

# Clinical Evaluation of Acroseal Endodontic Sealer

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Reviewed paper

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**Streszczenie**

Na podstawie badań klinicznych i radiologicznych oceniono materiał Acroseal jako uszczelniacz do wypełnień kanałów korzeniowych z bów. Zby (n=64) wypełniono, stosując metodę kondensacji bocznej wieków gutta-perkowych lub metodę wężka pojedynczego. Przeprowadzone badania kliniczne (po 7 dniach, 1 miesiącu i 6 miesiącach) i radiologiczne (bezpośrednio po wypełnieniu oraz po upływie 6 miesięcy) potwierdziły przydatność materiału w wypełnieniu kanałów korzeniowych.

**Summary**

The endodontic sealer Acroseal was evaluated on the basis of clinical and radiological examination. Teeth (n = 64) were root-filled, using the lateral condensation of gutta-percha cones or the method of single cone. Clinical examinations (after 7 days, 1 month and 6 months) and radiographs (immediately after filling and after 6 months) confirmed the usefulness of the material in root canal filling.

**Hasła indeksowe:** uszczelniacz kanałowy, Acroseal, ocena kliniczna

**Key words:** root canal sealer, Acroseal, clinical evaluation

Root canal treatment should prevent and treat the inflammation of periapical tissues by eliminating bacteria and tooth pulp altered by the disease process within the root canal system and by hermetic root canal obturation. Root canal filling is sometimes compared to implantation methods because the endodontic filling material is in contact with periapical tissues. To date, because the ideal material for filling root canals does not exist, gutta-percha with an endodontic sealing material is currently used.

Root canal filling should meet specific standards. Sealer efficacy depends mainly on its antibacterial activity, its tissue biocompatibility as well as its sealing properties, that is proper adhesion to the root canal dentine and proper film thickness, minimizing empty spaces between the gutta-percha and the root canal wall.

There are three types of root canal sealers: calcium hydroxide based, zinc oxide based with eugenol and resin based. Recently, Acroseal (Septodont), a bicomponent sealer, has been developed. It obtained safety certification, according to the ISO 11014-1 standard. The base contains methylene amine (hexamethylenetetramine) and glycyrrhetic acid (enoxolone) and the catalyst contains calcium hydroxide and DGEBA resin (Fig. 1). Both pastes contain a radiopaque excipient. Enoxolone (C<sub>30</sub>H<sub>46</sub>O<sub>4</sub>) has antibacterial properties. There have been attempts to use it in toothpaste (1). DGEBA is an epoxy resin, a diglycidyl ether of bisphenol A. Material's setting time ranges from 16 to 24 hours, depending on the hygrometry. Experimental studies have shown that Acroseal, compared with other canal sealers (RSA, Rocanal R4, N2, Bioseal) formed the thinnest layer (film)– 9 ± 2.55 µm ; versus Rocanal R4 95 ± 12 µm, N2 50 ± 23 µm, Bioseal 41 ± 13 µm or RSA 9.3 ± 1 µm (2), thus providing a hermetic, three-dimensional root canal obturation. This material has a minor cytotoxic effect. *Gambarini* et al. (3) evaluated the cytotoxicity of new root filling materials on mouse 3T3 fibroblast cultures. Bioseal, Acroseal and Fibre-Fill were assessed. It was found that all studied materials had mild cytotoxic effects, that are compatible with their common clinical applications.

The objective of this study was to prospectively evaluate root canal fillings using Acroseal sealer and gutta-percha cones.

**Materials and methods**

64 patients, from 20 to 65 years of age, were to receive root canal treatment. One single or multi rooted tooth was treated in a patient. Overall, 28 single-rooted and 36 multi-rooted teeth were treated. Figure 2 shows the number of patients in each age bracket.

