

# THE PREVALENCE OF CASES WITH APICAL SEALER EXTRUSION PUBLISHED IN RECENT ARTICLES OF THE ENDODONTIC LITERATURE

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## ABSTRACT

One of the most crucial phases in root canal therapy is establishing a well-sealed root canal system. To date, no investigations have been conducted to assess the prevalence of apical sealer extrusion using periapical radiographs. This study was aimed to quantify the cases prevalence of apical sealer extrusion published in recent articles of endodontic literature. A total of 439 cases of completed non-surgical root canal treatments were obtained from 62 issues (September 2015 - November 2020) of the *Journal of Endodontics* and 9 issues (January - September 2020) of the *International Endodontic Journal*. Two observers independently reviewed each of the periapical radiographs for signs of sealer overfill. Cohen's kappa coefficient for interobserver reliability was calculated at 98%. Of the 439 cases found in periapical imaging, an average of 142 exhibited apical extrusion of sealer. This corresponds to an average prevalence of 32.3% of published cases with sealer extrusion. It can be concluded that apical sealer extrusion is a relatively common finding in modern endodontic literature, and this may reflect the specialty's clinical trends as a whole. While outcome studies about sealer extrusion may be conflicting, overfilled cases are routinely included in published articles in major endodontic journals.

**Key words:** Endodontic sealer, Sealer puff, Sealer extrusion, Treatment outcome, Endodontics.

## Introduction

The goals of conventional endodontic therapy are eliminating pulpal disease and the complete resolution of periapical inflammation. After decontamination of the root canal system, the vacant spaces should be filled with inert materials, preventing reinfection and persistent inflammation. Schilder posited that root canal systems, including accessory canals, should be filled in three dimensions [1]. Modern obturation techniques have been developed using gutta percha and sealer to accomplish this objective. Dental gutta-percha, a relatively inert and volumetrically stable substance made of mainly zinc oxide and gutta-percha (trans-1,4-polyisoprene), is the material of choice for the solid core filling [2]. Sealer, which is available in various formulations, is used to adhere gutta-percha to the walls of the root canal system. Different types of sealer exhibit distinct properties, but all are relatively fluid when initially mixed, only set after a specific time. Sealer extrusion is a possible consequence of obturation due to delayed setting. Schilder described this as both overfill (overfilling of three dimensions) and overextension (filling of the vertical dimension) [1]. While numerous studies have recommended keeping obturation materials within the confines of the root canal system [3], sealer extrusion from the apical or lateral foramina is a relatively common phenomenon. These so-called "sealer puffs" are sometimes even sought after by practitioners, as they may indicate thoroughly cleaned and filled root canal systems.

This study sought to determine the total number of published cases depicting completed non-surgical root canal treatment of permanent human teeth and determine which of those showed apical extrusion of sealer.

## Materials and Methods

A total of 439 cases of completed non-surgical root canal treatments in permanent dentition were obtained from online publications of the *Journal of Endodontics* (American Association of Endodontists) and the *International Endodontic Journal* (British Endodontic Society and European Society of Endodontology). A total of 62 issues (2015-2020) from the *JOE* and nine (2020) from the *IEJ* were reviewed. Of the 439 cases, 362 were obtained from the *JOE* and 77 from the *IEJ* were obtained. Two observers, both postgraduate endodontics residents at the Herman Ostrow School of Dentistry of USC, independently reviewed each periapical image. No time restrictions were placed on the observers. Only permanent teeth that had undergone non-surgical root canal therapy, including both initial treatment and retreatment, were included in the study. The cases had to be presented in the form of periapical radiographs. No distinction was made between digital and film imaging. Cone-beam computed tomography scans were not included in this study. The observers were asked to state whenever there was radiographic evidence of a sealer extrusion. A sealer extrusion was defined as any radiopaque material expressed past the radiographic apex of a root.

The interobserver reliability was calculated using Cohen's Kappa Test for apical extrusion of sealer in published articles for JOE and IEJ [4]. The Collected data were analyzed using SPSS version 25.0 for Windows software (IBM Corp., Armonk, NY, USA). A simple non-chance corrected percentage agreement was calculated manually. The median of each observer's observations was used to calculate the interobserver reliability.

