

Reaction of the Human Gingival Tissue to Different Suture Materials Used in Periodontal Surgery

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The gingival reaction to 4 different suture materials used in periodontal surgery was studied in 36 patients. The gingiva was sutured prior to surgery and biopsies were taken at 3, 7 and 14 days to observe the tissue reaction. The histological examination showed that silk caused the most intense and longest inflammatory response. Polyester and perlon provoked shorter, less intense tissue reactions than silk, and nylon caused the least inflammatory response, with earlier tissue repair.

Key Words: suture materials, gingival reaction, periodontal surgery.

Introduction

The correct approximation of the edges of a wound during flap periodontal surgery is essential for the success of this technique, because it favors hemostasis, nutrition and repair. This close approximation of the tissues is achieved by suturing, which is thus a very important surgical step in hastening the healing of the surgical wound (Castro et al., 1974; Chambrone et al., 1982; Carvalho et al., 1986).

This fact has led to concern about that matter, supported by clinical and experimental observations on different aspects of suturing, especially on suture materials (Káclová and Janoúsková, 1965; Bergenholtz and Isaksson, 1967; Lilly, 1968; Chambrone et al., 1982; Cerqueira Luz, 1983; Oliveira et al., 1985), due to the possibility that its natural and physical properties interfere with the desired results (Lilly, 1968). It is important to know how the tissues react in the presence of different materials employed in the manufacturing of sutures.

There are a variety of suture materials proposed and available for oral surgery, which may be classified according to their origin, organic or synthetic, or according to their permanence in the tissue, absorbable and nonabsorbable. These details, as well as the type and the site of the operation, must be taken into consideration when sutures are used (Carvalho et al., 1986). This fact is important because sutures cause different reactions when they are superficial or deep (Castro et al., 1974), intraoral or extraoral (Cerqueira Luz, 1983). Lilly (1968) emphasized that the reaction of the oral tissue to sutures is different from that of other sites.

The suture materials most frequently studied, especially in terms of their tissue response, are cotton, silk, polyester, nylon, catgut and polyglycolic acid. Most of these studies have been performed in laboratory animals and the results may be considered inconclusive or conflicting (Castelli et al., 1978a,b; Oliveira et al., 1985).

The clinical studies that have been carried out in humans have presented contradictory results. Thus, while Liedke et al. (1974) affirm that linen is the most secure suture to be used in the oral cavity, Silva (1976) concludes that the monofilament nylon suture is the one which provokes a tissue reaction more compatible with the healing process. Wallace et al. (1970), testing sutures prior to several types of oral surgery, found that polyglycolic acid evoked less tissue response than silk and catgut, while Cerqueira Luz (1983) found that nylon, silk and catgut sutures provoke a similar response.

Therefore, taking into consideration that there is little research about the reaction to sutures in the human oral cavity, and that the results of these studies showed a variety of responses in extra- or intra-oral conditions (Lilly, 1968; Cerqueira Luz, 1983), as well as at different sites in the oral cavity (Castelli et al., 1978a,b), it seemed important to investigate this field. This importance is reinforced if one considers that sutures are largely employed in periodontal surgery, and studies under such conditions are practically nonexistent. Thus, the objective of the present investigation was to study the reaction of human gingiva to different types of sutures used in periodontal surgery.

Material and Methods

This study was carried out on 36 patients of either sex, 15 to 45 years old, suffering from no evident systemic disease, and with indication for surgical periodontal treatment. Data from personal history, clinical and radiographic examination, as well as the planned treatment, were recorded. Basic procedures of periodontal therapy, such as scaling and smoothing of the dental roots and crowns, were performed.

Four types of surgical sutures (Cirurmédica S.A.), acquired from the same batch, were used: 1) black siliconized braided silk, 2) green siliconized braided polyester (Surgilene), 3) single multiple-filament black perlon (Supramid), and 4) monofilament black nylon (Supelon).

All sutures used were 3-0, 45-cm in length, with a 3/8 circular, 19.5-mm triangular-pointed needle.

Surgical cement (Duradent, Odonto Comercial Importadora Ltda. S.A.) was used to protect the surgical area during the experimental periods of observation, being removed on the 7th day in the cases where biopsies were to be performed on the 14th day.

