Relation between corroded silver points and endodontic failures

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Several recently published papers have questioned the role of the silver cone as an acceptable root canal filling material because of its susceptibility to corrosion and its inability to adequately seal the root canal. Although the hazard that fluid percolation through a partially sealed apical foramen can lead to corrosion of the silver point and eventual failure of the endodontic therapy, silver cones have been used successfully for many years in endodontic practice. Currently, the use of silver cones is more restricted, although there are special instances in which they can be used to particular advantage, such as filling especially fine or curved root canals. Because of the controversy about the use of the silver cone as a root canal filling material, it was thought that a study concerning the corrosion of silver cones in clinical use and the relationship of corrosion to the success and failure of the treatment would prove enlightening.

MATERIAL AND METHODS

Ten silver cones were removed from the root canals of teeth of patients who had been treated one to six years previously. The treatment was evaluated clinically and radiographically as either an endodontic success or failure based on the following criteria: clinically, the presence or absence of pain, and the state of the periapical tissues; and radiographically, the condition of the periodontal membrane, medular bone, lamina dura, and root. Using these criteria, four cases were considered successes, and six cases were considered failures (Table).

In case 4, the silver cone extended beyond the apex of the palatal root. After removal, the silver cones were analyzed macroscopically. Then they were cut with pliers so that the apical portions could be mounted in 10-mm specimen holders and examined under the scanning electron microscope. In three cases (1,4,10), the surfaces of the silver cones were also studied by electron probe microanalysis in an effort to identify the chemical elements on the surface of the silver cone.

Table • Evaluation of relationship of silver cones to endodontic treatment.

Case no.	Tooth	Length of treatment (years)	Evaluation: (clinical and radiographic)	Macroscopic appearance	Scanning microscope appearance
1	Maxillary right first premolar	2	Success	Cones well-cemented, dry, clean	Signs of corrosion
2	Maxillary left first premolar	5	Failure	Cones underfilled	Signs of corrosion
3	Maxillary left second premolar	5	Success	Cone slightly black	Corrosion
4	Maxillary right first molar	4	Failure	Black, rough notching at apical third	Signs of corrosion
5	Mandibular right second molar	6	Success	Cone well-cemented	Without corrosion
6	Mandibular right first molar	4	Failure	Cones slightly black at apical third	Without corrosion
7	Maxillary right second premolar	2	Failure	Cone unfitted, black, rough	Signs of corrosion
8	Maxillary right first premolar	1	Failure	Cone unfitted, black	Signs of corrosion
9	Mandibular right second molar	5	Success	Cones unfitted	Corrosion
10	Mandibular left second molar	3	Failure	Cones unfitted, slightly black	Without corrosion

