STUDY REGARDING PHYSICAL AND CHEMICAL PROPERTIES OF SOME ROOT CANAL SEALERS USED IN ENDODONTIC THERAPY

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ABSTRACT

Aim study. The personal study aimed to determine pH and solubility of some root canal sealers used frequently in the treatment of chronic apical periodontitis. **Materials and method** The sealers were prepared accordingly to producer instructions. The analysis of pH was performed after a mixture between 0.5 g sealer and 20 ml sol. KCl 0,1N was shaked for 5 minutes. The pH values were recorded at diverse time intervals (baseline, 24 h, 7 days, 14 days) using pH-meter SEIBOLD WIEN. The analysis of solubility was focused on two hydroxid calcium based endodontic sealers (Sealapex- Septodont, Endoflas- Sanlor) immersed in two artificial solutions with pH 6 and pH 7,5. The solubility was assessed, at diverse time intervals (24 h, 48 h, 72 h) measuring the solid substance dissolved in 100 ml specific solvent. **Results** The pH values at baseline were 8.65 (Sealapex), 8.55 (Endomethasone), 8.26 (Endospad), 6.68 (AH26) and 5.80 (Pulpispad). The pH values after 2 weeks were 9.13 (Sealapex), 8.90 (Endomethasone), 8.72 (Endoflas), 8.50 (Endospad), 6.66 (Pulpispad) and 6.59 (AH26). Sealapex presents lowest solubility at pH 6 after 48 hours. After 72 h, solubility of Endoflas is higher comparing with Sealapex at pH 7.5. **Conclusions** The endodontic sealers with highest pH values present significant antibacterial and periapical remineralisation effects (Sealapex 8.65, Endospad 8.26, Endoflas 7.2). The degree of coronal filling sealing is an important factor to avoid the solubility of endodontic cements and to ensure the success of endodontic therapy.

Key words: pH, solubility, endodontic sealers, chronic periapical lesions

INTRODUCTION

The endodontic sealers are characterized by physical-chemical, antibacterial and biological properties. The physical and chemical properties have an important role in the sealing ability of endodontic space and stimulation of healing periapical processes. Nowadays the producers of endodontic sealers are requested to respect an international standard (ISO/DIS 6876 Dental root Canal Sealing Materials; article 57 of American Dental Association) regarding physical and chemical properties.

Aim of study

The personal study aimed to determine pH and solubility of some root canal sealers used frequently in the treatment of chronic apical periodontitis.

MATERIALS AND METHOD

The sealers were prepared accordingly to producer instructions. The analysis of pH was

performed after a mixture between 0.5 g sealer and 20 ml sol. KCl 0.1N was shaked for 5 minutes. The pH was recorded using pH-meter SEIBOLD WIEN:

- Immediately after mix preparation;
- After 24 hours;
- After 7 days;
- After 14 days.

The analysis of solubility was focused on two hydroxide calcium based endodontic sealers (Sealapex - Septodont, Endoflas - Sanlor) immersed in two artificial solutions with pH 6 and pH 7,5. The initial artificial saliva presented pH 7.5 and was adjusted with lactic acid to reach pH 6. The solubility was assessed measuring the solid substance (grams) dissolved in 100 ml specific solvent. The initial materials were weighted and then introduced in artificial saliva, to obtain four samples. The solubility values were obtained extracting and measuring the weight from these samples, after 24, 48, 72 hours of immersion in artificial saliva.

RESULTS AND DISCUSSIONS

The recorded data analysis highlights the pH variations of the six root canal sealers and pH variations related to different time intervals. The pH values at baseline, at 24 hours, 48 hours and 72 hours are presented in Fig 1.

In figure 1 are presented the pH values of endodontic sealers related to different time periods. The highest pH values were recorded at an 14 days interval for Sealapex (9.13); these value can be related to high concentration of $Ca(OH)_2$. Endomethasone presented pH 8.55 after preparation and 8.90 after 2 weeks. Endospad presented pH 8.26 after preparation and 8.50 after 2 weeks. The lowest pH values after preparation were recorded for Pulpispad (5.80), value that increased after 2 weeks at 6.66. AH 26 presented a low pH (6.68) after preparation. This endodontic sealer is the only one that had lower pH value after 2 weeks (6.59).

The solubility values of Sealapex and Endoflas at baseline, 24 hours, 48 hours and 72 hours are presented in tables 1.a and 1.b.