To avoid the adherence of the cement to the sutures during its permanence on the gingiva, a Dryfoil type adhesive shield (J.F. Jelenko & Co., NY, USA) was applied to prevent the direct contact of the region with the cement, which could irritate the tissues, causing secondary reactions and interfering with the results.

Interrupted suture was performed at the surgical area (Figure 1), in such a manner that the stitches reached the connective tissue but not the periosteum of the attached gingiva. The sutures were applied with sufficient tension to prevent loosening and separation of the stitches from the gingiva, but without producing local ischemia or tearing of the tissues. The physical characteristics of each suture material determined the type of surgical knot used: double-knot for silk and triple-knot for polyester, perlon and nylon.

The sutures were all performed by one surgeon, at least two weeks after the basic treatment and before the surgical operations, which were performed on the 3rd, 7th and 14th

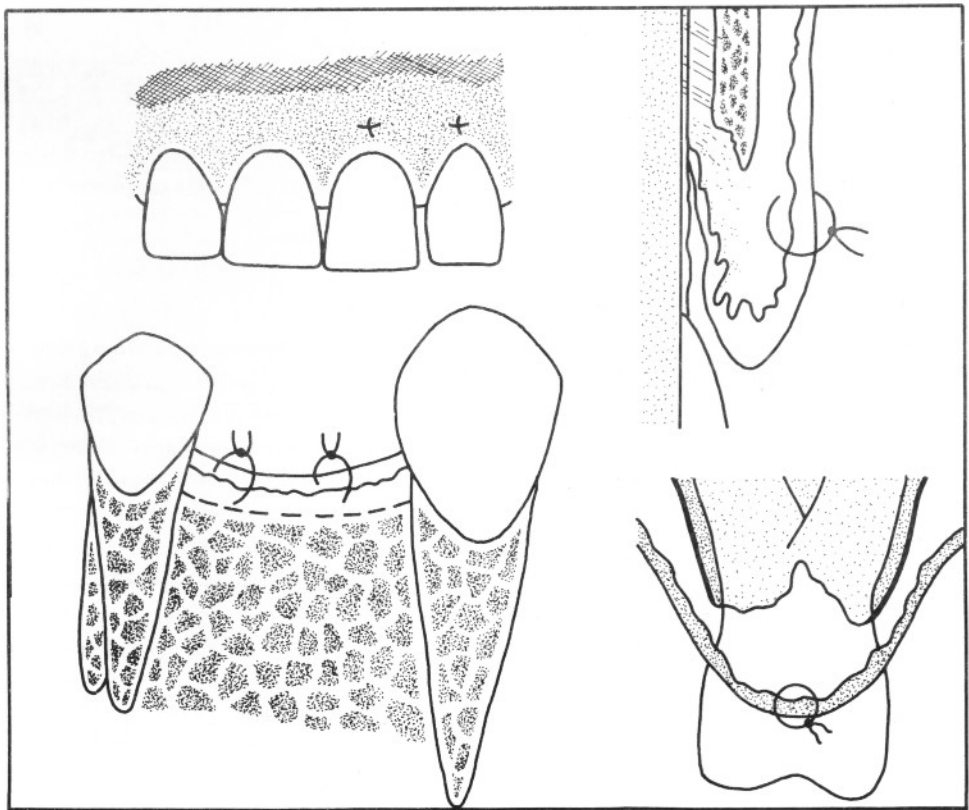


Figure 1 - Sites where the sutures were performed.

day, according to the time pre-established for biopsy (Table 1). The specimens were removed by linear incisions, with the gingival tissue and the sutures in a single piece. The total number of specimens is given by the factorial product: $4 \times 3 \times 3 = 36$.

Table 1 - Distribution of patients according to type of suture used and time of observation.

Suture material	Days			Total
	3	7	14	
Silk	3	3	3	9
Surgilene	3	3	3	9
Supramid	3	3	3	9
Superlon	3	3	3	9
Total	12	12	12	36

The specimens were then codified, fixed in 10% formalin for 24 hours and routinely processed for histological examination (paraffin embedding, 6- μ m semi-serial sections, hematoxylin-eosin staining technique).