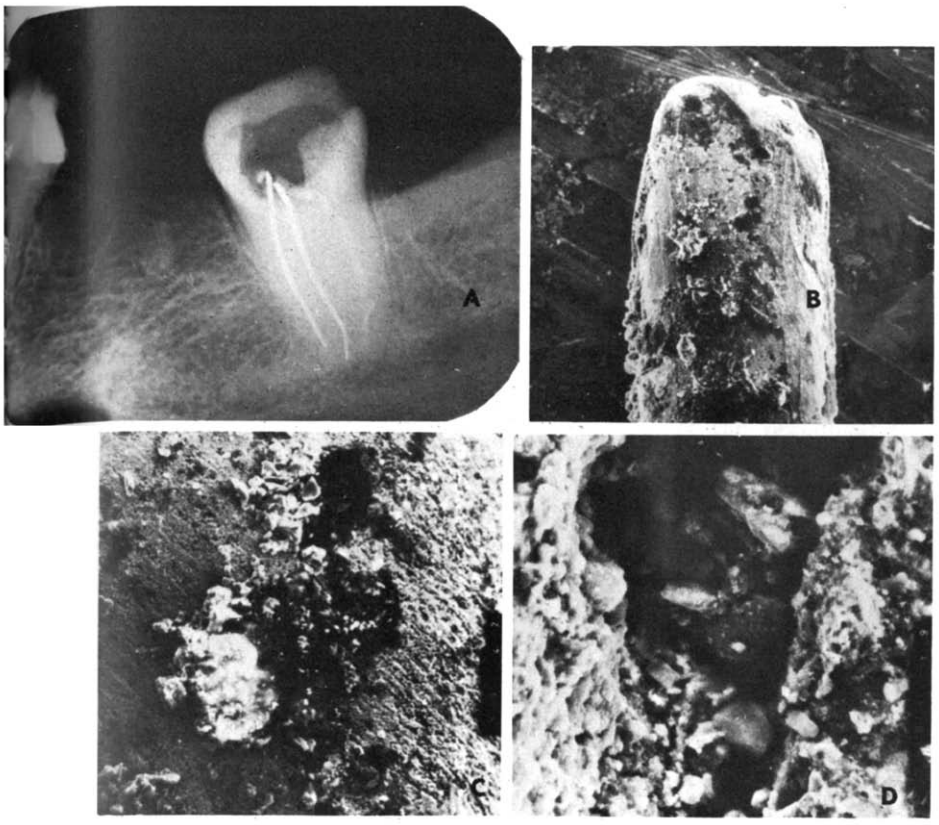

Fig 1—A, radiograph of case 9 shows endodontic success. B, silver cone with corroded areas (orig mag ×300). C, high magnification (orig mag ×2,000). D, higher magnification (orig mag ×4,000).

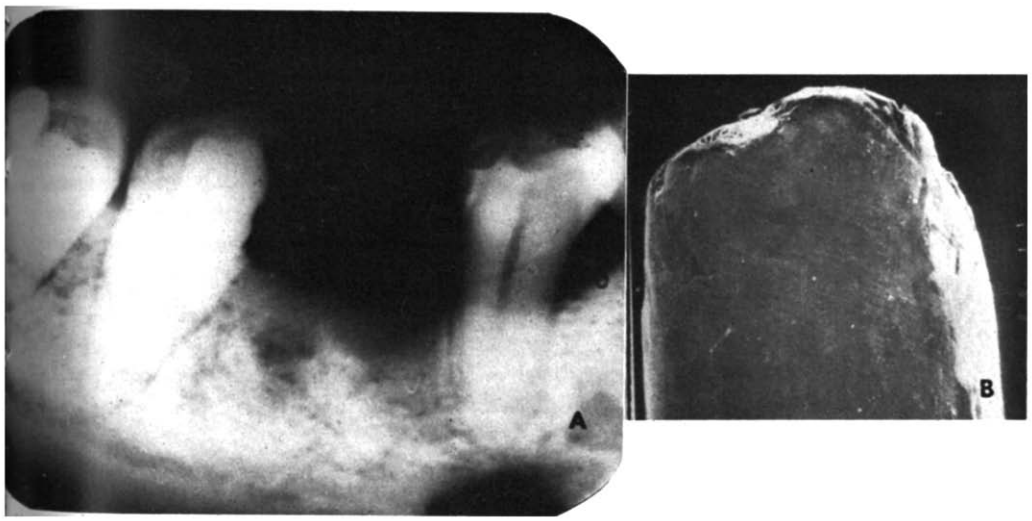

Fig 2—A, radiograph of case 5, evaluated as an endodontic success. B, silver cone without signs of corrosion (orig mag ×1,000).

RESULTS

Corrosion appeared as surface fissures and erosions, which were located mainly in the apical portion of the silver cones. Corrosion decreased considerably toward the middle zone. This was confirmed with scanning microscope examination and microanalytic study.

Of the four cases considered to be clinical and radiographic successes (1,3,5,9), signs of corrosion were observed in three (1,3,9). The remaining case (5) showed no evidence of corrosion (Fig 1,2).

Six cases were considered clinical and radiographic failures (2,4,6,7, 8,10). Signs of corrosion were observed in four (2,4,7,8), whereas the remaining two (6,10) showed no signs of corrosion (Fig 3,4).

