

# Retrograde Filling Materials: A Retrospective Success-Failure Study of Amalgam, EBA, and IRM

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**A retrospective study was done to compare the success rates of teeth with three different root end filling materials. The materials studied were SuperEBA, IRM, and zinc-free high-copper spherical amalgam. Radiographs of 488 cases from two geographically distinct offices were used, with the recall period ranging from a minimum of 6 months to a maximum of 10 yr. The cases in each office were examined independently using the same criteria. The results revealed that both SuperEBA and IRM demonstrated statistically significant improvements in success rates when compared with amalgam. The success rates were 75% for amalgam, 91% for IRM, and 95% for SuperEBA. The difference between IRM and SuperEBA was not statistically significant.**

For many years amalgam has been accepted as the material of choice for retrofillings in endodontic surgery. Recently, many authors have questioned the suitability of amalgam as a retroseal. Moodnik et al.(1) in a scanning electron microscopic study demonstrated gaps between the amalgam and the root canal wall. Oynick and Oynick (2) expressed concern about the effects of free mercury in the periapical tissues. Poor results in leakage studies (3-5) as well as concern about corrosion products (6) and electrochemical reactions (7) have led many researchers to look for alternative materials. Suggested materials include Cavit, gold foil, cyanoacrylate, composite, glass ionomers, IRM, and SuperEBA.

Oynick and Oynick (2) using a SuperEBA retrofilling material demonstrated excellent healing in two specimens using histology and scanning electron microscopy. Several leakage studies (8-11) demonstrated SuperEBA cement to have the least amount of leakage of any retrofilling materials tested. Two studies (4, 12) did not confirm these results. IRM has also been advocated as a retrofilling material (13) and was found to be resistant to leakage in in vitro studies (4, 10, 14).

Success-failure studies have been reported using many different materials. The purpose of this study was to evaluate the success-failure rates of apicoectomies when SuperEBA, IRM, and amalgam were used as retrofilling materials in a clinical setting.

## MATERIALS AND METHODS

This was a retrospective study in which there were no criteria determined in advance for which material was used. The materials used were zinc-free high copper spherical alloy (Sybraloy; Kerr Manufacturing Co., Romulus, MI), SuperEBA (Harry J. Bosworth Co., Skokie, IL), and IRM (L. D. Caulk Co., Milford, DE).

Records of all patients that had apicoectomy with a retrograde filling within the past 10 yr in two geographically distinct private endodontic practices were used for this study. In both offices, several endodontists performed these surgeries. Both offices utilized amalgam, with one also using SuperEBA (S. D.) and the other using IRM (A. G.).

Radiographs taken at the completion of surgery were compared with the latest recall radiograph. All radiographs were taken with a paralleling device. A minimum recall period of 6 months was required. A total of 488 cases was assessed.

The cases in each office were examined independently with the following criteria: (a) A healed lesion was defined as one in which complete regeneration of the periodontal ligament was demonstrated radiographically. (b) Tendency to heal was determined to be those lesions in which the periradicular radiolucency was decreased in size but still present. (c) A failure was defined as those teeth in which the periradicular radiolucency increased in size or remained the same. Teeth with vertical fractures and/or periodontal failures were eliminated from the study.

## RESULTS

The findings are shown in Table 1. When all healing cases were combined (Healed plus Tendency to Heal), the success rate for amalgam in both practices was 75% when rounded to the nearest percentage point. The success rates of SuperEBA and IRM were 95% and 91%, respectively.

Chi-square tests revealed that the difference between SuperEBA and amalgam was statistically significant ( $p < 0.001$ ), the difference between IRM and amalgam was statistically significant ( $p < 0.01$ ), but the difference between SuperEBA and IRM was not statistically significant.

## DISCUSSION

The results of this retrospective study indicate that, under a specific set of conditions in two endodontic specialty prac-

tices, retrofillings done with reinforced zinc oxide-eugenol materials such as SuperEBA and IRM are more successful than those done with amalgam.

SuperEBA and IRM are reinforced zinc oxide-eugenol-based cements (Table 2). The reinforcement eliminates the problem of absorbability that affected early attempts at using zinc oxide-eugenol (2) and Cavit (16) as a retrograde filling material. In leakage studies, the results of Szeremeta-Browar et al.(8), Beltes et al.(9), Bondra et al.(10), and King et al.(11) demonstrated that SuperEBA allowed significantly less leakage than amalgam. Similarly, IRM has demonstrated resistance to leakage in the studies of Smee et al.(14), Abdal and Retief (4), and Bondra et al.(10). Although not universally

accepted, these results seem to indicate that, on the basis of leakage studies alone, SuperEBA and IRM may be superior as retroseals.