Results and Discussion

The tissue reactions determined by the presence of the sutures in the *lamina propria* of the gingiva revealed that silk was the material which provoked the greatest initial inflammatory response and the slowest healing process. In the early stages of the tissue reaction, a dense acute inflammatory infiltrate was observed, which persisted throughout the intermediate stage, although with less intensity (Figure 2).

Farther from the sutures, the connective tissue exhibited a less intense inflammatory reaction, but maintained the same histological pattern. Even though fibroblasts and new capillaries could be seen during the intermediate stage, the connective tissue observed at the later stages was evidently still little organized (Figure 3).

This response of the tissues to the silk sutures agrees with most of the observations made on animals or humans, in which silk has been considered to be a material that induces unsatisfactory tissue reactions (Lilly, 1968; Salazar Martinez, 1971; Silva, 1976; Castelli et al., 1978a,b; Oliveira et al., 1985).

As compared to other suture materials, the existing data reveal that silk provokes more severe tissue reactions than synthetic materials (James and MacLeod, 1961; Káčlová and Janoušková, 1965; Bergenholtz and Isaksson, 1967; Lilly, 1968; Wallace et al., 1970;

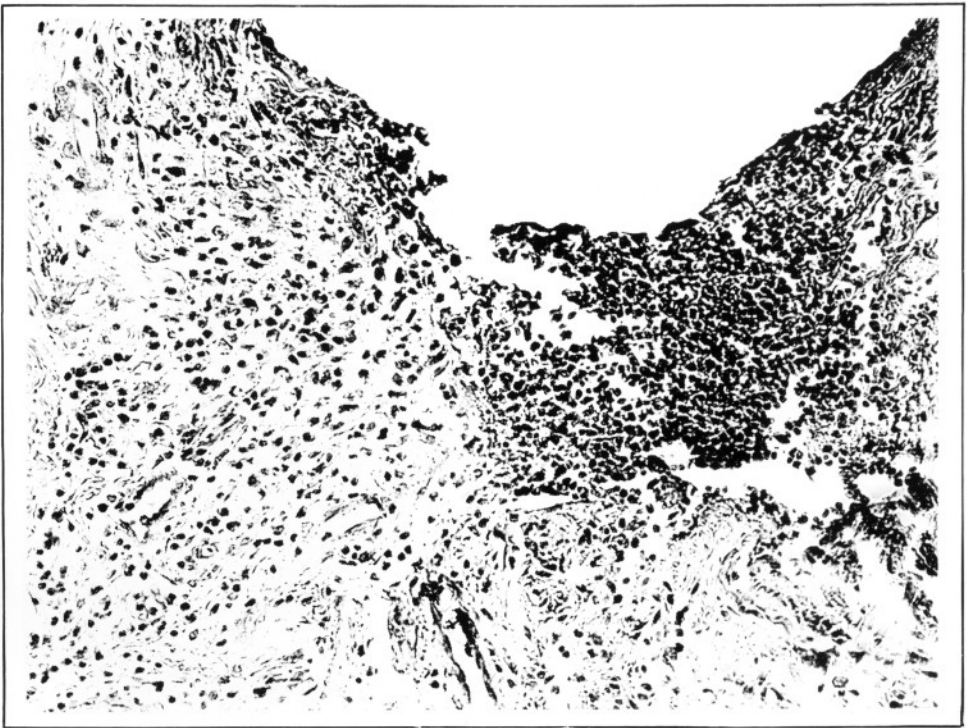


Figure 2 - Silk suture, 3 days. Note the presence of a large number of neutrophilic polymorphonuclear leukocytes close to the suture. H + E, 250 X.

Salazar Martinez, 1971; Silva, 1976; Castelli et al., 1978a,b), a fact also observed in the present investigation, in which the reactions to silk and to polyester, perlon and nylon sutures were compared.

These comparisons were possible because, although black siliconized silk sutures had been used in this research, the studies by Janes and MacLeod (1961), Postlethwait et al. (1962) and Lilly et al. (1969) demonstrate that there are no remarkable differences between the tissue reactions provoked by colored, waxed or siliconized silk and untreated silk.

The results of the present investigation indicated that the tissue reaction to polyester sutures was less intense and the proliferative phenomena occurred earlier than with silk sutures, inasmuch as in most cases an inflammatory infiltrate (with moderate numbers of lymphocytes, plasma cells and macrophages) predominated even at the earlier stages of the healing process, with a number of fibroblasts and new capillaries.

