An Examination of the Phenol–Croton Oil Peel: Part I. Dissecting the Formula

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This article investigates which ingredients are the active ones in the most popular peel formula. The benefits of the “phenol” peel have been attributed to the effects of phenol on the dermis. Baker published a simple peel formula in 1962 that became a classic that has been used since by almost all plastic surgeons and dermatologists. Brown et al., in 1960, passed along a set of dogmas: (1) phenol is the active ingredient; (2) phenol peels more deeply in lower concentrations; and (3) adding a surface tension-lowering agent increases the peel.

This article seeks to dissect the Baker formula by removing the croton oil. A patient was peeled serially with 18% phenol, 35% phenol, and 50% phenol solutions containing Septisol (surface tension-lowering agent) but no croton oil. This showed that increasing concentrations of phenol caused more clinical tissue reaction as evidenced by edema and erythema, but no significant dermal injury was seen. USP 88% phenol without Septisol did cause injury to the dermis.

To test the effect of croton oil in the formula, the patient’s face was peeled with two variations: the perioral area was peeled with 50% phenol to which croton oil was added to a strength of 2.1% and the remainder with 50% phenol without croton oil. The perioral area showed vesiculation, slough, and dermal exposure characteristic of a deep peel requiring 11 days to heal. The remainder of the face treated with 50% phenol without croton oil showed only edema and erythema without significant dermal injury. This experiment shows that the main postulates of Brown et al.—that phenol in lesser concentrations peels more than in higher concentrations and that phenol is the sole agent—are not true.

In a fourth peel, a 0.7% concentration of croton oil in 50% phenol was applied to the parts of the face not peeled with croton oil in the third peel. The areas peeled with 50% phenol with 0.7% croton oil healed in 7 days, whereas the treatment with 50% phenol with 2.1% croton oil required 11 days.

Deconstructing the Baker formula reveals fallacies in the four-decade-long belief system regarding these peels. The serial peels performed in this study show that increasing concentrations of phenol without croton oil cause increasing skin reaction but insignificant peeling effect. The addition of croton oil to 50% phenol, however, causes a marked increase in the depth of peeling into the dermis. Lowering the concentration of croton oil caused a lesser burn, as evidenced by fewer days to heal. The depth of the peel, therefore, seems to be more dependent on the concentration of croton oil than phenol. This will be further explored in Parts II, III, and IV. (Plast. Reconstr. Surg. 105: 227, 2000.)

“For we know in part, and we prophesize in part.”

I Corinthians 13:9

Lay peelers were doing phenol–croton oil peels before plastic surgeons paid or bartered to know the ingredients. Plastic surgeons used one formula—almost to the exclusion of all others—for 35 years. During this period, from 1962 to 1995, no physician identified what role croton oil played in the formula. I propose to show you by a simple human experiment that croton oil is the ingredient responsible for the efficacy of the peel that we have come to know as the “phenol peel.” Also, by varying the concentration of croton oil in the mixture, it is possible to increase or decrease the depth of the peel and thereby accommodate different skin thickness.

It is ironic that this knowledge arrives now, just as the phenol–croton oil peel’s demise is announced by laser manufacturers. It is said that lasers can do better. Some physicians tout...
the ability to vary the flux for different skin thickness, as well as other less demonstrable advantages. However, the phenol–croton oil peel’s results are still the standard against which all skin “rejuvenation” will be judged.

A Bit of History

In September of 1961, Litton courageously presented 50 cases with a 2-year follow-up at the ASPRS meeting in New Orleans, Louisiana. Litton (personal communications, 1996 through 1999) told me he had paid a lay peeler by the name of Coopersmith in Fort Lauderdale, Florida, for the formula in 1958 or 1959. In his follow-up article published in this Journal in 1962, Litton¹ did not print a specific formula, saying only that a “minute” amount of croton oil was added to a 50% solution of phenol with glycine and water. He wrote significantly that “croton resin” causes vesculation and sloughing, but he did not reference those attributes and did not follow up on them. Biopsy photomicrographs at 3 months postoperative and four sets of preoperative and postoperative results were published.

