

Influence of Atopy in the Outcome of Avulsed and Replanted Teeth during 5 Years of Follow-up

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Abstract

Introduction: The goal of replantation after dental avulsion is to maintain the tooth in its socket. Presence of vital periodontal ligament cells on the root surface of the replanted tooth and the immunologic status of the patient are factors that protect against root resorption. It is known that dental constituents play an active role in root resorption by inducing specific and non-specific immune responses; however, little information exists regarding the influence of the acquired immune response on replantation. Therefore, the aim of this study was to evaluate the 5-year outcome of replantation in non-atopic and atopic patients. **Methods:** Clinical and radiographic examinations were performed in 62 replanted teeth during a 5-year period. The evaluation of atopy was based on the patients' personal and family histories and skin prick test results. The χ^2 and the Z tests were used to assess the association between atopy and the outcome of the replanted teeth ($P < .05$). **Results:** There were significant differences between the 1-year and 5-year outcomes of the replanted teeth ($P < .05$) and atopic and non-atopic patients who had their teeth extracted because of inflammatory or replacement root resorption after 5 years ($P < .05$). **Conclusions:** Being atopic may offer the advantage of loss of fewer teeth because of replacement resorption, whereas being non-atopic may create an advantage of loss of fewer teeth because of inflammatory root resorption during the first 5 years after trauma. (*J Endod* 2017;43:25–28)

Key Words

Atopy, avulsion, immunology, inflammation, replantation, root resorption

Dental avulsion is the most severe form of trauma to permanent teeth. Immediate replantation is the treatment of choice because a favorable outcome can be achieved, maintaining the

tooth in its socket, at least until the complete development of the child's facial features. Then if the replanted tooth is lost, it may be replaced with an implant within the ideal conditions of the alveolar bone. The presence of vital periodontal ligament cells on the root surface of the replanted tooth protects against root resorption (1–3).

The prevalence of unfavorable tooth replantation outcomes is reported to be 57%–80%. Root resorption is the most critical consequence because it is the main cause of extraction of the replanted tooth and may occur within a few months of replantation (4).

There are a few studies on the molecular and immunologic mechanisms involved in root resorption after trauma (5). It has been determined that dental constituents play an active role in root resorption by inducing specific and non-specific immune responses. The immune-inflammatory reaction against the antigen can also induce the destruction of hard tissue (6). The roles of bacteria and modulating molecules in the periodontal ligament, which may or may not alter the course of disease, are also important factors in the resorption process.

Specific information regarding the influence of the acquired immune response on root resorption when a tooth is avulsed and replanted is scarce. Previous studies have shown that the tooth of an atopic patient who has a predominantly T-helper 2 lymphocyte (Th2) immunologic profile and a heightened anti-inflammatory cytokine response had a good 1-year post-replantation outcome (7–9). Therefore, the aim of this study was to evaluate whether the immunologic profile of atopic and non-atopic patients may keep affecting the outcome of replanted teeth after 5 years.

Significance

This is the first article in the literature demonstrating the influence of the immunologic profile in the outcome of replanted teeth during a long time. It can help in the development of supporting technique to prevent and/or control root resorption.

Materials and Methods

Eighty-eight teeth of atopic and non-atopic patients were replanted, treated, and followed during a 1-year period (9). Of these, 62 teeth underwent clinical and radiographic evaluations after 5 years. Twenty-six teeth were not included in this study because the patients could not be found for follow-up studies. Informed consent was obtained from all patients, and the study was approved by the Ethics Committee of the Pontifícia Universidade Católica do Paraná (CEP 1406).

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Sample

The inclusion criteria for this study were as follows:

1. Permanent avulsed and replanted teeth;
2. Patients who attended our clinic every 15 days or at least every 30 days during a 12-month period and twice a year for the next 5 years or at least at the time of tooth extraction;
3. Patients in good health;
4. Patients not taking any continuous medication (daily);
5. Patients with good nutritional status;
6. Patients who did not suffer any prior anterior or posterior dental trauma;
7. Patients with adequate tooth brushing and good oral hygiene; and
8. Patients who did not receive orthodontic treatment at any time during the dental trauma follow-up period.

Clinical and Radiographic Data

The patients were evaluated clinically and radiographically every 15 days during the endodontic treatment and every 3 months during the follow-up period. The radiographic examination included a comparison with initial radiographs taken during emergency care soon after replantation with those obtained after 5 years of follow-up. Radiographs were obtained with sensitivity E/F, size 2 Kodak Insight periapical films (Eastman Kodak Co, Rochester, NY), and JON radiographic positioners (São Paulo, SP, Brazil). These images were analyzed with a scattering light box and with the aid of $\times 4$ magnifier and dark card stock. Three trained endodontists with very high intraexaminer agreement (kappa scores: 0.90%, 0.86%, and 0.82%) and very good interexaminer agreement (0.86%) looked for the presence or absence of radiographic changes suggestive of root resorption, apical lesions, and ankylosis.

