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THE NATURAL EVOLUTION OF COMEDONES INTO INFLAMMATORY PAPULES AND PUSTULES*

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ABSTRACT

A four-month study by serial photography of the progression of comedones in a 17-year-old white boy with untreated, moderately severe acne vulgaris showed that both open and closed comedones (blackheads and whiteheads) can become inflamed and pustular. The lesions tend to resolve in an average 13 days from the start of inflammation. Open comedones sometimes remain unchanged except for size for more than three months before becoming inflamed. Generally, the longer such lesions persist, the longer the ensuing combined periods of inflammation and pustulation. Because of their potential to become inflamed and pustular, the nontraumatic removal of comedones is suggested.

Several authors have reported that in acne vulgaris the closed comedo (whitehead) usually develops into a pustule whereas the open comedo (blackhead) rarely becomes inflamed unless traumatized (Shelley and Kligman, 1957; Strauss and Kligman, 1960; Kirschbaum and Kligman, 1963; Frank, 1971; Strauss, 1971; Pochi, 1972). However, older reports (MacLeod, 1926; Kromayer, 1930; Becker and Obermayer, 1947; Barber, 1948; Sulzberger and Wolf, 1952) and our clinical findings have shown that frequently, if not invariably, both open and closed comedones, even when untreated and untraumatized, become inflammatory lesions. Lowney et al. (1964) reported similar findings.

The study reported here was designed to show the natural evolution of comedones, especially those of the open variety, in acne vulgaris.

MATERIALS AND METHODS

This study was performed on a 17-year-old white boy with a two-year history of previously untreated, moderately severe acne of the face, rated 2+ on a scale of 0 to 4+. During the study, no treatment was given, and the patient was admonished not to touch, press, or squeeze any lesion. Comparable photographs were taken by a professional medical photographer using an 8 × 10 Szabad studio-view camera with a 4 × 5 reducing back and a 14″ Kodak Commercial Ektar Lens. A master guide on the camera's ground-glass lens made it possible at each sitting to reposition the subject exactly. Lighting was by electronic flash; the film was Professional Ektachrome of the same emulsion number, stored at 10° C, developed within 24 hr of use, producing color transparencies.

On Mondays, Wednesdays, and Fridays of the 120-day study period, three views (full-face, forehead, and right cheek–chin) were taken of the subject's face. The findings reported here are restricted to a representative view of the face, namely, the right cheek and adjacent part of the chin, which was photographed at a magnification of 1.5 and clearly depicts blackheads and inflamed lesions.

Each cheek–chin transparency was overlaid with a clear acetate sheet and placed on a light box. Lesions and facial landmarks were traced from each color transparency to its overlay. On the tracing of day 1, 20 randomly chosen blackheads of the 35 or more present at the time were assigned numbers (1 to 20). The tracing of the next transparency was placed over that of day 1, and the blackheads numbered on day 1 and still present on the next tracing were identically numbered on that next tracing. By placing each tracing over that which preceded it, we were able to follow precisely the evolution of all numbered blackheads. Figure 1 shows the transparencies and acetate overlays for days 20 and 38, respectively.

OBSERVATIONS

The evolution of blackheads reported in this study is limited to the following three stages: uninflamed blackhead; the subsequently inflamed lesion characterized by erythema and edema; and the eventual pustular lesion. The black tip of the open comedo, which is clearly evident in the inflamed stage, is recognizable even in the early pustular phase, but not always in the late pustular phase. A macule of residual erythema was taken as the end-point of the process.

The progression of changes in blackheads present at the beginning of the study (#1 to #20) from the quiescent stage through inflammation and pustulation is shown in Figure 2. The total duration of these phenomena is a minimum figure since all of these blackheads started some time before day 1.

During the study, 10 new blackheads became visible in the cheek–chin area and were numbered (21 to 30) as they appeared; their evolution is shown in Figure 3. Each blackhead started as the smallest of visible, blackened tips and gradually increased in diameter before becoming inflamed. Of these 10, seven completed the evolution through inflammation to macule end-point within the study period. Of the remaining three, one was inflamed and two were pustular at the end of the study. When the duration of the uninflamed comedo stage was compared with that of the combined stages of inflammation and pustulation, the uninflamed blackheads of longer duration tended to be associated with more protracted combined inflamed and pustular phases.