In November of 1961, Baker² contributed a specific easily measured and mixed formula in the Journal of the Florida Medical Association. One patient was identified in a photograph as having a 3-month follow-up. No specific number of patients was given. The Baker formula (1961) included the following:

- Phenol USP 88%: 5 cc, 47%
- Distilled water: 4 cc, 49%
- Croton oil: 3 guttas, 1.2% (correct percentage if 1 gutta = 27 drops per cc)
- Septisol: 8 guttas, 2.6%

Baker stated “phenol was used as the active ingredient in this study.” No reason was given for the inclusion of croton oil or Septisol in the formula. Baker told me in March of 1999 (personal communication) that he was stimulated at the time by an article on a Miami lay peeler, Miriam Maschek. He approached Maschek and discussed peeling with her but could not get her formula. He also approached Coopersmith, the lay peeler in Fort Lauderdale. Among other things she told him “croton oil is an important ingredient.”

In 1962, Baker³ published what was to become the “classic” formula. The Baker formula (1962) included the following:

- Phenol USP 88%: 3 cc, 49%
- Distilled water: 2 cc, 44%
- Croton oil: 3 guttas, 2.1% (correct percentage if 1 gutta = 27 drops per cc)
- Septisol: 8 guttas, 4.5%

This formula has been used more than all other formulas by plastic and cosmetic surgeons and other M.D. peelers. Almost all histologic research by plastic surgeons and dermatologists have used this formula. Lay peelers⁴ continued to practice their art with their own formulas during this time period. Truppmann and Ellenby⁵ published one of these formulas without attribution in 1979, and Francis Maschek,⁶ a lay peeler in his area, published it in 1980 identifying it as his own. Litton et al.⁷ published an exact formula 14 years after his original publication and attributed it to Coopersmith, the lay peeler from Fort Lauderdale, Florida, who was active in the 1950s and 1960s. Because of the time and complexity of preparing these lay formulas, compared with the “classic” Baker formula, I do not believe they gained many adherents. Our reluctance as plastic surgeons to investigate or use other formulas was a disadvantage both for the profession and for the patients.

Some Dogmas

The article published by Brown et al.⁸ from Los Angeles, in 1960, in the British Journal of Plastic Surgery was 11 pages in length with only two references. These authors, without references—or experimental proof of their own—stated several suppositions that eventually, by repetition, became veritable dogmas—believed by most plastic surgeons to this day.

1. High concentrations of phenol (80 to 90%), by denaturing keratin, prevent a deeper penetration into the dermis. Conversely, lower concentrations penetrate more deeply and cause a deeper peel.
2. Adding a soap (saponins) to lower surface tension increases penetration of phenol into the dermis.
3. Adding an oil “buffers” the solution.

From this article came the idea that lower concentrations of phenol would burn more than higher concentrations. A search of the literature fails to find an animal or human study that demonstrates this convincingly.

The adding of a surface tension-lowering agent (soap) is again unreferenced and unproven. However, the obvious usefulness of a
saponin in aiding the emulsification of the croton oil floating on the surface of the water–phenol mixture is sufficiently striking that one must suppose that the idea was accepted without further inquiry.

Thus, a formula arrived in the plastic surgery literature by the mid-1960s with the following set of beliefs:

1. Phenol was the active ingredient.
2. Lower concentrations of phenol penetrated deeper than higher concentrations.
3. Lower concentrations of phenol were more dangerous.
4. Septisol (a surface tension-lowering agent) caused a deeper penetration.
5. Croton oil was present, but no real reason for its presence was given other than it was an "irritant."

Silence

No plastic surgeon challenged this orthodoxy for more than 30 years. Many hundreds of thousands of peels—probably millions—were performed with this mixture. There were good and bad results. If the right patient was chosen who fit the formula, generally a good result was obtained. Patients became hypopigmented. Plastic surgeons attributed this outcome to phenol's supposed specific toxicity for the melanocyte—a postulate for which evidence is not overwhelming—rather than the depth of the burn as seems more likely. The postoperative course was rather grim for the patients and trying for most physicians.

