

Relationship Between Extra-Alveolar Time and Atopy in the Prognosis of the Replantation of Avulsed Teeth

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Background: The aim of this in vivo study was to evaluate the correlation between the occurrence of root resorption in avulsed and replanted teeth, extra-alveolar time, and the possible influence of Th2 immunologic profile, represented by patient's atopy and its influence in the prognosis of the tooth.

Methods: This study evaluated the presence or absence of root resorption in 57 avulsed and replanted teeth. The replantation technique and endodontic treatments were performed following the International Association of Dental Trauma guidelines. Follow-up of the replanted teeth included monthly clinical and radiographic examinations during 1 year. The patient's medical examination, including the personal and family allergic history, in conjunction with the skin prick test based the evaluation of patient's atopy.

Results: Of the 37 teeth of atopic patients, 33 (89.2%) teeth did not present root resorption. Of these, 27 (72.9%) had an extra-alveolar time of <1 hour and 6 (16.2%) had an extra-alveolar time >1 hour. Four (10.8%) teeth presented root resorption and an extra-alveolar period of time >1 hour.

Conclusion: These results showed the importance of the extra-alveolar time and the predominantly Th2 immunologic profile, represented by atopic patients, that suffered replantation after dental avulsion in a 1-year follow-up.

Key Words: Tooth avulsion, Replantation, Root resorption, Extra-alveolar time, Immunologic response, Atopy.

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One of the most important dental traumatism is tooth avulsion, which consists of the tooth being completely displaced out of its socket. This occurrence accounts for 0.5% to 16% of the traumatic lesions in permanent dentition.¹

The most indicated procedure for this type of traumatism is replantation of the tooth,^{1,2} because it is a conservative procedure that allows esthetic function to be preserved, defers the need for prosthetic work, and reduces the psychologic impact resulting from the immediate loss.³

Unfortunately, root resorption is a frequent complication after tooth replantation,^{1,2,4} and it can lead to the need to extract the tooth. A protective factor against resorption is the presence of complete preceement and vital cementoblasts at

the root surface of the replanted tooth, to maintaining the health of the cells in the periodontal ligament.^{5–9}

Studies have shown the importance of the innate and acquired immune response in the molecular and cellular mechanisms involved in hard tissue resorption.^{10–14} The importance of acquired humoral response has also been demonstrated, which is represented by antibodies in periodontal disease and influenced by the balance in the relationship between the T helper 1 lymphocyte (Th1) and T helper 2 lymphocyte (Th2) in immunologic responses.^{15,16} Therefore, understanding of these mechanisms in the periodontal ligament would facilitate the development of new therapies or protocols for the treatment of replanted teeth.

MATERIALS AND METHODS

In this in vivo study, 57 teeth were analyzed in patients who suffered accidental tooth avulsion and the teeth could be replanted. This was followed by endodontic treatment as well as clinical and radiographic control in a 1-year follow-up.

The teeth were replanted in accordance with the guidelines of the American Association of Endodontists¹⁷ and International Association of Dental Traumatology.¹⁸ The informed consent of all human subjects who participated in the experimental investigation reported or described in this article was obtained after the nature of the procedure and possible discomforts and risks had been fully explained. This study received the approval of the Ethics Committee of the Catholic Pontifical University of Parana (CEP 1406).

The exclusion criteria for this study were as follows:

1. Patients who could not attend our clinic every 15 days or at least every 30 days in a 12-month period.
2. Patients taking anti-histaminic drugs.
3. Patients following a medical treatment during the endodontic treatment.
4. Patients with bad nutritional status.
5. Patients who had suffered an anterior dental trauma.
6. Patients with chronic periodontitis.
7. Patients with an inadequate tooth brushing and poor oral hygiene.

A radiographic study was performed by three different endodontic specialists. They compared the initial with the control radiograph taken after 1 year of follow-up of each replanted tooth. The radiographs were evaluated as regards the presence or absence of images suggestive of root resorption. The teeth were also analyzed clinically (absence or

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presence of symptoms, excessive, normal, or no mobility caused by ankylosis, and with or without high-pitched percussion sound).

Atopy was selected to represent patients' Th2 profile, because individuals with this predominantly immunologic response produce more anti-inflammatory cytokines, thus leading to the diminishment of activation of clasts cells, responsible for the root resorption. Therefore, to evaluate the presence or absence of patient's atopy, patients answered a questionnaire with questions as regards the possible signs or symptoms of personal and family atopy history, and the skin prick test was used for atopy assessment.