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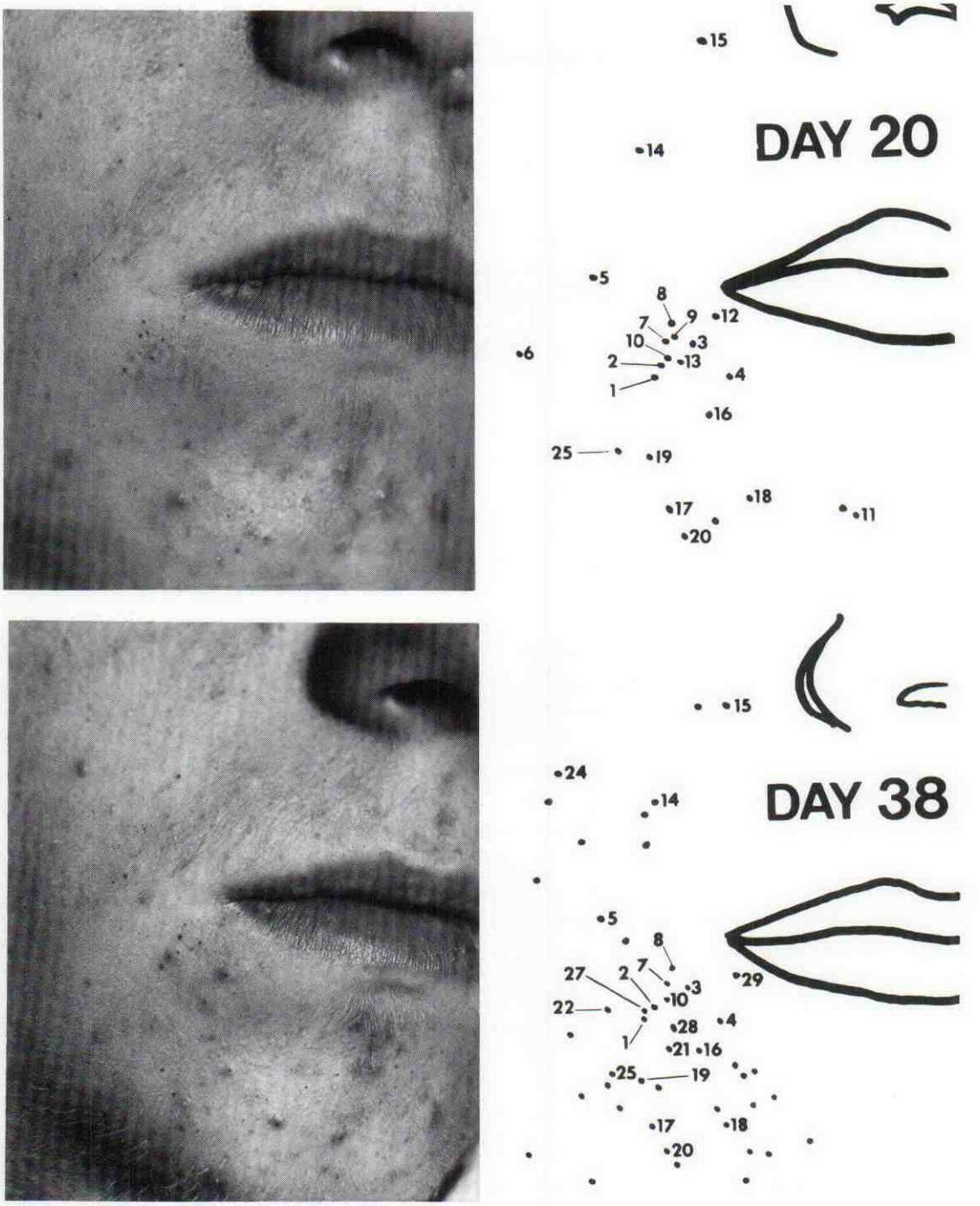

FIG. 1: Black and white prints of the color transparencies for days 20 and 38 with the corresponding acetate overlays (at right) showing blackheads present on day 1 (#1 to #20) and still present on days 20 and 38, and some blackheads which first became visible during the study (#21 to #30). Identification numbers are immediately to the right or connected to the comedo by a line.