Sealapex presents lowest solubility at pH 6 after 48 hours from preparation. Endoflas presents higher solubility at baseline comparing with Sealapex. After 72 h, solubility of Endoflas is higher comparing with Sealapex at pH 7.5. The Endoflas solubility decreases progressively and reaches lowest value after 72 hours at pH 6.

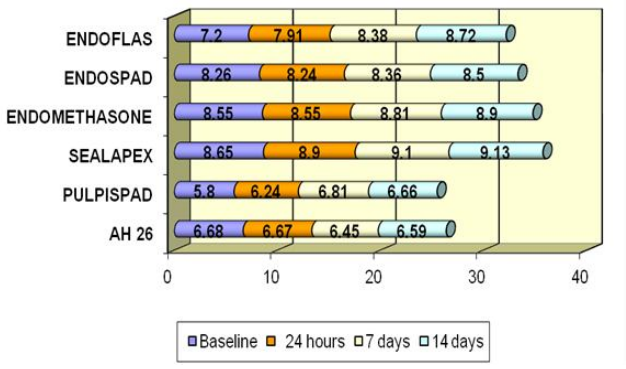

Fig. 1. pH of endodontic sealers related to different time periods

SEALAPEX	pH 6	pH 7,5
24 h	0,0036g	0,0060g
48 h	0,0001g	0,0040g
72h	0,0004g	0,0036g

Table 1. The Sealapex solubility values for pH 6 and 7.5 at diverse time intervals.

ENDOFLAS	pH 6	pH 7,5
24 h	0,0076g	0,0116g
48 h	0,0100g	0,0096g
72h	0,0004g	0,0060g

Table 1.b. The Endoflas solubility values for pH 6 and 7.5 at diverse time intervals

DISCUSSIONS

The correlations between pH level and the therapeutically effect of endodontic cements are demonstrated by the intense periapical healing processes associated to sealers with higher pH levels. The high pH ensures powerful antibacterial effects that reduce periapical inflammatory processes and stimulate periapical healing.

The high pH level is also associated with an increase of alkaline phosphatase action and periapical bone remineralisation. The endodontic sealers with low pH can create conditions for osteoclasts activity and can stimulate bone resorption. Especially for severe periapical lesions, Sealapex and Endoflas our study recommends the sealers with highest pH. For moderate or small periapical lesions, can be useful sealers like Endomethasone or AH 26. Literature data prove that high pH values are recorded for Sealapex, Sealer 26 or Apexit (Siqueira et.al 1995). Eldeniz AU. & al. (2007) proves that Sealapex has higher pH value comparing with Apexit and Acroseal. Duarte MA. & col. (2000) also found higher pH value for Sealapex comparing with Sealer 26 and Apexit.

There is a low number of studies focused on the solubility of endodontic sealers in saliva environment. The results of our in vitro study regarding endodontic sealers solubility must be adjusted regarding numerous interactions with oral environment factors. Schafer E. & al. (2003) found high solubility values for Sealapex, Aptal-Harz and Ketac Endo and low solubility values for AH 26, AH Plus, RSA RoekoSeal and Diaket. Carvalho-Junior JR. & al. (2003) found that Endofill and Ketac-Endo overpass solubility values recommended by ADA. The in vitro study performed by McMichen FR. & all. (2003) found that AH-Plus is the endodontic sealer with lowest solubility values and Apexit has highest solubility values.

Vivan R & col. (2010) prove that sealers MTA Angelus and MTA Bio present higher pH values and lower solubility values, comparing with epoxidic resins based sealers or Portland cement. Massi S & col. (2011) found that MTAS, a MTA-based sealer, presents high pH value, with highest pH recorded at an interval of 48 hours. Candeiro GT. & col. (2012) consider that bioceramic sealer Endosequence BC Sealer, presents excellent physical and chemical properties, conclusion sustained by the high pH values and high concentration of released Ca ions at 10 days interval.

CONCLUSIONS

- The initial pH range of endodontic sealers is between 5,8 (Pulpispad) and 8,65 (Sealapex);
- There is a progressive increase of PH to intervals of 24 hours, 7 days; some endodontic sealers reach maximum values at 7 days (Sealapex 9,13, Endomethasone 8,90, Endoflas 8,70);
- The endodontic sealers with highest pH values present significant antibacterial and periapical remineralisation effects (Sealapex 8,65, Endospad 8,26, Endoflas 7,2);
- The acid saliva determines higher solubility values of endodontic sealers. The solubility can increase with time; highest values of solubility are recorded after 72 h at pH 6.
- The degree of coronal filling sealing is an important factor to avoid the solubility of endodontic cements and to ensure the success of endodontic therapy.

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