The evolution of the histological picture is characterized by a decrease in the inflammatory infiltrate and by an increase in the number of fibroblasts and new capillaries; the differentiation of the connective tissue begins and some bundles of collagenic fibers are

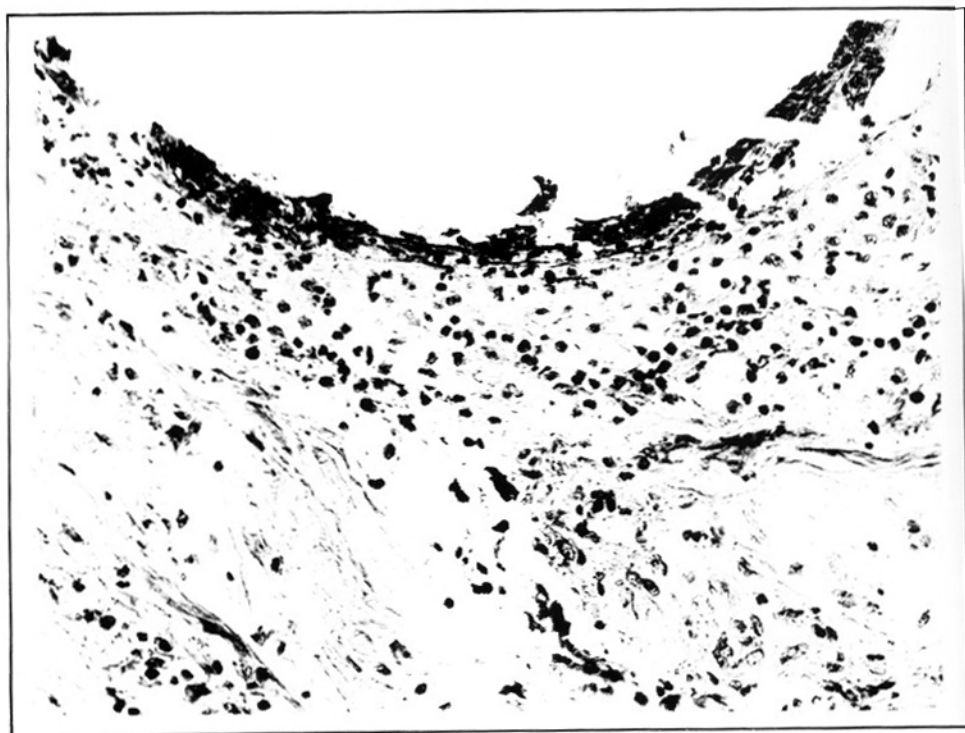


Figure 3 - Silk suture, 14 days. The connective tissue shows a large number of lymphocytes and macrophages, besides some plasma cells and neutrophils. H + E, 250 X.

observed running parallel to the suture (Figure 4). At the end of the period of observation, the healing process appeared histologically more advanced in comparison to the one seen around the silk sutures.

These results are in accordance with the findings of James and MacLeod (1961), Bergenholtz and Isaksson (1967) and Lilly (1968), and confirm the observations of Postlethwait et al. (1975) and Chambrone et al. (1982) that polyester sutures provoke only a slight tissue reaction and present good results with superficial sutures (Cerqueira Luz, 1983; Chambrone et al., 1982).

The comparison of the tissue responses caused by polyester and perlon revealed that there were no relevant differences between them. Near the suture, perlon provoked a more acute early reaction, but in the more distant connective tissue, the histological features were very similar. It is interesting to note that, although the initial reaction to perlon was more acute, the healing process evolved more rapidly than in the polyester response, so that in the final stage the connective tissue appeared more differentiated, with bundles of collagenic fibers surrounding the surface of the sutures.

