

SCANNING ELECTRON MICROSCOPY OF TERMINAL PARTS OF HAIR IN INDIAN GIRLS

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Scanning electron microscopy of the terminal part of hair taken from Indian girls who complained of terminal splitting of their hair, shortening of the hair lengths and loss of small fragments of hair, revealed longitudinal splitting of the terminal part of the hair into two fragments characteristic of trichoptilosis. In addition, these hair had a localized spot a few millimeters proximal to the distal end of the hair which revealed splintering of the hair shaft into multiple fragments which joined again at a lower level. These changes are characteristic of trichorrhexis nodosa and this is considered to be responsible for the breakage and loss of small fragments of hair.

Key words: Terminal trichoptilosis, Preterminal trichorrhexis nodosa, Scanning electron microscopy, Hair.

Most Indian girls complain of splitting at the distal ends of their scalp hair and believe erroneously that the hair stops growing in length once the end splits into its fragments. Some of these girls even report shortening of the length of their scalp hair and loss of small fragments of the hair. Macroscopic examination of the hair reveals that the terminal end of the hair has split longitudinally (terminal trichoptilosis) and most of these hair also show a whitish nodular spot a few millimeters proximal to the site of trichoptilosis. A slight pressure on the distal end of the hair reveals that this white spot is actually a weak spot on the hair shaft because the hair can be bent into an acute angle at this spot. This has been referred to as the sign of coudability by Shuster.¹ A slight traction on the hair distal to the white spot leads to breaking off of the distal part of the hair at the site of this white spot. Light microscopy reveals that terminal trichoptilosis is constituted by a longitudinal splitting of the hair shaft into two and rarely more fragments, while the whitish spot prox-

imal to the trichoptilosis consists of a brush-like splintering of the hair shaft — a finding characteristic of trichorrhexis nodosa. If the hair has already broken off at this point, the distal end of the remaining part of the hair shows finger-like processes projecting from the end.

These changes are seen in almost all girls who do not trim their hair, but some girls have this change in most of their hair while others have it in only some of their hair. There is no known treatment for this condition. Most individuals apply a lot of oil on their hair. This masks the terminal splitting, and the hair in addition stick to each other and each hair acts as a splint for the other hair. Alternatively, the distal parts of the hair are cut off with scissors to remove the defective parts and this process is repeated as and when the distal ends develop the same pathology again.

Recently, we had an opportunity to examine these hair under the scanning electron microscope, the findings of which are interesting to report.

Materials and Methods

The terminal portion of the hair bearing the terminal trichoptilosis and preterminal trichorrhexis from 3 patients were subjected to

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scanning electron microscopy. The patients were advised to shampoo their hair thoroughly and not to apply any oil. Relevant portions of the hair having the macroscopic evidence of terminal trichoptilosis and preterminal trichorrhexis were cut with scissors for examination under the scanning electron microscope.

The hair specimens were mounted on a plain face stub at their two ends with the help of an adhesive tape. The specimen was then coated with a conducting layer of silver upto a thickness between 150 and 200 nm. Specimen stub was rotated several times during the process to ensure that the surface of all parts of the specimen becomes coated with the silver metal. After coating, the stub was placed inside the instrument chamber and scanning was carried out using stereoscan S4 10 scanning electron microscope. Suitable pictures at desired magnifications were taken.

Results

The scanning electron microphotograph of the hair at the site of the whitist spot (the pre-

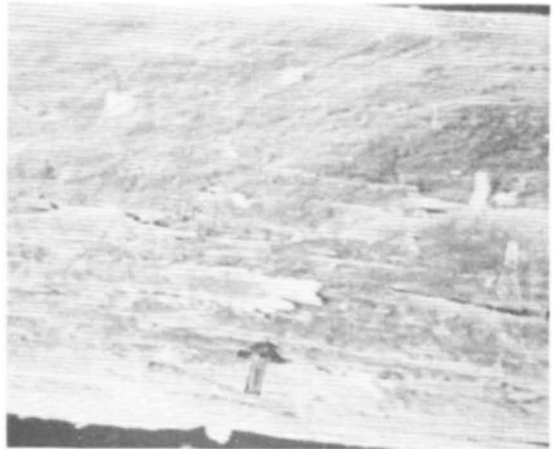


Fig. 2. Earliest change of trichorrhexis with separation of only a few fibres (Scanning electron micrograph, X 455).

terminal trichorrhexis), revealed (Fig 1) multiple fibrils getting separated from the main hair shaft above the whitist spot and rejoining the shaft below this spot. The cuticular scales were absent on this part of the hair. Fig 2 seems to be the earliest change where only some of the hair fibres can be seen to be separating from the main hair shaft. Fig 3 represents the end

