

Ascorbic acid and wound healing
pharmacodynamic effect
punch biopsy
staining with toluidine blue

Effect of ascorbic acid on oral healing in guinea pigs

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Summary: Gingival wound healing was graded in days by the disappearance of connective tissue staining (1% toluidine blue) following a standard wound in 12 guinea pigs subsisting on a vitamin C deficient diet. In the group with no ascorbic acid supplement, the mean healing time was 16.7 days. The second group receiving, intraperitoneally, 2 mg per day (the amount allegedly required to prevent scurvy), healed in 12.0 days. In a third group administered 20 mg vitamin C each day intraperitoneally, the mean healing time was 8.0 days.

Introduction

A considerable volume of research data has been published concerning the importance of ascorbic acid in the formation of collagen (Glickman [2, 3], Woodruff [8], Hunt and Paynter [4], Thomas et al. [7]) in scorbutic animals. On the other hand, the dental and medical literature is practically devoid of data pertaining to a relationship between ascorbic acid and the clinical evaluation of wound healing in relatively healthy animals. This study was designed to demonstrate the effect of ascorbic acid supplementation upon the speed of oral healing in presumably well guinea pigs. Since ascorbic acid metabolism is very similar in guinea pigs and human beings, the horizons of applicability of this data may possibly be extended to the tissue healing potential of the human subject.

Materials and Methods

After one week on a stock diet, three groups of guinea pigs (each with four 400 g animals) were placed on an ascorbic acid deficient diet (Nutritional Biochemical Corporation).

Group I received no ascorbic acid supplement. Each guinea pig in Group II was injected, intraperitoneally, with two mg of ascorbic acid per day. This quantity is regarded as the amount required to prevent any macroscopic or microscopic evidence of scurvy (Cowan [1]). Each animal in Group III received, intraperitoneally, twenty mg of ascorbic acid per day, which is considered the amount required to produce tissue saturation [1]. On the first experimental day (ascorbic acid deficient diet), a circular punch biopsy, two millimeters in diameter, was

made on the mandibular labial gingiva extending down to the alveolar bone. To evaluate oral healing on the first postoperative day and each succeeding day, the wound was cleansed with a cotton applicator soaked in 1 per cent acetic acid and stained with 1 per cent toluidine blue for one minute. The wound and surrounding mucosa were then cleansed with a 1 per cent acetic acid solution to remove the excess toluidine blue (Speed [6]). A daily color photograph was taken of each wound immediately after the staining procedure.

Results

Toluidine blue stains the exposed connective tissue upon application (Figure 1). As the epithelium covers the wound the amount of vital staining decreases. Healing was considered complete when the biopsied area was covered. Toluidine blue does not stain the intact epithelium (Figure 2). The clinical healing time for each animal may be observed in Figure 3. The mean healing time in days for Groups I, II, and III were 16.3 ± 1.5 , 12.0 ± 1.4 and 8.0 ± 0.8 .

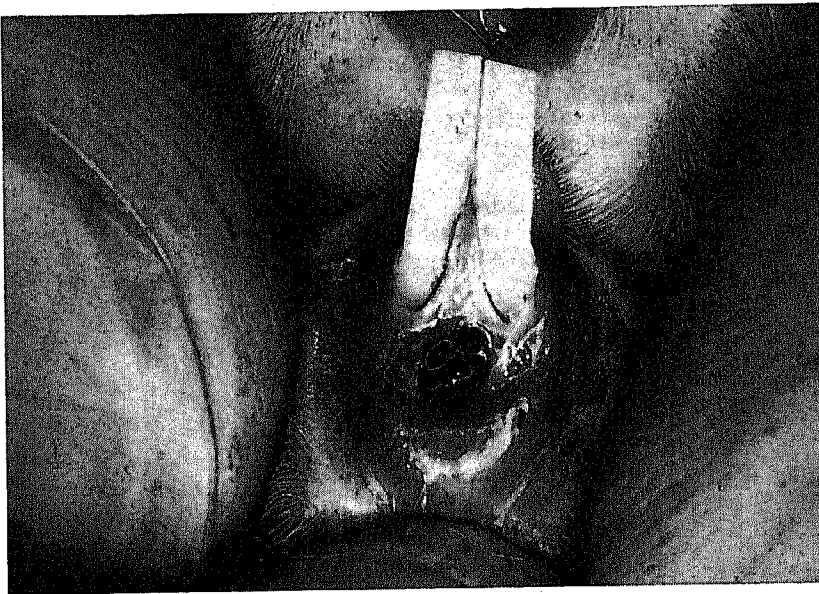


Figure 1. Wound site on the labial mandibular gingiva stained with 1 per cent Toluidine blue

