an angle)</td>
<td>Large epidermal hyperpigmentations resistant to depigmenting substance</td>
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<tr>
<td>Timedsurgical de-epithelialisation and application of a saturated resorcin solution (mixed peeling)</td>
<td>Direct - Coag microelectrodes 1 Watt - EM 10 Yellow (bent at an angle)</td>
<td>Facial lentigines (Dermal-epidermal hyperpigmentation) application of resorcin for 20 seconds</td>
</tr>
</tbody>
</table>
tion must be applied to the de-
epithelialised marks for a few
seconds. Topical or local anaesthesia is used.
Post-inflammatory hyperpigmenta-
tion must be treated by means of
timesurgery at least three years
after its onset. Indeed, some areas of
hyperpigmentation may fade within
that time, while others may persist
indefinitely.
Timesurgery can also be used effica-
ciously to treat inflammatory linear
verrucous epidermal naevi (ILVEN).

26.1 **Epidermal hyperpigmentation**

Programme data
Superficial timesurgical coagulation
Direct - Coag microelectrodes -
1 Watt - EM 15
Timesurgical resurfacing
Direct pulsed 0.3/5.3 hundredths
of a second - Coag microelectro-
des - 27 or 38 Watts - EM 15

In epidermal hyperpigmentation, the
pigment is localised in the basal layer
(Fig. 26.1.1). Small solar lentigines on the face and
body may be eliminated by means of
superficial timesurgical coagulation
(Fig. 26.1.2-4).

Fig. 26.1.1 Solar lentigo. Epidermal hyperpigmentation. The melanin is mostly localised in the
basal layer of the epidermis.
Techniques

The neutral electrode is positioned and the operating field is moistened and disinfected with saline solution. The direct mode is selected and the apparatus is set to coagulation with microelectrodes. Power is set to 1 Watt and an EM 15 electromaniple is connected. The tip is delicately touched repeatedly onto the epidermis and coagulates the surface, which becomes lighter. The electromaniple must be perfectly clean. The tip should be kept moving and must not remain long in the same place. The epidermis is not removed. Healing times are brief: a week on the face. If residual pigmentation remains, the procedure may be repeated after two months.

Very extensive areas of epidermal hyperpigmentation which are resistant to depigmenting therapy may be treated by means of pulsed timedsurgical de-epithelialisation. The innovative timedsurgical resurfacing technique enables epidermal hyperpigmentation to be treated safely and efficaciously. The Timed micropulse is set to the Direct mode, coagulation with microelectrodes at a power of 27 or 38 Watts and an EM 15 electromaniple is fitted. The epidermis must not be removed.
Fig. 26.1.3 Superficial timedsurgical coagulation of solar lentigo. Programme data: coagulation with microelectrodes, 1 Watt, EM 15 electromaniple. Topical anaesthesia. The hyperpigmented area is repeatedly touched with the tip of the electromaniple. The coagulated epidermis is not removed.

Fig. 26.1.4 Result after two sessions.
26.2 **Elimination of lentigines on the hands**

Programme data:
Pulsed superficial timedsurgical coagulation

**Direct pulsed 4/9 hundredths of a second** - Coag microelectrodes - from 1 to 3 Watts - EM 15

Timedsurgical resurfacing

**Direct pulsed 0.3/5.3 hundredths of a second** - Coag microelectrodes - 27 or 38 Watts - EM 15

Lentigines on the hands are eliminated by means of **pulsed 4/9 hundredths of a second**, following the application of a 30% urea cream for two weeks (Fig. 26.2.1). Two sessions are normally required. The direct mode is selected and the apparatus is set to coagulation with microelectrodes. Power is set from 1 to 3 Watts. The tip of the EM 15 electromaniple is touches repeatedly onto the epidermis and coagulates the surface. The epidermis is not removed. The tip of the electromaniple must be kept moving and must never dwell on one spot. The procedure is carried out under topical anaesthesia and has to be repeated after 6 months.

Timedsurgical resurfacing is an extremely safe method of removing patches from the hands. When using this new technique, the epidermis must not be removed.

Fig. 26.2.1 Patches on the hands. Superficial pulsed timedsurgical coagulation. Programme data: **coagulation with microelectrodes**, 2 Watts, pulsed 4/9 hundredths of a second, EM 15 electromaniple. Topical anaesthesia. Result after one session.
26.3 **Dermal-epidermal and dermal hyperpigmentation**

Programme data
Timed surgical de-epithelialisation
Direct - Coag microelectrodes - 1 Watt - EM 10 Yellow (bent at an angle)

In dermal-epidermal hyperpigmentation, the pigment is situated in the basal layer of the epidermis and in the upper part of the dermis (Fig. 26.3.1)

**Technique**

Timed surgical de-epithelialisation is carried out at 1 Watt with an EM 10 Yellow electromaniple (bent to an acute angle).

After eliminating the epidermis (see section 24.2), the operator observes the dermis through a magnifying lens. If it appears even slightly pigmented (Fig. 26.3.2-4) or has an irregular surface, it is washed with an aqueous solution of resorcin (mixed peeling).

The solution is prepared by placing a small quantity of resorcin in a sterile container. The powder is dissolved in a few drops of sterile water. The resorcin is applied to the pigmented dermis with a cotton wad. After 10-20 seconds the de-epithelialised area whitens and the operator immediately removes the resorcin with a gauze soaked in physiological saline solution. Hyper-pigmentation of the dermis undergoes the same treatment, but the resorcin solution is applied for a longer time.

On the face, the area is left exposed to the air; on the body it must be protected with a non-adherent dressing. Owing to the coagulative properties of resorcin, a crust forms on the face after a few hours.