According to the color transparencies of open comedones #1 to #30, no blackhead decreased in diameter and all continued to enlarge somewhat until inflammation occurred. Open comedo #15 (Fig. 2), which had a particularly long uninflamed period, had a typical gradual increase in diameter.

During the study, 10 other lesions first appeared inflamed and became pustular. Since they were not preceded by visible blackheads, they presumably evolved from closed comedones that were not apparent on our photographs of unstretched skin. The data (Fig. 4) on these 10, presumably closed, comedones cover only the photographically visible inflamed and pustular phases of their evolution.

GENERAL DISCUSSION

The findings of this photographic study, though derived from one patient, support clinical observations that untraumatized blackheads frequently become inflamed and pustular. They confirm the study of Lowney et al. (1964) who found that the removal of open and closed comedones reduced the incidence of inflamed lesions.

In a study of experimentally induced acne by penta- and hexachloronaphthalenes, Shelley and Kligman (1957) described blackheads becoming inflamed and then pustular within four to six months of induction. These investigators interpreted the eventual inflammation of the blackheads to be due to rupture of the follicular wall induced by the primary toxic effect of the chemical. More-

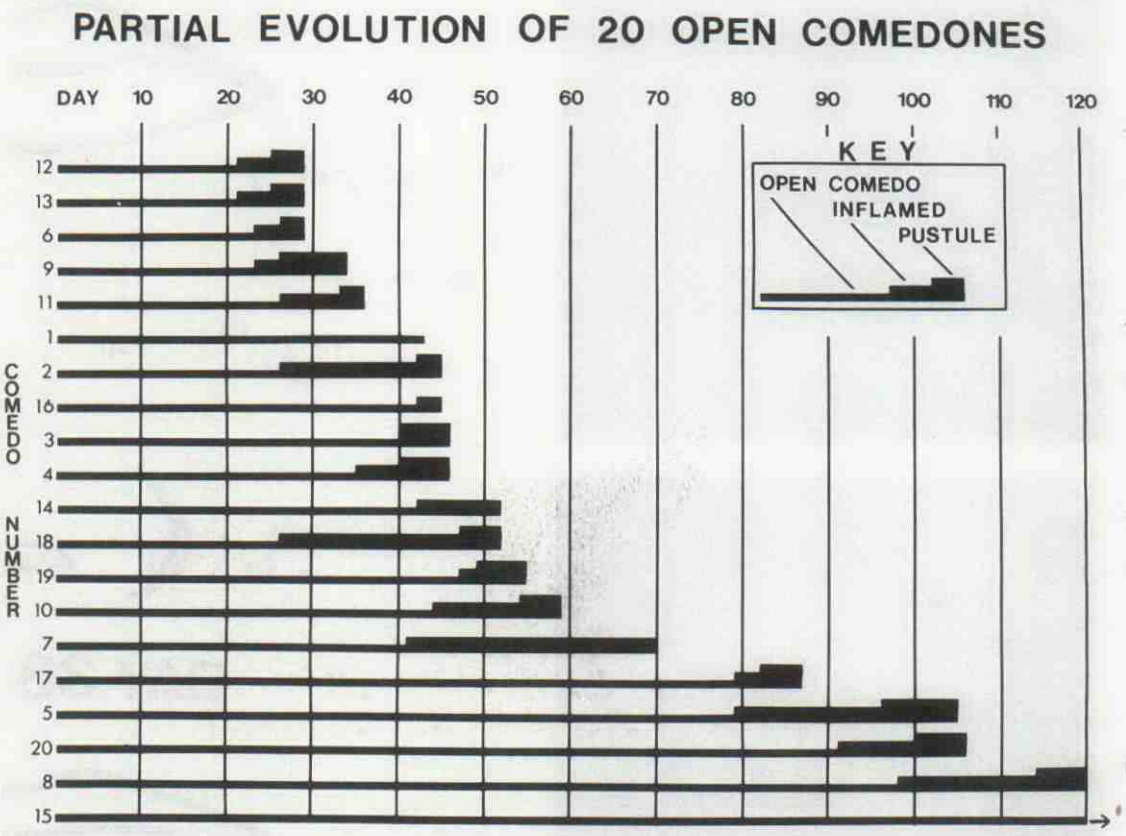

FIG. 2: Progression of 20 open comedones from their uninflamed stage (partial duration) through pustulation. Days between photos probably account for missing stages. Blackhead #1 disappeared with neither inflammation nor pustulation simultaneously with the appearance of the pustular phase in #2, less than 2 mm away.

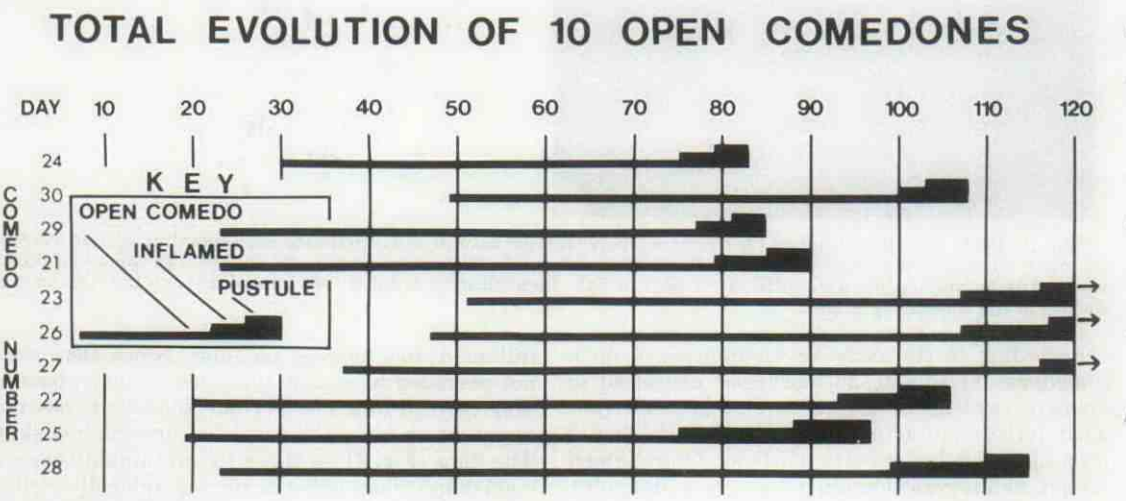

FIG. 3: Progression of 10 open comedones from their uninflamed stage (total duration) through pustulation.

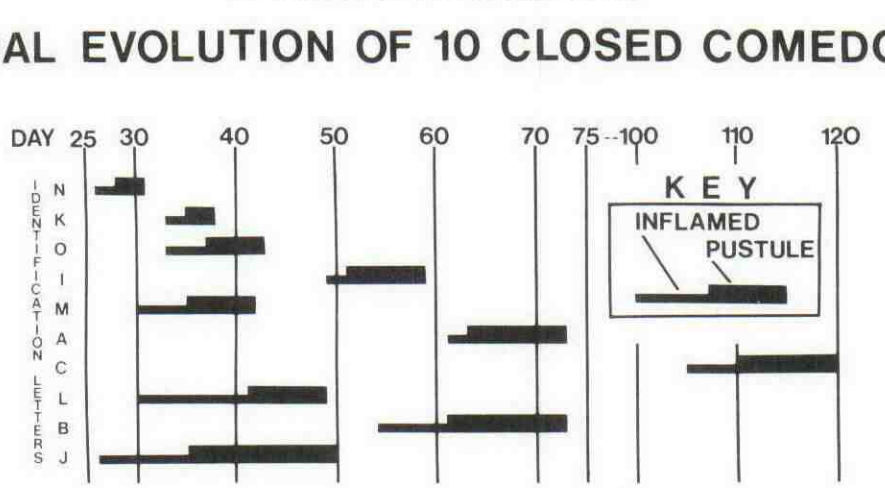

FIG. 4: Inflamed and subsequently pustular lesions that appeared during the study. Since none was preceded by a visible blackhead, all presumably evolved from closed comedones.