In 24 treated teeth (37.5%), **irreversible pulpitis = advanced vital pulp inflammation** was present, in 17 (26.6%), necrotic or gangrenous cytolytic pulp was observed and in 23 teeth (35.9%) revision of endodontic treatment was required (Fig. 3). **Working= Functional** root length was evaluated using **an electronic apex locator = a resistance endometer** and verified radiologically. Canals were treated using conventional (39.1%) and step-back (12.5%) methods with manual (NiTi FlexMaster) or rotational (EndoMate TC) endodontic instruments.



**Fig 1. Acroseal Root canal Sealer**

52 (81.2%) root canals were filled using the lateral condensation method and 12 (18.8%) using the single cone method. In the lateral condensation method, a minimal quantity of sealer was introduced into the root canal using a manual instrument, then the main cone was placed, covered with a minimal quantity of sealer and cold condensation was performed. Moreover, each additional third cone was covered with a minimal quantity of sealer. In the single cone method, the sealer was introduced into the canal roots using a Lentulo needle, and a gutta-percha cone was inserted. Filling quality was radiologically verified.

Clinical tooth evaluations (percussion test, visual assessment and palpation of the periapical region) were performed at 1 week, 1 month and 6 months. The check-up included medical history of possible pain (spontaneous or caused by chewing), its duration and its evolution (decrease or increase). Pain intensity

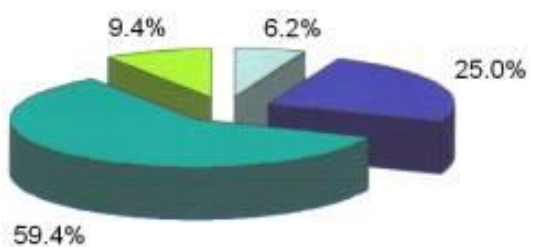
was rates as: 0 – no discomfort, 1 – mild, regardless of duration, not requiring analgesics and not compromising chewing function; 2 – moderate – requiring analgetics and 3 – severe – compromising chewing function. After 6 months, X-rays were performed following patient's consent.

**Results and Discussion**

The quality of root canal treatment and its prognosis depend on several factors related to the dental practitioner, the patient and the tooth, as well as the materials and instruments used during procedures. Studies show that the technical quality of endodontic treatment, evaluated using the ratio between the filling length and the length of the radiological root apex and filling adaptation to the canal walls, is relatively poor (4, 5, 6). This figure ranged from 23% in France (4), 34.3% in Spain (5) to 42% in the US (6). In our study, 90.6% of cases (58/64) showed a proper filling length and 9.4% (6/64) showed a sealing material

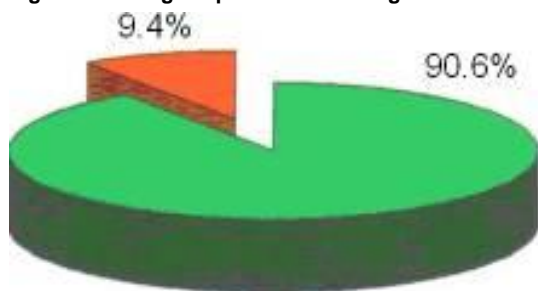
which slightly capped the radiological tooth apex (Fig. 4). In our previous studies concerning AH Plus sealer, we observed the presence of sealing material beyond the single-rooted tooth's apex in 44.4% of cases (7). A lower percentage of such cases, observed with Acroseal as a sealing material, may be due to the material's higher density.

As aforementioned, the recommended method for root canal obturation is a gutta-percha condensation associated with root canal sealing material. Among the many methods of gutta-percha condensation, the most commonly used in clinical practice is cold lateral condensation. However, many dental practitioners fill with sealing material and a single cone.



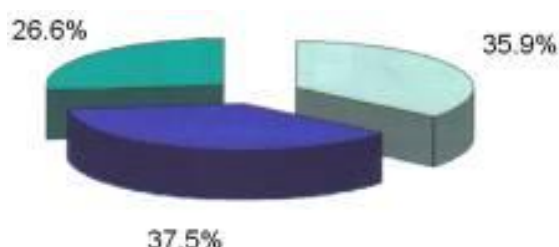
< 20 years ■ 21- 30 years ■ 31- 60 years ■ > 60 years

Fig. 2. Percentage of patients in each age bracket.