Our findings parallel the findings of the dye leakage study of Bondra et al. (10), in which they found SuperEBA to be slightly better than IRM, but not statistically significant. The difference in our success rates between SuperEBA and IRM were not statistically significant. It is interesting to note, however, that the results with SuperEBA were significant to the 0.001 level of confidence while the results with IRM were significant to the 0.01 level of confidence. Both materials, however, exhibited significantly less leakage in the Bondra study, and higher success in this study, than did amalgam.

One leakage study (12) reported poorer results with SuperEBA than with amalgam. The authors also reported that they trimmed the excess material with a scalpel blade. This technique may have been responsible for pulling the material away from the margins and therefore increased leakage. Clinically, we have found that it is important to burnish the margins of the material with a ball burnisher or the back of a curette after removing the excess.

Since both SuperEBA and IRM contain eugenol, concern has been expressed about possible harmful effects on the periapical tissues. In a tissue tolerance study, Kearney (19) found that IRM elicited a slight-to-none inflammatory effect after 90 days and concluded that IRM was just as tissue tolerant as any other retrofill material. Blackman et al.(20) found IRM to be relatively biocompatible and suggested it would be useful for endodontic retrofilling procedures. Since SuperEBA contains only one-third as much eugenol as IRM, similar results could reasonably be expected with SuperEBA. In fact, Oynick and Oynick (2) found collagen fibers over the material and actually growing into it, which would suggest that the EBA was well tolerated by the tissue.

Retrospective studies such as this one can be criticized for having a lack of controls, but it is this lack which may make the results more clinically significant. The retrograde fillings were placed in a variety of situations and by a total of 10 different endodontists in two geographically distinct and independent practices.

The fact that the failure rate for amalgam was the same for both offices adds some creditability to the results obtained. Table 3 compares these results with several previously re-

**TABLE 1. Results of apicoectomy with retrograde fillings of amalgam, SuperEBA, and IRM\***

	Healed +	Tendency to Heal	= Success	Failure	Total Cases
Amalgam					
Office 1	63 49%	34 26%	97 75%	32 25%	129
Office 2	108 65%	16 10%	124 75%	41 25%	165
SuperEBA					
Office 1	49 75%	13 20%	62 95%	3 5%	65
IRM					
Office 2	95 74%	22 17%	117 91%	12 9%	129
					488

\* SuperEBA significantly different from amalgam:  $df = 2$ ;  $\chi^2 = 18.67$ ;  $p < 0.001$ . IRM significantly different from amalgam  $df = 2$ ;  $\chi^2 = 11.34$ ;  $p < 0.01$ . No statistical difference between IRM and SuperEBA.

**TABLE 2. Ingredients of reinforced zinc oxide-eugenol cements**

SuperEBA (Bosworth)	IRM (Caulk)
Powder	
Zinc oxide, 60%	Zinc oxide, 80%
Alumina, 34%	Polymethylmethacrylate, 20%
Natural resin, 6%	
Liquid	
Eugenol, 37.5%	Eugenol, 99%
<i>ortho</i> -Ethoxybenzoic Acid, 62.5%	Acetic acid, 1%

**TABLE 3. Success rates for retrofillings compared with some previously reported studies\***

Authors	Material and No. Examined	Healed (%)	+ Tendency to Heal (%)	= Success (%)	Failure (%)
Dorn and Gartner, 1989	Amalgam (294)	57	18	75	25
	SuperEBA (65)	75	20	95	5
	IRM (129)	74	17	91	9
Hirsch et al. (15)	Amalgam (467)	49	—†	49	51
Finne et al. (16)	Amalgam (116)	58	17	75	25
	Cavit (102)	40	21	61	39
Rud and Andreasen (17)	Amalgam (237)	72	11	83	17
Mattila and Altonen (18)	Amalgam (32)	59	19	78	22

\* All rates were rounded to the nearest percentage point.

† Considered all incomplete healing as failure.

ported studies (15–18). While there is some variation in reported success, results for amalgam fall within the same range as that found by other investigators and are almost identical to the findings of Finne et al.(16) and Mattila and Altonen (18). The overall success rates of SuperEBA and IRM, as determined in this study, are superior to those of the other materials.

The prognosis for the use of reinforced zinc oxide-eugenol cements (SuperEBA and IRM) as retrofilling materials appears favorable.

We wish to thank our partners, Dr. Sy Weiner and Dr. John Cohen.

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