The Obagi Peel

Between 1988 and 1992, I sought better peel results by investigating the Obagi® variation of the trichloroacetic acid peel. I performed 134 peels during this time. I continued to do some phenol–croton oil peels as well as combinations using both peel formulas. I reported on these at the annual meeting of the Canadian Society of Aesthetic (Cosmetic) Plastic Surgery in Toronto, October 14 through 16, 1993. By 1992, I had become convinced that I could not achieve the excellent perioral results with Obagi's formula that I could with Baker's formula. Further, I had caused more hypertrophic scars with trichloroacetic acid in 5 years than in 15 years with phenol–croton oil. Obagi® has shown that different skin thicknesses on the face should and could be peeled to different depths. Why should not this also be possible with phenol mixtures?

Can Half Really Equal the Whole?

I was aware that beauticians used 20% phenol in some states and they obtained only minimal results. On this basis, in 1989, I used the Baker formula on a patient for the perioral area, but I diluted it to half strength with water (to approximately 25% phenol) for use on the remaining areas of the face (Figs. 1 and 2). This half-strength mixture, nevertheless, produced a significant peel of the cheeks and forehead. What stood out was that the result seemed nearly as effective as the full-strength Baker peel. It was much more effective than the beauticians' 20% phenol applications. Which ingredient caused the difference between the beauticians' 20% phenol and half-strength Baker at 25% phenol?

The Experiment

As my first step, I would remove the croton oil fraction and peel only with phenol with Septisol, and I would peel in ascending percentages of phenol to see what different concentrations would do. For that, I needed a patient who would be willing to endure multiple peels.

Four years later, in 1993, my collaborator arrived in the office—a 71-year-old woman who had the severe sun damage characteristic of the Nevada desert and was willing to partake in experimentation. I offered to peel her at no fee to the results she could expect from reviewing my peel photographs. But, I told her it might take six stages. She agreed. Fate was kind. This lady was tough, had a low pain threshold, and did not have a husband or relatives at home to muddy the doctor–patient relationship.

MATERIALS AND METHODS

Ingredients

USP phenol (88%) was diluted with tap water to the desired percentage. Croton oil (Delasco, Council Bluffs, Iowa) was added by the drop from the dropper supplied with the bottle. This dropper delivered 27 drops/ml.

Septisol (Delasco) was added by the drop from the dropper on the bottle, which delivered 33 drops/ml. Septisol was used in all the phenol formulas to the same percentage as in the Baker formula from 1962.
Note that all formulas are dropper-dependent and, therefore, inconsistent between practitioners. All percentages in this report are calculated using the drops per milliliter stated above.

The phenol was mixed with tap water to provide final mixtures of 18, 35, and 50% phenol. The amount was 10 ml. To this was added 16 drops of Septisol in all cases, making the total 10.5 ml.

In the third peel, 6 drops of croton oil per 10.5 ml was added to the 50% phenol solution (equivalent to 3 drops in the Baker formula) to provide a 2.1% concentration.

In the fourth peel, 2 drops of croton oil was added to 10.5 ml of the 50% phenol solution (equivalent to 1 drop of croton oil in the Baker formula) to provide a 0.7% concentration (one-third as strong as the Baker formula).

Trichloroacetic acid (50%) was diluted with Obagi’s Formula V (Obagi Medical Products, Long Beach, Calif.; glycerin plus a saponification agent, which is patented) to reach a 40% solution of trichloroacetic acid. This formula was used for the neck and chest.

Preparation. The patient was treated with Retin-A and hydroquinone for 4 weeks before the first peel. The face was cleansed with 70% isopropyl alcohol before treatment and allowed to dry.
Technique. The Obagi technique of application was used. This consists of wrung out cotton Q-tips for the lids. Cotton pads (2 × 2) dipped in the solution and wrung out are folded over the thumb and brushed over the face and neck in multiple coats—more in some areas than others. The mixture is constantly stirred to emulsify.

The endpoint is a subjective one based on the degree of whitening, which is based on experience. This differs from gray-white around the lips, to white on the cheeks and forehead, to pink-white on the temples, preauricular area, and lids. Correspondingly fewer coats leads to a decreasing peel depth, in my opinion.

The neck and chest are treated with 40% trichloroacetic acid with the Obagi application technique; this area is more pink with a very light frost and should not be overdone.

The whole application takes about 30 to 45 minutes, and anesthesia time is 75 to 90 minutes. No abnormal electrocardiogram patterns were observed when the phenol–croton oil formula was applied in the rather dry manner described.