Clinically, when the cone was loose within the root canal, without sealer, and could easily be removed, it generally showed some corrosion. The cones that fitted properly and had been correctly cemented showed fewer signs of corrosion, or none at all. In overfilled silver cones, the degree of corrosion was greater, and peeling of the overfilled surface was observed (Fig 3).

The presence or absence of corrosion visible through the scanning electron microscope was corroborated by the microanalysis study in the three cases evaluated with this method.

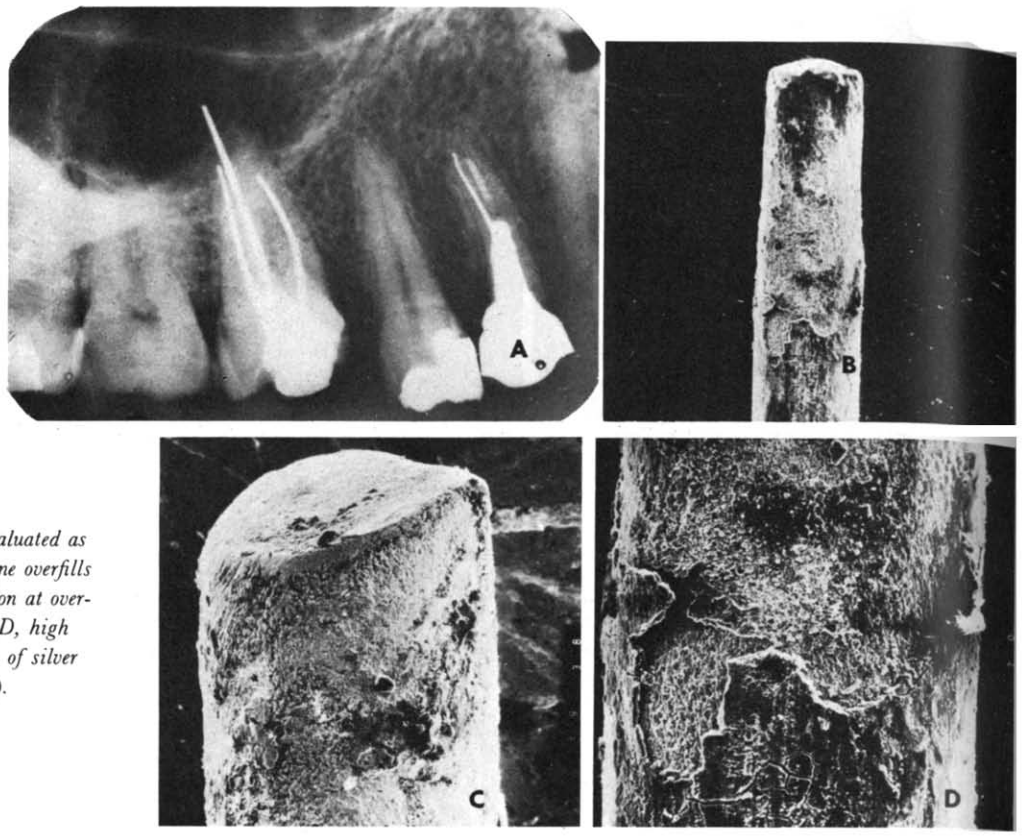

Fig 3—A, radiograph of case 4, evaluated as endodontic failure. Palatal silver cone overfills root canal. B, great signs of corrosion at overfilled portion (orig mag ×80). C-D, high magnification shows peeling surface of silver cone (orig mag ×200 and ×600).