TABLE

Average duration of inflammation and pustulation of open and closed comedones

	Average (days)	Range (days)
Open Comedones (Figs. 2, 3)		
Average duration of inflammation (27 comedones)	8.6	2–29
Average duration of pustulation (24 comedones)	5.2	3–9
Average duration of pustulation and inflammation (23 comedones)	13.3	6–26
Closed Comedones (Fig. 4)		
Average duration of inflammation (10 comedones)	4.9	2–11
Average duration of pustulation (10 comedones)	8.2	3–15
Average duration of inflammation and pustulation (10 comedones)	13.1	5–24

over, Shelley and Kligman stated that the inflammation of open comedones in chloracne constitutes an important specific distinction between chloracne and acne vulgaris. On the other hand, our data suggest that inflammation is characteristic of comedones in both types of acne even though the exact cause of inflammation in blackheads probably differs in chloracne and acne vulgaris.

Our photographic study corroborates the prolonged duration of uninflamed blackheads. For example, blackhead #8 (Fig. 2) was present at least 98 days before becoming inflamed. Such protracted periods of noninflammation in some comedones may have led to the erroneous conclusion that untraumatized open comedones of acne vulgaris rarely become inflamed.

The Table shows the average duration of inflammation and pustulation of open and closed comedones in this study. Open comedones appear to have a longer period of inflammation and a shorter period of pustulation than closed comedones. However, when the periods of inflammation and pustulation are averaged, there is no significant difference between the evolution of blackheads and whiteheads since both tend to resolve in an average 13 days from the start of inflammation. Pochi (1972) has also observed that "individual inflammatory lesions tend to heal within two to three weeks."

IMPLICATIONS FOR TREATMENT

Strauss (1971) has stated a widely held theory that "the removal of open comedones does not materially influence the course of the disease since these lesions do not become inflammatory." He does, however, recommend that they be removed "for cosmetic purposes" and asserts that closed comedones should be removed to prevent rupture.

Decades ago the removal of open comedones was held to be prophylactically sound because of their tendency to inflame (Radcliffe-Crocker, 1905; MacLeod, 1926; Kromayer, 1930; Becker and Obermayer, 1947; Sulzberger and Wolf, 1952). More recently, in a bilateral comparison, Lowney et al. (1964) demonstrated that the nontraumatic removal by pressure extraction of both open and closed comedones was of distinct benefit in noncystic acne. These workers concluded that inflamed acne lesions can evolve from either open or closed comedones and that this evolution can be prevented by evacuating the primary lesion.

We consider acne vulgaris to be a disorder of the pilosebaceous units (mainly of the face, chest, and back) in which the lesions usually start as open or closed comedones, evolve into inflammatory papules and pustules that either resolve to macules or go on to secondary pyoderma that results in various sequelae. Concomitantly, acne can be associated with an inflammatory, necrotic reaction to detritus (keratin and bacteria) entrapped beneath the surface of the skin. This type of acne occurs mainly in patients with tunnel scars with multiple ostia that are the result of physiologic,

epidermal containment of contiguous acne pustules. Surgical revision of these tunnel scar formations is required if chronic recurrence of detritus encystments is to be prevented.

Barring total prevention, the goal of the treatment of acne vulgaris is to arrest, as early as possible, the natural evolution of its lesions, both individually and collectively. The findings of Lowney et al. (1964), together with our photographic study and clinical observations, cause us to conclude that the complete removal of open and closed comedones with the least possible trauma is of benefit because it prevents the evolution of these primary lesions into inflammatory papules and pustules. Our observations also indicate that open comedones increase in diameter with time and that those of longer duration tend to have a longer period of inflammation and pustulation. Since prolonged pustulation is surely associated with increased scarring, the early removal of open comedones is particularly advantageous.

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