## Results and Discussion

A total of 439 published cases with completed endodontic treatment were observed. Sealer extrusion was noted in 142 of them (32.3%). The JOE exhibited 33.8% of published radiographs with sealer overfill (**Table 1**). The IEJ had a 25.3% rate of published cases with apical extrusion of sealer (**Table 2**). Cohen's kappa coefficient for interobserver reliability was 99.4% in the JOE and 96.6% in the IEJ, indicating a very high level of reliability and near-perfect agreement between the observers. The mean Cohen's kappa for both the JOE and IEJ was computed to be 98% (**Table 3**).

**Table 1.** Cases of sealer extrusion from periapical radiographs (PAs) in the *Journal of Endodontics (JOE)*

	Sealer extrusion	No sealer extrusion	Total PA	%
<b>Observer 1</b>	124	238	362	0.342541
<b>Observer 2</b>	121	241	362	0.334254
	mean % =			0.338397

**Table 2.** Cases of sealer extrusion from periapical radiographs (Pas) in the *International Endodontic Journal (IEJ)*

	Sealer extrusion	No sealer extrusion	Total PA	%
<b>Observer 1</b>	20	57	77	0.259740
<b>Observer 2</b>	19	58	77	0.246753
	mean % =			0.253246

**Table 3.** Cohen's kappa coefficient for interobserver reliability

	JOE	IEJ	JOE+IEJ mean
<b>Cohen's kappa</b>	0.9948	0.9656	0.9802
<b>% agreement</b>	99.50%	96.60%	98.00%

Apical extrusion of sealer has long been a source of contention in endodontics. A prospective clinical trial by Yu and others discovered incidences of epoxy sealer extrusion using warm vertical obturation at 41.5% and calcium silicate

sealer extrusion using a single-cone technique at 13.7% [5]. Nevertheless, biologic principles of obturation dictate that overfilling may lead to chronic inflammation, as the sealer is a foreign material that is commonly cytotoxic before setting [6]. Schaeffer and associates conducted a meta-analysis limited to 2-year recall and found that over-extensions in obturation led to lower success rates [7]. In addition, a recent systematic review by Aminoshariae and Kulild found that sealer extrusion contributed to a 32% higher risk of contributing to non-healing outcomes than no extrusion [8].

On the other hand, several retrospective cohort and meta-analysis studies have determined that the presence of extruded sealer may not affect overall outcomes. Goldberg and colleagues found that unintentional canal overfilling by lateral condensation and various epoxy and zinc oxide sealers with average recall times of 4.86 years had no statistically significant impact on outcomes [9]. Similarly, Ricucci and others also concluded that apically extruded sealers by lateral condensation with epoxy and zinc oxide sealers after four years produced no statistically significant differences in outcome, even when the extruded sealers were still radiographically present. They concluded that the primary determinant of outcome was the presence of a pre-operative periapical lesion, agreeing with the larger body of accepted endodontic evidence [10]. Chybowski and collaborators determined that sealer extrusions occurred in 47.4% of cases using the calcium silicate sealer type with the single-cone type. With recall periods of 2.5 years, they also found that sealer overfills had no significant effect on treatment outcomes [11].

Different recent published studies discussed the important of obturation techniques and the favorable type of sealer in endodontic treatment and how will effect on the endodontic practice towards patients and dentists [12-18]. The findings of these studies illustrated the role of apical sealing in successful of endodontic treatment [12-18].

The evidence seems to contradict itself, yet the overall phenomenon of unintended apical sealer extrusion appears to be well-tolerated in clinical practice. The present study seeks to examine the recent literature of two major endodontic journals for the overall rates of sealer extrusion. Namely, it found that of all published cases of completed non-surgical endodontic treatment of permanent teeth, 32.3% exhibited sealer extrusion (142 out of 439). This indicates that sealer extrusion is a common occurrence in the combined scope of clinical and research cases. While this rate is not a direct comparison to regular endodontic practice, it highlights the relatively high prevalence of sealer extrusion.

## Conclusion

Apical extrusion of sealer, resulting in both overfilling and overextension, is a relatively common occurrence in

endodontic obturation. About 32.3% of published cases from recent articles published in two major endodontic journals exhibited sealer extrusion. While the overall impact on outcomes is still unclear, the research and academic endodontic community reasonably tolerate sealer extrusion.

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