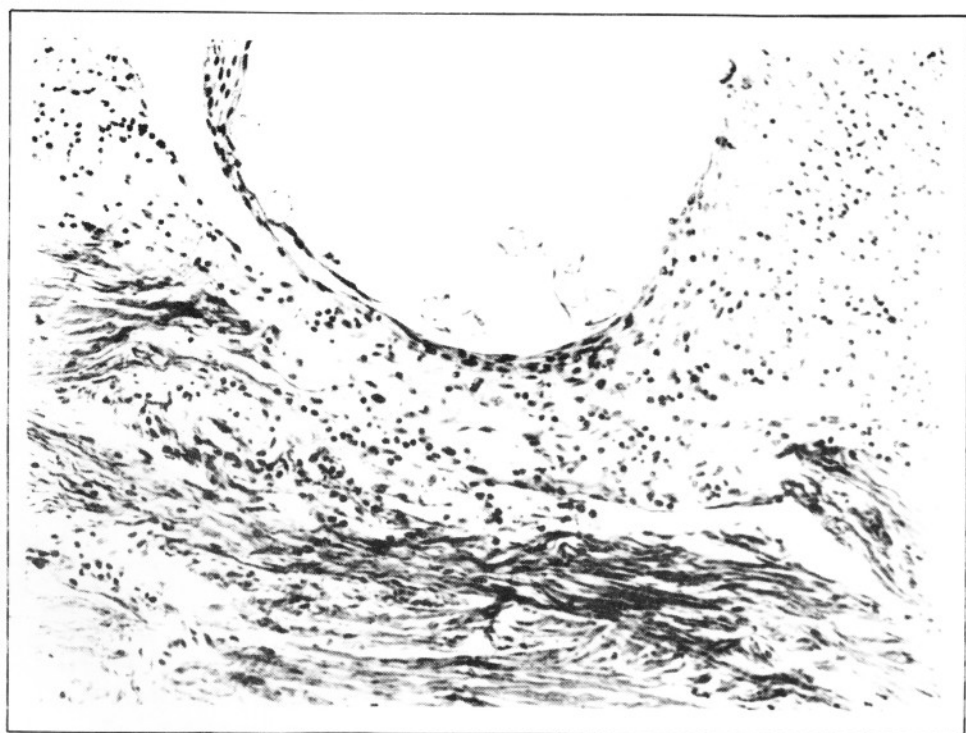


Figure 4 - Polyester suture, 7 days. Observe the presence of bundles of collagenic fibers partially surrounding the suture. H + E, 125 X.

The comparative analysis of the results obtained with perlon is difficult because only one reference to this material was encountered in the literature - an article by Madsen (1958) - in which the author compared this suture with reabsorbable single and chromic catgut, concluding that perlon is superior, producing a less exudative reaction and presenting a better capacity of fixation to the tissues and of maintaining its resistance to tension. However, as this suture is basically multifilamentary in spite of being externally coated, it is possible to extrapolate the results of the present investigation and compare them to those referring to the reaction to this kind of suture.

These results are in accordance to those of James and MacLeod (1961), who used similar suture material (black braided nylon) and noted a considerably less intense reaction to perlon as compared to silk, with little initial inflammatory infiltrate which soon disappeared, giving rise to the proliferation of fibroblasts and to the appearance of a few macrophages. This rapid evolution of the healing activity, also observed in the present research (Figure 5), seems to be a characteristic of multifilament nylon, notwithstanding the

initially more intense reaction at the site of the sutures, a fact also reported by Grossi et al. (1971/1972).

This reaction might be explained by the physical characteristics of the suture, which would be initially those of a multifilament thread - since the coating has little influence on the type of reaction provoked (James and MacLeod, 1961; Postlethwait et al., 1962) - and posteriorly would be the already demonstrated properties of a monofilament artificial thread.

From a biological standpoint, monofilament nylon seems to be the ideal type of suture (Carvalho et al., 1986), and the results of the present research confirm most of the studies concerning the biological connective tissue response of the gingiva to different suture materials.

Thus, during the initial period, the tissue response to nylon was the least of all the inflammatory reactions observed, either near or far from the suture. There was a moderate number of lymphocytes and macrophages (Figure 6) and occasionally some neutrophils and plasma cells, with evidence of a slight proliferation of fibroblasts and new capillaries at some sites.