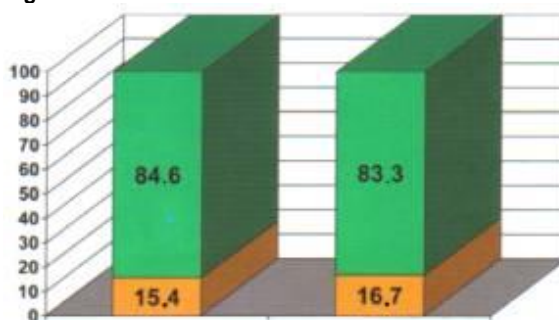
■ proper length ■ improper length

Fig. 4. Percentage of teeth with proper and improper length of root canal filling.



Revision ■ Irreversible pulpitis ■ Pulp necrosis = Necrosis/gangrene

Fig. 3. Reasons for dental treatment.



lateral condensation method ■ single cone method

■ pain ■ no symptoms

Fig. 5. Relationship between root canal filling method and pain.

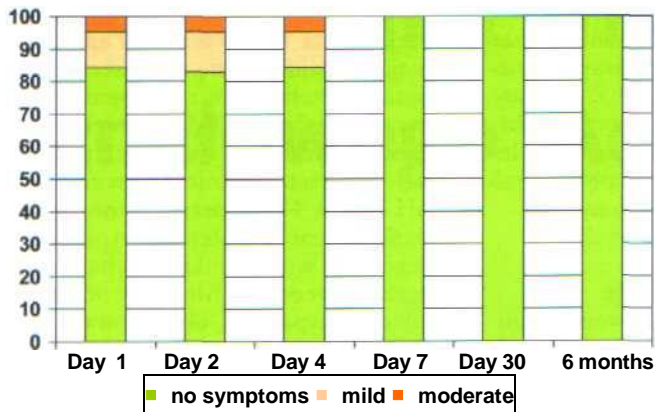


Fig. 6. Postobturation pain duration and intensity at specific observation points.

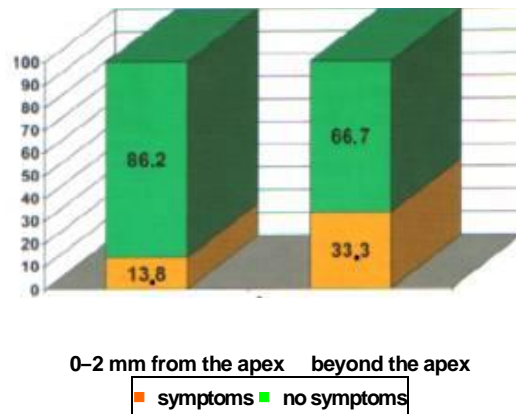


Fig. 7. Relationship between root canal filling length and pain.

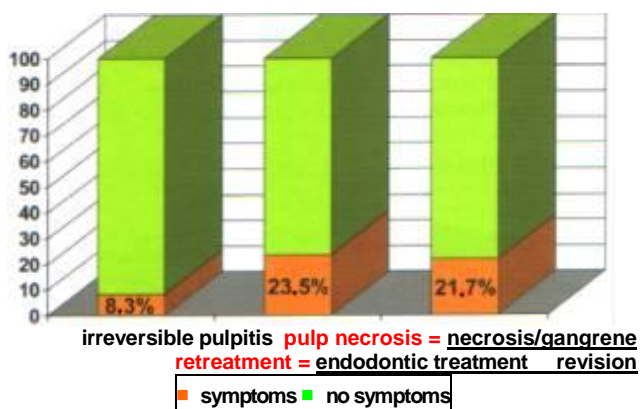


Fig. 8. Relationship between postobturation pain and pre-treatment diagnosis.