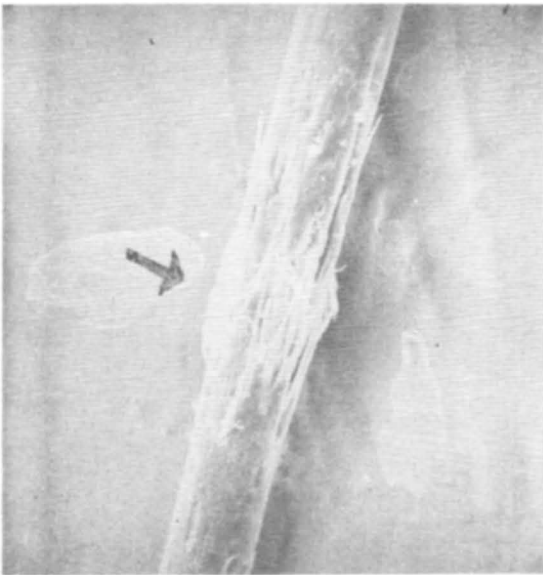


Fig. 1. Preterminal trichorrhexis revealing separation of several fibrils from the hair shaft (Scanning electron micrograph, X 85).

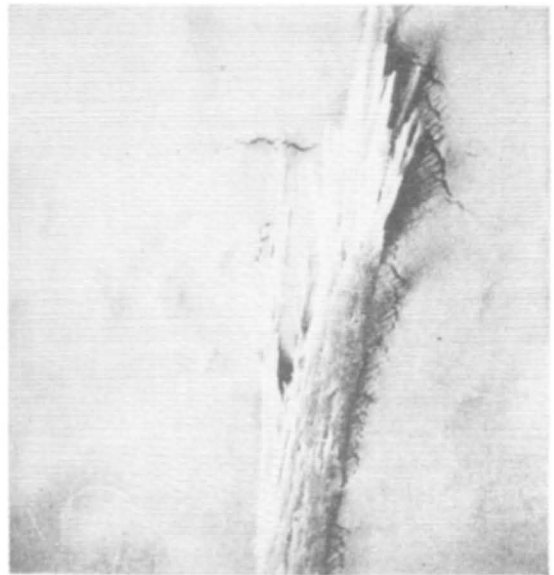


Fig. 3. The point of trichorrhexis from where the distal hair fragment has broken off (Scanning electron micrograph, X 85).

of the hair from where the distal hair fragment has already broken off at the point of preterminal trichorrhexis. This end of the hair is seen as a brush-like splintering of the hair shaft into its fragments. Fig 4 is the distal part of the hair which shows splitting of the hair shaft into two fragments (trichoptilosis) and a spot of trichorrhexis on the larger hair fragment

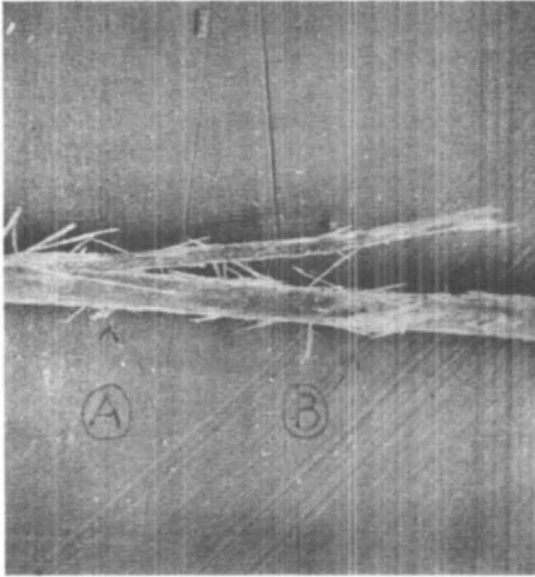


Fig. 4. Splitting of the hair into two fragments (terminal trichoptilosis) (A). A spot of trichorrhexis is also visible on the larger hair fragment (B) (Scanning electron micrograph, X 85).

Comments

Scanning electron microscopy confirms that the distal part of the hair shaft undergoes two types of changes, (1) terminal trichoptilosis in which the hair shaft splits into two fragments longitudinally, and (2) preterminal trichorrhexis in which the hair shaft fragments into several brush-like splinters. Since these changes are seen only at the distal end of the hair which is the oldest part of the hair, these are most probably degenerative in nature. Moreover, because most of the hair in almost all the individuals show these changes, this is

perhaps a normal degenerative phenomenon meant for restricting the length of the hair. The more effective mechanism for the loss of hair no doubt is the telogen hair loss.

The pathogenesis of trichoptilosis and trichorrhexis may not be significantly different because in both these conditions the hair splits into its components, two in trichoptilosis and several in trichorrhexis. This may be initiated by the loss of cuticular scales followed by dissolution of the intercellular or interfibrillar cement of the hair fibres. The role of detergents and/or other factors in causing this change needs investigation. Owens and Chernosky² reported reproduction of trichorrhexis by mechanically rubbing the normal hair in a specially designed apparatus, while some others have observed these changes in disorders of aminoacid metabolism such as Netherton syndrome³ and argininosuccinic aciduria.⁴⁻⁶ Trichorrhexis has also been noticed in association with 20 to 33% cases of alopecia areata but rarely due to other causes.^{8,9}

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