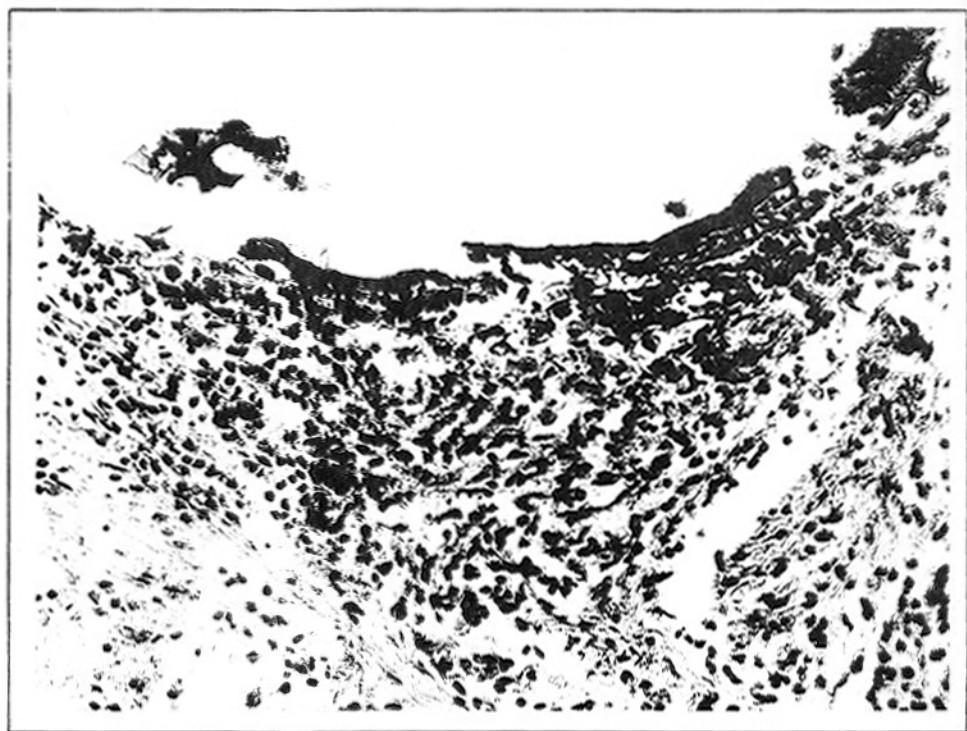


Figure 5 - Perlon suture, 14 days. Note the well differentiated connective tissue both close to and far from the suture. H + E, 250 X.

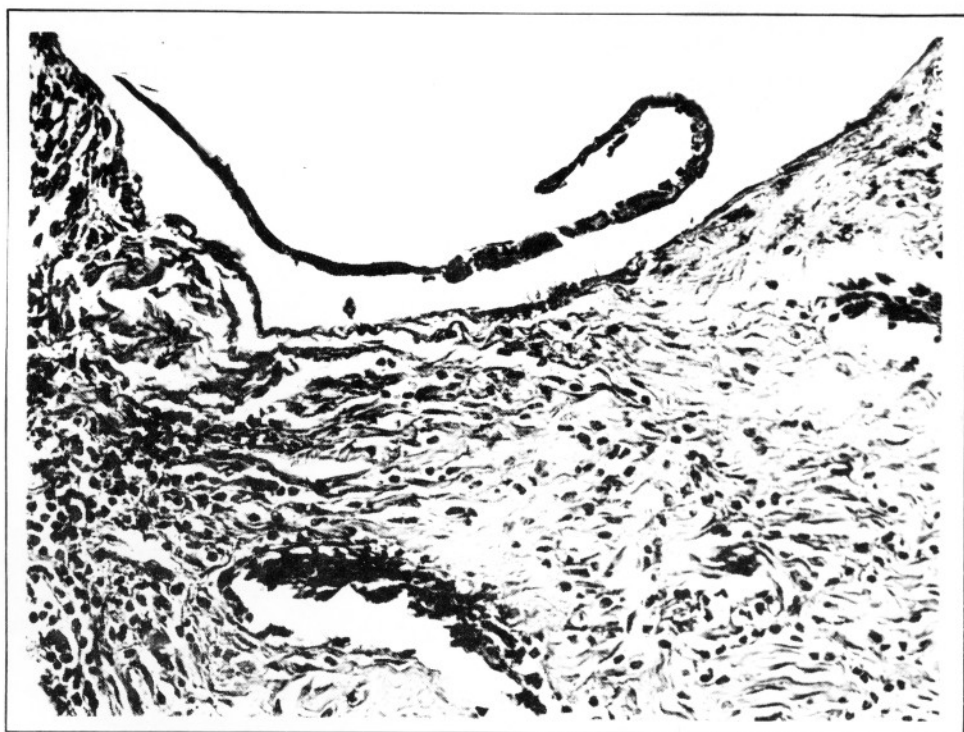


Figure 6 - Nylon suture, 3 days. There is a narrow band of connective tissue with a moderate number of lymphocytes and macrophages. H + E, 250 X.