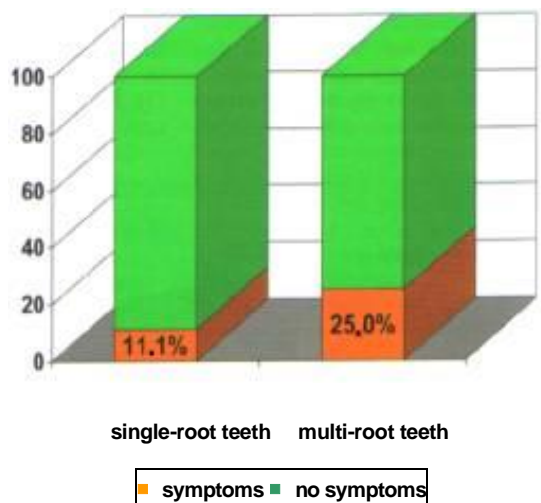


Fig. 9. Relationship between postobturation pain and treated anatomical tooth type.



Fig. 10. Tooth 11 – pre-treatment diagnosis : pulp necrosis = gangrene . A – before treatment, B – radiological evaluation of the root length; C – immediately following root canal filling using the gutta-percha lateral condensation method; D – 6 months after root canal obturation.

Based on previous studies it has been concluded that 16% of Belgian dentists use the single cone method and 60–65.8% use the lateral condensation method (8, 9), versus 31.3% and 61.0%, respectively, in Nigeria (10). In the Polish literature, there is no comprehensive review of root canal obturation methods, thus, this area requires further study. Our own observations suggest that these methods are frequently used and therefore, in this study, root canals were also filled using these methods.

Among our patients, 15.6% (10/64) experienced postobturation pain on day 1 and 17.2% (11/64) on day 2. Postobturation pain occurred slightly more often in patients treated by the single cone method than those by the lateral condensation method (16.7% vs 15.4%) (Fig. 5).



Fig. 11. Tooth 22, **retreatment = endodontic treatment revision**. A – before treatment – loss of a crown-root inlay, B – radiological evaluation of the root length; C – immediately following root canal filling using the gutta-percha lateral condensation method; D – 6 months after root canal obturation; E – restored tooth.

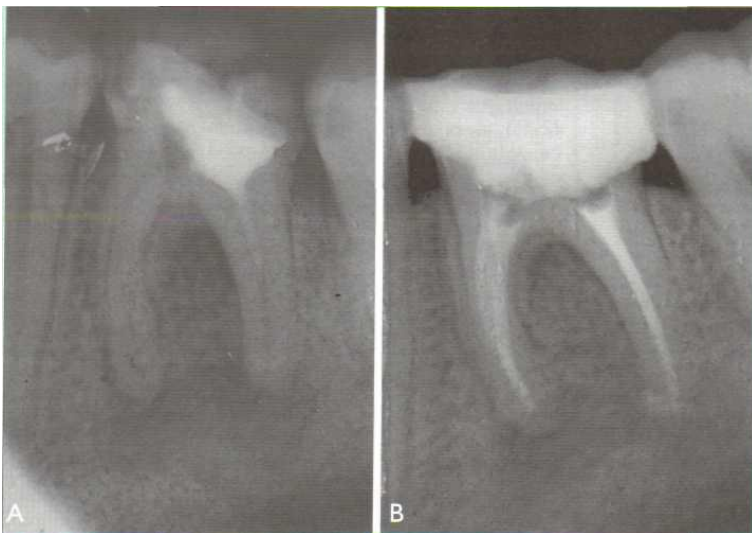


Fig. 12. Tooth 46, **retreatment = revision of endodontic treatment**. A – before treatment, underfilled distal canal, mesial canals unfilled; B – immediately after root canal fillings using the gutta-percha lateral condensation method, in a distal canal the sealer is visible beyond the radiological apex of the root.