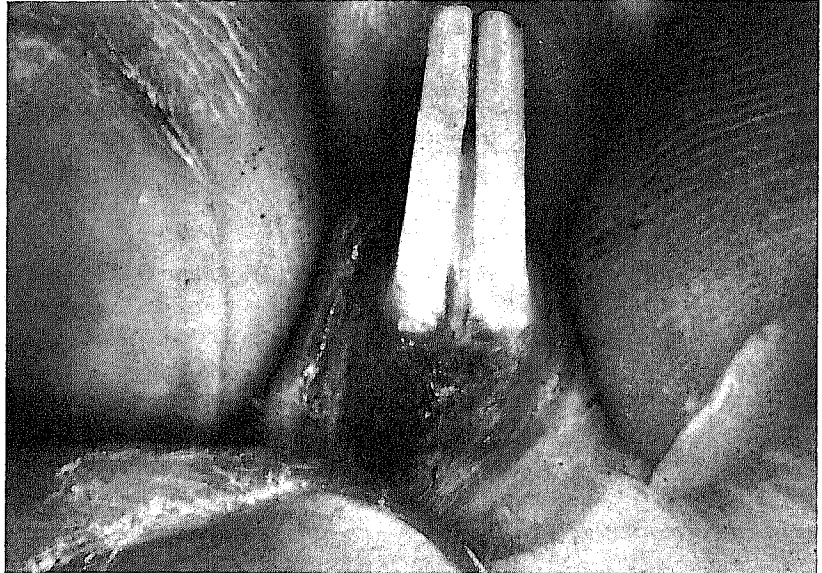


Figure 2. Healed wound site on the labial mandibular gingiva stained with 1 per cent Toluidine blue

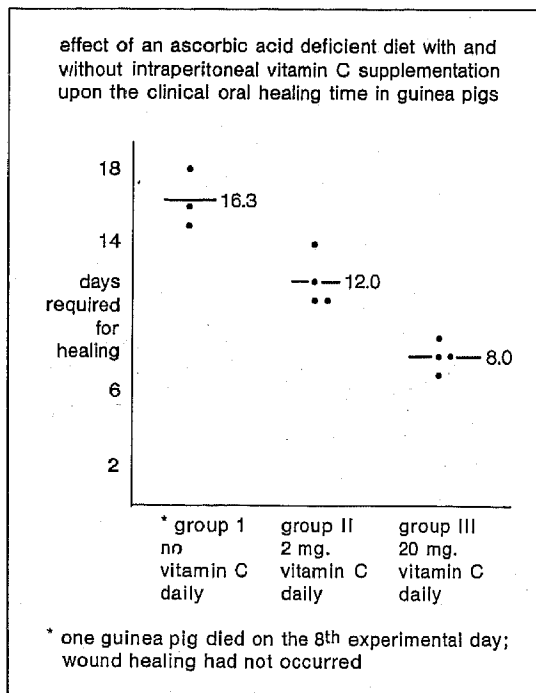


Figure 3. Vitamin C supplementation and clinical oral healing

Discussion

Not only has there been a lack of interest in the role of ascorbic acid in clinical healing, but its therapeutic supplementation following surgical procedures has not been recognized as necessary except in the occasional obvious scorbutic. Recently, the combination of calcium and ascorbic acid has been found to accelerate the rate of fracture repair in experimental animals by almost 25 per cent (Singh and Udupa [5]).

The results from this study seem to indicate that clinical healing is enhanced by a minimal ascorbic acid intake (as in Group II) but is further improved following greater supplementation (as in Group III). In the light of these data, one might speculate as to the possibility of decreasing the average oral postsurgical healing time in humans with ascorbic acid supplementation.

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