After the frost subsides (about 20 minutes), the patient’s peeled areas are coated with a whipped emulsification of equal parts of Polysporin Ointment and 2% or 4% Xylocaine jelly. The patient also applies this postoperatively as needed for pain and coverage.

Analgesia and Sedation

Toradol (50 mg) intramuscularly is given 30 minutes before starting. An intravenous line is started, and Ringer’s lactate is run at about 300 ml per hour. Controlled intravenous analgesia is given consisting of Valium, Sublimaze, and ketamine in incremental doses. Facial nerve blocks with 1¼% Duraneest with epinephrine (1:200,000) are administered.

Toradol is given 10 mg orally every 6 hours in the postoperative period. Decadron (4 to 6 mg) is given intravenously during the procedure, and a Decadron 5-12 pack is prescribed postoperatively.

Postoperative Care

Zovirax (Acyclovir; 400 mg twice a day) prophylaxis against herpes simplex is continued for 10 days postoperatively and started 3 days preoperatively. No tape, mask, or powder is used so that the full inflammatory and healing process can be followed carefully and to eliminate this uncontrollable variable.

The patient used the emulsified Polysporin–Xylocaine jelly mixture for 2 to 4 days. Light debridement with Q-tips was carried out in the office as desquamation and epidermolysis progressed on a daily basis. The patients were then switched to Preparation H or other emollients as tolerated.

Photography

All photographs were taken with the same 35-mm SLR Canon camera, with a 90-mm macro lens and single, on-camera flash, using Fuji slide film. Backgrounds were inconsistent during 1993 because of an office dislocation resulting from fire.

The Experiment

The patient is seen in Figure 3 (above, left) before peeling. She had severe criss-cross rhytids, a leather-like loose skin, severe sun-induced discoloration with “bronzing,” and irregular pigmentation. The neck skin was likewise discolored and moderately loose. The first peel was carried out on April 26, 1993, with 18% phenol without croton oil applied to the face, forehead, and eyelids, and 35% phenol without croton oil to the perioral area and glabellar rhytids. Forty percent trichloroacetic acid with formula V was applied to the neck and chest.

The patient did not complain of pain, had little noticeable swelling, and no blistering. There was insignificant peeling of keratin on postoperative day 4 and slight redness of the glabellar lines. There was no apparent benefit.

In Figure 3 (above, center and right), the patient is shown on postoperative days 1 and 7. The conclusion is drawn that 18% phenol without croton oil and with Septisol has insignificant peeling effect on the epidermis of the face and has no lasting effect on the dermis.

The second peel was carried out on May 19, 1993, at the behest of the patient. She felt there was no benefit from the first peel and wanted to “get on with it.”

The eyelids were peeled with 18% phenol without croton oil, and the face and forehead were peeled with 35% phenol without croton oil. The rhytids of the glabella, cheeks, and lips were treated with 88% USP phenol with no croton oil and no Septisol (toothpicks dipped in the stock solution for application). The neck and chest were peeled somewhat more aggres-
sively with 40% trichloroacetic acid with formula V.

The patient is shown preoperatively in Figure 3 (center, left) and on postoperative days 2, 5, and 8 (center, right; below). There is a brown hue by day 2, as well as modest edema and erythema in the face. There is a greater reaction on the neck where 40% trichloroacetic acid was used than on the face. By day 5, there was some desquamation, and the edema was resolving. There was no blistering or ulceration. The rhytids where 88% USP phenol was applied were very red with superficial ulceration. This was healed by day 5, but redness lasted for some weeks.

By day 8, only a mild erythematous effect was still visible in the face where 35% phenol without croton oil was applied, whereas a fiery redness was present where 88% USP phenol had been used on the rhytids of the glabella.

The conclusion was drawn that 35% phenol with no croton oil had insignificant effect on the dermis of the face, including thin-skinned areas such as the preauricular skin. Full-strength (USP 88%) phenol produced a noticeable wounding with healing by day 5 but with persisting redness lasting some weeks.

**Third peel.** The third peel was carried out at the patient’s request on June 16, 1993. The eyelids were treated with 18% phenol without croton oil. The face and forehead were treated with 50% phenol without croton oil. The perioral area and the rhytids of the cheek and glabellar were treated with the same 50% phenol solution, but to which 6 drops of croton oil were added per 10 ml of solution (providing a concentration of 2.1% croton oil).