Immunologic Evaluation

All patients were interviewed and given a family and personal history questionnaire about atopy signs and symptoms during their first appointment at the Dental School. The topics covered by the questionnaire included age, gender, occupation, place of birth, place of living, working conditions, and descriptions and specifications of possible signs and symptoms of atopy (respiratory, cutaneous, or digestive for ambient factors; medication or drugs; foods or any other allergen).

In addition, a skin prick test was performed by an immunologist to confirm the presence of allergen-specific immunoglobulin E antibodies, which are used for the diagnosis of atopic diseases in humans (10). *Dermatophagoides pteromyssinus*, *Dermatophagoides farinae*, *Blomia tropicalis*, *Lolium perenne*, and *Fungi III* were the selected allergens. Histamine was the positive control, and saline was the negative control (IPI Laboratory Brazil, Sao Paulo, Brazil). These allergens were selected because they are the most common in our region (Paraná State, Brazil) (10).

Statistical Analysis

To evaluate the outcome of replanted teeth in non-atopic and atopic patients, this study used SPSS 23.0 (SPSS Inc, Chicago, IL) statistical software to perform a χ^2 test for the comparison of 2 independent groups at a probability level of $P < .05$. For small sample sizes, the Z test was used. The following were studied: outcome after 1 year (absence of root resorption, inflammatory, or replacement of root resorption); outcome after 5 years (absence of root resorption, inflammatory, or replacement of root resorption of teeth still in their sockets, and inflammatory or replacement of root resorption that caused the extraction of the teeth); and atopy (atopic and non-atopic patients).

Results

Of the 88 patients who had their teeth replanted and treated and an atopic evaluation after 1 year (9), 62 (70.5%) returned during the next 5 years for clinical and radiographic evaluations. The mean age of the patients was 13 years. Fifty-six patients (90.3%) were younger than 19 years of age.

Thirty-one teeth (50%) remained in their sockets after 5 years of replantation; 12 (19.4%) did not present root resorption, and 19 teeth (30.6%) did, 10 (16.1%) with inflammatory resorption and 9 (14.5%) with replacement resorption. Thirty-one teeth (50%) were extracted; 13 (21%) were due to inflammatory, and 15 (24.2%) were due to replacement resorption. Three teeth (4.8%) were lost because of periodontal disease.

A significant difference between the outcomes of the replanted teeth at 1 and 5 years was observed ($P < .05$). Of the 44 teeth without resorption after 1 year of replantation, 12 teeth (27.3%) did not present root resorption after the fifth year ($P < .05$) (Table 1). Of the 44 teeth that did not present root resorption in the first year, 4 (9.1%) were extracted because of replacement resorption and 12 (27.3%) because of inflammatory resorption. Of the 18 teeth that already had root resorption in the first year, 11 (61.1%) were lost because of replacement and 1 (5.6%) because of inflammatory resorption.

Table 2 demonstrates the association between the outcome of the teeth and the group that represented the immunologic status of the patients (atopic and non-atopic) ($P < .05$). There was also a significant difference between atopic and non-atopic patients in relation to the lost teeth caused by inflammatory and replacement root resorption. Of the 23 teeth that developed inflammatory root resorption, 13 were extracted; 11 (84.6%) were from atopic patients and 2 (15.4%) from non-atopic patients ($P < .05$). Of the 24 teeth that developed replacement root resorption, 15 were extracted; 11 (73.3%) were from non-atopic patients and 4 (26.7%) from atopic patients ($P < .05$).

Discussion

Our study proposes a new point of view on the outcome of replanted teeth. By researching intrinsic and individual factors that may contribute to specific immune-inflammatory responses, our results suggest that causes other than technical factors may also influence the success or failure of dental replantation.

The accomplishment of an *in vivo* study with children who have suffered dental trauma is always difficult. It is necessary to have a complete commitment of the patients and their parents or close relatives for a long period of time such as the 5-year period described in this study. For this reason, our sample decreased from 88 participants at the end of the first year to 62 by the 5-year follow-up.

The mean age of the patients (13 years) when they experienced the dental avulsion influenced the decision to reevaluate the patients 5 years after replantation. The psychological advantage of the child not having a missing tooth during childhood and adolescence, the maintenance of physiological space during facial growth, and the bone quality and thickness are advantages that encourage the dentist and patient, or parents, to maintain the replanted tooth in its socket for as long as possible (11). When facial growth is completed, the patient and the clinician may choose to replace a seriously compromised resorbed tooth with either a prosthetic bridge or a dental implant. In these cases, even though it may be necessary to extract the replanted tooth as early as 5 years after replantation, it may still be considered a favorable outcome.

Periapical radiographs were used to establish the presence or absence of root resorption. They are still the best method for a clinical cost/benefit ratio for this investigation (12). However, it has disadvantages such as two-dimensional image of a three-dimensional structure.

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