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**Fig. 26.3.1** Solar lentigo. Dermal-epidermal hyperpigmentation. Abnormal concentration of melanin in the epidermis and dermis.
Fig. 26.3.2 Both epidermal and dermal-epidermal lentigines are present. The most conspicuous dermal-epidermal lentigo is treated by means of mixed peeling. Programme data for timedsurgical de-epithelialisation: coagulation with microelectrodes, 1 Watt, EM 10 Yellow electro-maniple, bent at an angle. Local anaesthesia. After de-epithelialisation, a saturated resorcin solution is applied for 20 seconds. The epidermal lentigines must be treated by means of superficial timedsurgical coagulation.
Fig. 26.3.3 Mixed peeling. A) Dermal-epidermal hyperpigmentation. B) Timed surgical de-epithelialisation. Programme data: coagulation with microelectrodes, 1 Watt, EM 10 Yellow electromaniple, bent at an angle. Local anaesthesia. C) Resorcin solution is applied for 20 seconds. D) Result.
Fig. 26.3.4 Mixed peeling. A) Dermal-epidermal hyperpigmentation. B) Timedsurgical de-epithelialisation. Programme data: coagulation with microelectrodes, 1 Watt, EM 10 Yellow electromaniple, bent at an angle. Local anaesthesia. After de-epithelialisation, the dermis surface appears pathological. C) Resorcin solution is applied for 20 seconds. D) Result after five months. In addition to eliminating the pigmentation, mixed peeling has normalised the skin surface.
after two or three days on the body. This rapid crust formation minimises the risk of infection. On the face, the crust falls after about 8 to 10 days, and on the body 15 to 20 days. The de-pigmented area remains pink or dark for a few months and must be protected from UV radiation with anti-sun cream. The results are consistently good.

Mixed peeling (Fig. 26.3.5) can also be used to treat reticulated seborrheic keratoses, which evolve from solar lentigines (Fig. 26.3.6), if they are flat and extensive.

Fig. 26.3.5 Reticulated seborrheic keratosis.
Fig. 26.3.6 Reticulated seborrhoeic keratoses, which evolve from solar lentigines, can be eliminated by means of mixed peeling if they are flat and extensive. Programme data: coagulation with microelectrodes, 1 Watt, EM 10 Yellow electromaniple, bent at an angle. Timed surgical de-epithelialisation is performed without removing the hair. Saturated resorcin solution is applied for 30 seconds. Local anaesthesia.
Timed surgical mixed peeling is able to treat other pigmented neoformations, even when extensive, such as inflammatory linear verrucous epidermal naevi (ILVEN) \(\text{Fig. 26.3.7}\). The procedure normally has to be repeated after 6 months. After de-epithelialisation, the saturated resorcin solution is applied for 40-60 seconds. If the residual pigmentation is not too conspicuous the dwell time of the resorcin solution can be reduced during the second session. The results are excellent \(\text{Fig. 26.3.8}\).
Fig. 26.3.8 Inflamatory linear verrucous epidermal naevus (ILVEN). After testing, mixed peeling is carried out. Programme data of timedsurgical de-epithelialisation: coagulation with microelectrodes, 1 Watt, EM 10 Yellow electromaniple, bent at an angle. Local anaesthesia. Resorcin solution is subsequently applied for 1 minute. Any residual pigmentation is retreated with mixed peeling. The same result can be achieved by means of the recent timedsurgical resurfacing technique in the cutting function, using a power of 50 Watts and the EM 15 electromaniple.
Timed surgical mixed peeling can be used to treat both deep and superficial congenital giant naevi (Fig. 26.3.9).

When the location of the giant naevus hinders excision and plastic reconstruction, mixed peeling offers a valid alternative on account of its consistently good results (Fig. 26.3.10).

The operation must be carried out in the first two weeks of life and repeated once or twice at yearly intervals.

Mixed peeling is able to eliminate superficial congenital giant naevi.

Deep congenital giant naevi, however, which often infiltrate the subcutaneous tissue and muscle, cannot be removed completely.

Fig. 26.3.9 Deep congenital giant naevus.
In this case, mixed peeling offers the advantage of rendering the neoformation flat right from the first session, which enables any nodules that might arise later to be detected immediately. Subsequent sessions create a layer of fibrous tissue which prevents repigmentation of the treated area. The procedure is carried out under general anaesthesia. Once the surface of the congenital giant naevus has been de-epithelialised, a saturated resorcin solution is applied for about 1 minute; the solution is dabbed onto more prominent areas several times.

Fig. 26.3.10 Mixed peeling of a deep congenital giant naevus. The operation was performed 12 days after birth. Timed surgical de-epithelialisation. Programme data: coagulation with microelectrodes, 1 Watt, EM 10 Yellow, bent at an angle. General anaesthesia. Application of saturated resorcin solution for 50 seconds.

(see below)
Result after the first session of mixed peeling.
26.4 Depigmentation of normochromic skin

Timed-surgical mixed peeling enables normochromic skin to be depigmented (Fig. 26.4.1). The operation is required in cases of generalised or universal vitiligo when one or more areas of pigmented skin, which appear as unsightly patches, are located within an area of achromic skin. Depigmentation requires two sessions, 6 months apart. Once de-epithelialisation at 1 Watt has been carried out, a saturated resorcin solution is applied for 40-60 seconds. Once the thin escar has dropped off, the treated area must be protected by anti-sun cream.

Fig. 26.4.1 Depigmentation of normochromic skin. A) Generalised vitiligo. B) Timed-surgical de-epithelialisation and application of a saturated resorcin solution for 45 second. Programme data: coagulation with microelectrodes, 1 Watt, EM 10 Yellow electromaniple, bent at an angle. Local anaesthesia.

(see below.)
C) Result after the first session of mixed peeling. D) Immediately after the second session, during which the resorcin solution was applied for 1 minute. E) Result.