The areas treated with 50% phenol without croton oil showed considerable edema and a gray-tan cast with moderate erythema during the first few days. There was superficial desquamation by day 5. The patient complained of little pain in these areas. By day 7, little effect was seen on the forehead and cheeks (Fig. 4, center, right). This is not the result we expect from a “phenol” peel.

The areas treated with 50% phenol with about 2.1% croton oil showed a very dark gray-brown color, followed by blistering, shaggy slough, more marked edema, obvious dermal injury with weeping and crusting. The perioral wound required 11 days to heal. Figure 4 shows the patient preoperatively (above, left) and the patient on postoperative days 2, 4, and 7 (above, right; center). There is significant dermal injury in the perioral area and on the rhytids of the glabella and cheek treated by toothpick application (Fig. 4, below, left), where the croton oil-containing solution was also used. There were later postoperative milia and a persistent red-purple color for many weeks in the perioral area. This is the course we expect from a “phenol” peel.

We may observe on the basis of this experiment that 50% phenol alone, in the amounts used, has a superficial peeling effect on the skin of the face with edema, erythema, and superficial desquamation but little pain. The addition of 2.1% croton oil to the same 50% phenol solution causes a significant dermal burn requiring 11 days to heal. The addition of croton oil converts a 50% phenol solution from a superficial peeling agent into a deep peeling formula, causing a burn of a wholly different magnitude.

**Fourth peel.** The patient requested her fourth peel 5½ months later on December 6, 1993. She desired the kind of improvement that she had experienced around the mouth from peel three (Fig. 5) for the remainder of the face. The face and suprabor Brow area were treated with 50% phenol containing 0.7% croton oil (2 drops of croton oil per 10-ml solution). This is the equivalent of 1 drop in the standard Baker formula.

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Fig. 3. (Above, left) Preoperative view of 71-year-old volunteer patient before she began her series of peels. She had severe sun exposure: criss-cross rhytids, leather skin, and irregular pigmentation. There is mild erythema from 6 weeks of pretreatment with Retin-A and hydroquinone. (Above, center) One day after the first peel following application of 35% phenol without croton oil to perioral area and glabellar rhytids, 18% phenol without croton oil to the rest of the face and eyelids, and 40% trichloroacetic acid to neck and chest. There is a slight gray pallor and mild edema. The neck shows more reaction than the face. (Above, right) Seven days after the first peel. There is no erythema present. Glabellar rhytids show some redness where toothpick application of 35% phenol occurred. No significant effect is seen from 18% phenol. (Center, left) Preoperative view before the second peel with 35% phenol without croton oil to the face, 88% USP phenol to the glabellar rhytids, and 40% trichloroacetic acid to the neck and chest. (Center, right) Two days postoperative. There is a dark color to the epidermis and moderate edema. (Below, left) Five days after the second peel. There is still mild generalized edema and mild erythema. Some epidermal desquamation is seen. There is excoriation of the glabellar rhytids treated with 88% USP phenol. (Below, right) Eight days after the second peel. The edema has subsided, and the rhytids have returned. There is no lasting effect from the application of 35% phenol without croton oil. There is a persisting hyperemia of the glabellar rhytids treated with 88% USP phenol.
Fig. 4. (Above, left) Preoperative view on June 16, 1993, before the third peel using 50% phenol without croton oil to the forehead and cheeks and 50% phenol with croton oil to the perioral area, cheek, and glabellar rhytids. (Above, right) Two days after the third peel. Note the severe reaction in these areas where croton oil was added to the 50% phenol mixture: perioral, glabellar, and cheek rhytids. Note dark epidermolysis, blistering, and shaggy slough. Note absence of similar reaction on forehead and cheeks where no croton oil was used, where there is moderate edema, erythema, but no blistering or slough. (Center, left) Four days after the third peel. Crusting is present in areas where croton oil was used. There was a mild epidermal desquamation on the cheeks where no croton oil was used. The edema and erythema in the cheeks and forehead are subsiding. (Center, right) Seven days after the third peel. The perioral area is still crusted with serous drainage where croton oil was used. The larger cheek folds and rhytids have reappeared, as the generalized edema has disappeared. There is no persistent effect where 50% phenol without croton oil was used. There is a significant dermal injury where the croton oil-phenol was applied. (Below, left) On the first postoperative day after the third peel, the perioral area, treated with croton oil in 50% phenol, shows a shaggy brown epidermis, serous exudate, multiple blisters, and marked edema. The cheek creases show a similar appearance, whereas the remaining cheek shows only edema and erythema. (Below, right) At 5 days after the third peel, the two cheek creases treated with 50% phenol with croton oil show a weeping dermal wound, whereas the remaining cheek, treated with 50% phenol without croton oil, shows no obvious dermal injury.
(one-third the strength of the "classic" formula).