The healing process is rapidly stimulated and, 7 days after the implantation of the suture, bundles of collagenic fibers are seen running parallel to the surface of the material, with an adjoining mature connective tissue with rare lymphocytes. At the end of the observation period, well differentiated connective tissue is present, in which the bundles of collagenic fibers are dense and parallel to the surface of the sutures (Figure 7).

These results are in accordance with the findings of James and MacLeod (1961), Lilly et al. (1969), Salazar Martinez (1971), Castro et al. (1974) and Castelli et al. (1978a,b) in laboratory animals, and of Postlethwait et al. (1975) and Silva (1976) in humans, in which they verified that monofilament nylon is the suture that provoked the shortest inflammatory reaction, followed by the earliest healing process.

Conclusions

The methodology employed and the results obtained permit the following conclusions:

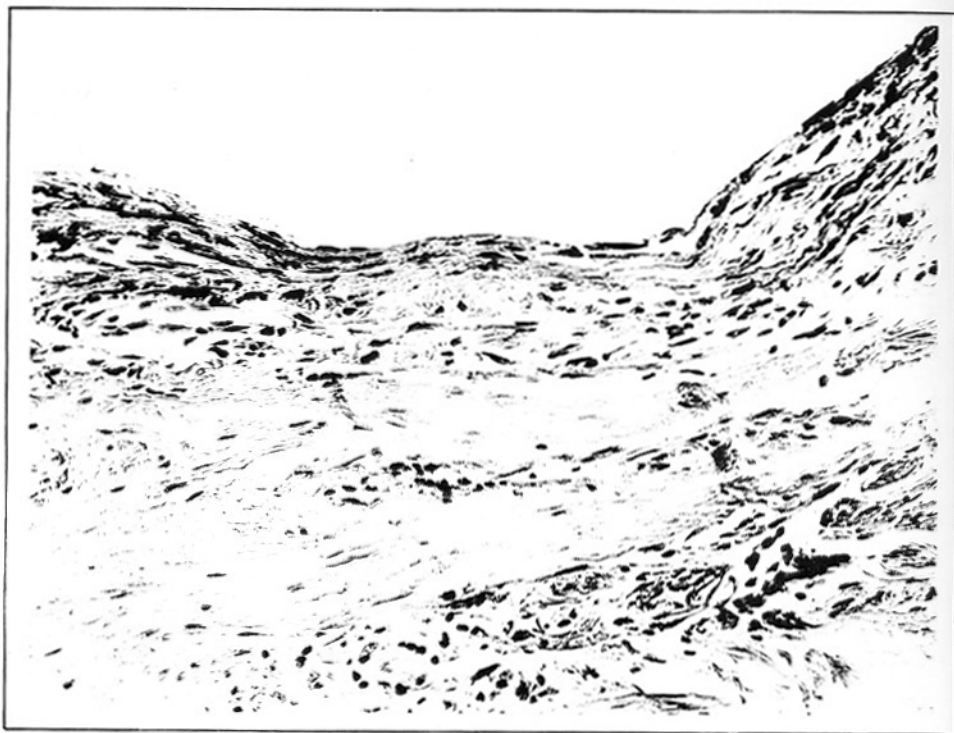


Figure 7 - Nylon suture, 14 days. Observe the well differentiated connective tissue, characterized by the presence of many mature collagenic fibers. H + E, 250 X.

1. Silk sutures caused the most intense and prolonged inflammatory reaction.
2. Polyester and perlon sutures presented very similar results and, in comparison to silk, provoked a shorter, less intense inflammatory reaction.
3. Nylon was the material that caused the least inflammatory response and the earliest healing process.

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