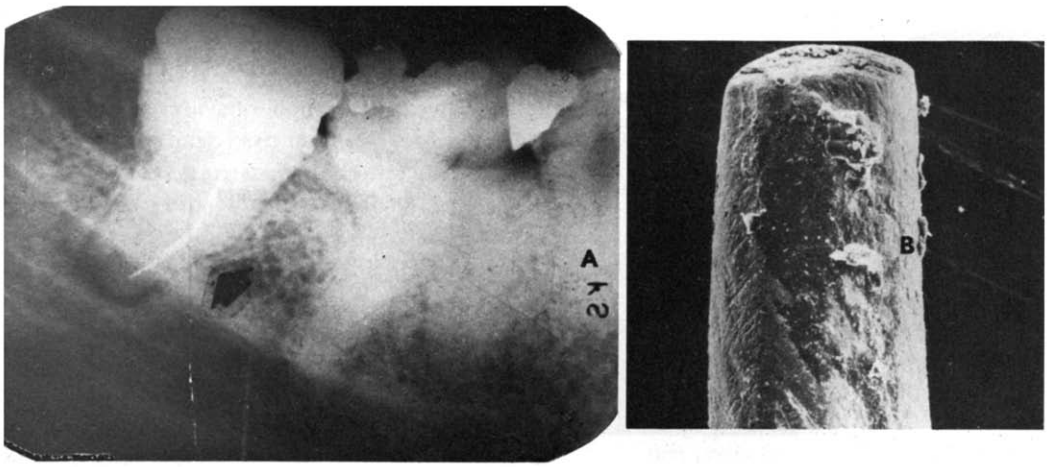

Fig 4—A, radiograph of case 10 evaluated as an endodontic failure. B, distal silver cone without signs of corrosion (orig mag ×400)

Electron probe microanalysis showed the presence of phosphorus, sulphur, chlorine, calcium, and some concentrations of sodium and potassium in the apical portion of two cases (1,4). In both cases, no chemical elements were found in the middle third of the cones. In case 10, only silver was found on the surface.

DISCUSSION

Silver cones have the potential to corrode in the root canal when fluids percolate between the cone and the dentin wall.[1-3] Although it is difficult to achieve a hermetic seal with a silver cone and root canal sealer,[4-6] a correct endodontic filling technique, with the complete closure of the dentinal wall-silver cone interphase, can be achieved to prevent leakage and silver corrosion. When traditional endodontic treatments are analyzed, it is important not to condemn a material or a technique when the real problem may be lack of care taken during operative procedure.[7]

Even in cases in which little corrosion occurs, the material may be tolerated,[3] as long as it is confined to the root canal. The problem of corrosion occurs in overextension, as silver cones remain in close contact with the periapical tissues. In such cases, corrosion is greater. Our observations in cases of overextension confirm those of other authors in regard to surface peeling on the silver cone.[1-3]

In this paper, only clinical and radiographic criteria were used to evaluate successes and failures. Al-

though differences in the results might be obtained if histologic criteria are used,[8] it was convenient to adopt the former criteria because endodontists use them in clinical practice.

The results obtained in this study showed that corrosion of the silver cone occurs in both successful and unsuccessful cases. Similar findings were observed in cones that were not corroded. Several factors may contribute to the success or failure of endodontic treatment, but we think it would be hasty to consider corrosion as the only factor for condemning a filling material or technique used successfully for so many years.

CONCLUSIONS

Although the possibility of corrosion of silver cones must be considered clinically, corrosion is not the sole factor in accounting for endodontic failure. Signs of corrosion are greater in the apical third of the silver cone, in which there is generally an insufficient amount of sealer. The presence of the silver cone in the periapical tissues resulting from overextension represents a clinical problem because, in these cases, the corrosive products might endanger the normal state of the periapical tissues.

SUMMARY

Ten silver cones were removed from teeth treated endodontically and were analyzed using scanning electron microscopy and electron probe microanalysis. In seven of the cones studied, signs of corrosion were found; in the other three, no corrosion was seen. The possibility of corrosion occurring is related to the quality of the endodontic filling technique. The presence of corrosion on the silver cone within the root canal is not the sole determining factor in the success or failure of the endodontic treatment.

This study was conducted at the Scanning Electron Microscopy Department, National Council for Research in Science and Technology, and the Metallurgy Department of the National Council of Atomic Energy, Argentina.

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