The patient experienced modest pain and showed early blistering, crusting, and marked erythema. Healing was complete by day 7. Figure 6 (above) shows the patient at 1 and 3 days postoperatively. Figure 6 (below) shows the patient at 5 days and almost healed.

By reducing the amount of croton oil to one-third of that used for the perioral part of the third peel, the healing time was shortened: 7 versus 11 days. This was interpreted as a less deep burn but with a good clinical result for the thinner skin of the cheeks and with less pain and earlier healing. Results at 7 weeks postoperative are seen in Figure 7; compare with Figure 5.

**Results of the Experiment**

The results of this series of peels on the same patient are (1) 18% phenol shows minimal effect; (2) 35% phenol shows mild keratolysis but no obvious dermal effect; (3) 50% phenol shows some desquamation and perhaps a mild dermal effect; (4) 88% USP phenol shows obvious upper dermal effect with healing in 4 to 5 days; (5) the addition of croton oil to 50% phenol causes a profound dermal effect; (A) 0.7% croton oil in 50% phenol caused a dermal burn that healed in 7 days; and (B) 2.1% croton oil in 50% phenol caused a burn that healed in 11 days.

**Deductions**

As a peeling agent, phenol peels more deeply in higher concentrations. USP phenol (88%) without Septisol peels more deeply than 50% phenol with Septisol, which peels more than 35% phenol with Septisol, which peels more than 18% with Septisol. The postulate of Brown et al. and all his followers (that phenol in lower doses peels more deeply) is refuted. The addition of croton oil to all water-phenol formulas gives these formulas a deeper peeling action. By varying the concentration of croton oil, the depth of peeling action can be varied.

Two-year postoperative results are shown in Figure 8. Notice that the patient’s cheeks are not depigmented as we would expect from a "classic" Baker peel.

**Criticism of the Method**

The obvious criticism to the method is that the first three peels were so close together that their effect was cumulative.
There was some desquamation after the second peel and, therefore, the third peel might have taken more. The striking difference between the peeling effect of 50% phenol with croton oil and 50% phenol without croton oil cannot be explained away.

The great advantage of having the same patient with the same physiologic reaction to injury cannot be overvalued. This allows the reaction to injury and the resolution to be evaluated and allows more valid comparisons than between patients.
Questions undoubtedly will be raised about what effect the application of tape or a mask would have had. But that question is not germane to the issue, which is: *what response is due to which ingredient?*

*What Is Croton Oil?*

Now that I have demonstrated that croton oil is the vital element in the standard medical chemical peel (as well as most known lay peels), what is croton oil?

The following information came into the scientific literature between the 1920s and 1950s before the publications by Brown, Litton, Baker, and Truppman. I went to the 25th edition of *The Dispensatory of the United States* (1955). Here is what was available to the authors at that time.

Croton oil is pressed from the seeds of croton tiglium, which is a small shrub native to India and Ceylon. It was used as a purgative in India and arrived in Europe in 1630 for that purpose.

The NF croton oil is described as slightly soluble in alcohols. It contains the following: 37% oleic acid, 19% linoleic acid, 7½% myristic acid, 1½% arachidic acid, less than 1% each of the following: stearic, palmitic, lauric, valeric, tiglic, butyric, acetic, and formic acids, and 7% glycerin. A toxic fraction, soluble in ethyl alcohol, is present to 3.4%.