Postobturation pain occurred fairly frequently. It disturbs the dental practitioner and worries or annoys the patient especially when the tooth was painless prior to treatment. In our study, on day 1 10.9% (7/64) of patients experienced mild postobturation pain during chewing (grade 1), moreover 4.7% (3/64) experienced moderate spontaneous pain (grade 2). Symptom frequency decreased slightly (around 1.6%) on day 2, gradually diminished until day 4, and after one week, and in the weeks that followed, patients did not experience pain (Fig. 6). However, when using AH Plus sealer, pain was observed

in 38.9% of cases one week after filling (7). Analysis of the relation between the extent of canal obturation and pain showed higher pain rates when the filling extended beyond the root apex (33.3% versus 13.8%) (Fig. 7). A slightly higher (37.5%) incidence was observed in canal overfilling using the AH Plus sealer (7). No relationship was observed between the canal filling method and pain duration. In the literature, there are many publications on the incidence and severity of postobturation pain. These articles noted high incidences on day 1 and day 2 after obturation. *Ng et al.* (11) observed pain after correct root canal filling in 48.2%

of cases. *Glennon* (12) in 64.7%, *Albashaireh et al.* (13) in 27–38%, *Oginni and Udoye* (14) in 49% and *Polycarpou et al.* (15) in only 12%. In most cases, pain intensity was mild to moderate, and severe pain **followed = followed** by a gradual decline was observed in only 10–16.5% (11, 12, 14). In the study by *Oginni and Udoye* (14), symptoms of mild pain decreased by 19.7% (from 32.5% to 12.8%), and moderate or severe pain by 15.6% (from 16.5% to 0.9%), after 1 week. In our **patients = population**, we did not observe any pain after 1 week (Fig. 6).

Postobturation pain may be caused by many variable factors, such as gender, tooth type, pain prior to treatment, periapical lesions, number of **treatment visits = treatments** and patient's overall state of health. Some authors report an increased frequency of pain with single visit versus multiple visit root canal treatments, (11, 13, 14, 17, 18), while others did not note any difference (19). The relation between preoperative and postobturation pain was examined (15, 20). A positive correlation was observed between severe pain and swelling and multiple-visit treatment, endodontic treatment revision as well as preoperative pain and periapical lesions.

There is no consistent relationship between postobturation pain and preoperative pulp state. The absence of such a relationship (14, 21, 22) and a significantly higher incidence of postpreparation pain and swelling in teeth with necrotic pulp versus teeth with inflammatory vital pulp (13) was shown.

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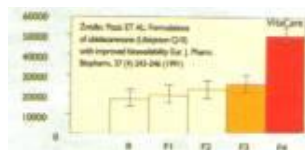
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Our results suggest that there is a relationship between postobturation pain and pretreatment pulp state. In fact, postoperative discomfort was less commonly observed during treatment of teeth with irreversible pulpitis – 8.3% (2/24), than with pulp necrosis – 23.5% (4/17) and during endodontic treatment revision – 21.7% (5/23) (Fig. 8). Furthermore, a relationship between pain expression and anatomical tooth type was also observed. Pain occurred more often after filling multi-root (25.0%) than single-root (11.1%) teeth (Fig. 9).

During radiological evaluation of filling quality, good sealing material radiopacity is very important. Acroseal sealer has good radiopacity, thanks to which adhesion to the canal walls may be precisely assessed. In the authors opinion, the material's consistency must be optimal in order to fill canals using the lateral condensation method or the single cone method. Mixing

catalyst and basal paste is simple and a homogenous material, without air bubbles or clots, is obtained. Radiographic evaluation (Fig. 10–12) accurately shows filled spaces between gutta-percha cone/cones and canal walls, thus enabling hermetic obturation. This stems from the formation of a uniform layer (film), as shown in *in-vitro* tests (2). Material may be easily removed when removal of all or part of canal filling is necessary, for example due to abnormal or improper crown-root inlay placement. If the canal must be refilled, the sealer may be dissolved using the Endosolv preparation (23).

In conclusion, it should be emphasised that this clinical evaluation of Acroseal sealer was very positive. Its application was very simple, its adhesion to the canal walls was tight and when necessary, it could be easily removed from the root canal.

**References** – 23 items – not yet available

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