*A Brief Discussion*

I submitted the present article in March of 1999 with the following sentence:

"It is likely, but has not been proven by any existing science of which I am aware, that the toxic fraction (the purgative inducing chemical(s) which can cause intestinal slough and death) is also responsible for much of the dermal burn seen in chemical peeling."

This had been my view since 1992. One month after submission, I received several articles published in 1935 by an organic chemist who had searched for natural insecticides. Joseph R. Spies isolated the croton resin from croton oil using a Swiss technique. He tested it on the skin of a volunteer (presumably himself) and found it to cause vesication and what he labeled a severe burn requiring 2 to 3 weeks to heal.

Therefore, we may now state that it is highly likely that croton resin (the toxic fraction) is responsible for much of the dermal burn in chemical peeling, and there is scientific evidence to support this view.

Further, Spies and others showed that croton resin is soluble in alcohol and benzene...
Fig. 8. (Above) Preoperative frontal view on April 13, 1993, before peel series started and postoperative view on August 13, 1995, 20 months after the fourth peel. The patient is not depigmented, nor does the patient show the tight, glabrous appearance often seen with the "classic" formula. Observe the near obliteration of cheek rhytids, the disappearance of the horizontal glabellar lines, and loss of perioral lines. (Center) Preoperative left oblique view from April 13, 1993, and postoperative left oblique 20 months following the fourth peel. Observe especially the preoperative preauricular and perioral redundancies that disappear in the postoperative view of August 13, 1995. Especially noteworthy is the normal appearance of the postoperative skin. Neck only modestly improved by 40% trichloroacetic acid. (Below) Preoperative photograph taken on April 13, 1993, and postoperative view of mouth and perioral area taken 20 months after the fourth peel. The chin and perioral rugae show nearly complete obliteration.
(and phenol is a hydroxy benzene) and, further, that it is poorly soluble in water.

Finally, there is evidence that acetyl phorbol bone has similar toxic effects and thus could be the agent, or one of the physiologically active agents. Phorbol is thought to be a precursor and has been separated from the croton resin that is left after removing all of the nontoxic fractions.

Observations on the Solubility of Croton Oil

Croton oil does not mix well with a 50% phenol, 50% water mixture. Oil floats on the surface. A surfactant (soap or detergent) lowers the surface tension and allows the oil and the phenol–water mixture to emulsify more easily. This is obvious when the “classic” Baker formula is prepared.

It is striking that there is no mention in Litton’s or Baker’s articles about the poor miscibility of croton oil in the phenol–water mixture or any suggestion of using another solvent instead of water. This leads one to the conclusion that both of these contributors adopted these ingredients from having seen existing formulas in which the croton oil was floating on the surface because (1) croton oil dissolves totally in 88% phenol, (2) croton oil dissolves totally in 90% ethyl alcohol, and (3) croton oil begins to surface on phenol or alcohol as water is added at about the 70% phenol, or 70% alcohol level.

What Can We Learn from These Simple Observations?

We may deduce from them that all fractions of croton oil dissolve in 88% phenol. We may also conclude that at least the fats in croton oil are forced out of solution by the presence of more than 30% water. What we do not know is of central importance. We do not know, for sure, if the resin (toxic fraction) remains in the phenol or surfaces with the fats or, less likely, dissolves in water, or a combination of all.

The Cytotoxic Fraction

I suggest to you (it is a hypothesis that will require a chemical analysis to prove) that most of the toxic fraction (resin) remains in the phenol. The phenol would thus become the carrier of the cytotoxic fraction—probably acetyl phorbol bone and/or its analogs, and they reach the same depth as the phenol where they cause their toxic reaction.

CONCLUSIONS

The postulates of Brown et al. from 1960, which continue to be repeated in articles up to the present day, are no longer tenable. We believe the following postulates based on human clinical research have been proven. (1) We may say that the higher the concentration, the deeper phenol peels. (2) We may say that croton oil in the formula is what causes the deep peel we recognize as the “phenol peel.” (3) We may say that varying the concentration of croton oil gives us the capacity to vary the depth of the peel.

I believe this information will lead to a Renaissance in the phenol–croton oil peel. The news of its demise by its detractors is truly premature. Let us now turn our attention to the lay history in Part II of this investigation of the phenol–croton oil peel. We will try to see clearly that which we have seen heretofore only darkly.

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