The prick test is a confirmative skin test primarily for allergen-specific IgE antibodies, which are used for diagnosing allergic diseases in humans.¹⁹ The following were selected as allergen extracts: *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Blomia tropicalis*, *Lolium perene*, Fungi III, positive control (histamine) and negative control (saline solution) (Laboratório IPI-ASAC Brasil, São Paulo, SP, Brazil). These were chosen for evaluation in this study because they are the commonest allergens in our region,²⁰ together with a positive control of the reaction given by histamine and negative control given by saline solution.

With the aim of evaluating whether there was a statistical dependence between extra-alveolar time, atopy, and root resorption, chi-square test and Fisher's exact test, at a level of probability $p < 0.05$, were used.

RESULTS

Of the 57 teeth analyzed, 37 (65%) were teeth of atopic patients and 20 (35%) were of nonatopic patients. Statistically significant dependence was verified between the extra-alveolar time, atopy, and root resorption because the Fisher's exact test showed a value of $p < 0.05$.

The results showed that of the total number of cases with root resorption, in 10 (90.91%) teeth, the extra-alveolar time was >60 minutes and in only 1 (10%), this time was shorter. Nevertheless, for the total number of cases without root resorption, in 31 (67.39%) teeth, the extra-alveolar time was <60 minutes and in 15 (32.61%) for a longer time interval than this period (Table 1).

Of the 37 teeth of atopic patients, 33 (89.2%) teeth did not present root resorption. Of these, 27 (72.9%) had an extra-alveolar time of <1 hour and 6 (16.2%) had an extra-

TABLE 1. Relationship Between Root Resorption of Replanted Teeth and Extra-Alveolar Time

Root Resorption	Quantity	Extra-Alveolar Time		Total
		$<60'$	$>60'$	
Absent	Number of teeth	31	15	46
	Percentage	67.39	33.61	100
Present	Number of teeth	1	10	11
	Percentage	9.09	90.91	100
Total	Number of teeth	32	25	57
	Percentage	56.14	43.86	100

TABLE 2. Relationship Between Root Resorption of Replanted Teeth and Extra-Alveolar Time and Atopy

Root Resorption	Extra-Alveolar Time	Quantity	Atopy		
			Present	Absent	Total
Absent	$<60'$	Number of teeth	27	4	31
		Percentage	87.1	12.9	100
	$>60'$	Number of teeth	6	9	15
		Percentage	40	60	100
Present	$<60'$	Number of teeth	0	1	1
		Percentage	0	100	100
	$>60'$	Number of teeth	4	6	10
		Percentage	40	60	100

alveolar time >1 hour. Four (10.8%) teeth presented root resorption and an extra-alveolar period of time >1 hour.

When the extra-alveolar time was <60 minutes and the patient was atopic, 27 (87.09%) teeth did not present root resorption, and in nonatopic patients, only 4 (12.90%) roots were not resorbed. When the extra-alveolar time was >60 minutes and the patient was atopic, 6 (40%) teeth did not present root resorption, and in nonatopic patients, 9 (60%) roots were not resorbed. None of the teeth presented root resorption when the extra-alveolar time was <60 minutes and the patient was atopic, and one tooth (100%) in a nonatopic patient presented root resorption. When the extra-alveolar time was >60 minutes, there were 4 (40%) teeth with root resorption in atopic patients, and 6 teeth (60%) teeth in nonatopic patients (Table 2).

DISCUSSION

The current emergence of osteoimmunology has increased interest in defining the mechanisms underlying bone resorption in periodontal diseases.⁵ The action of the components from the response of the Th1 immunologic profile (T helper 1 lymphocyte) in periodontal disease^{12–14} and the importance of cytokines of Th1 and Th2 profile (T helper 2 lymphocyte) on homeostasis of the alveolar bone were also demonstrated. However, not much is known about dental root resorption. Therefore, the aim of this study was to verify the role of acquired immune response, represented by the Th2 predominantly profile in dental trauma.

When there is a trend toward immunologic responses of the Th2 type, as occurs in atopic patients, there is a greater intensity in humoral, anti-helminthic and allergic immune responses, with production of anti-inflammatory cytokines as IL-4, IL-5, IL-10, and cytotoxic T-lymphocyte antigen 4. This event makes the production of inflammatory cytokines as IL-12 and INF-gamma decrease. These cytokines down-regulate the effectiveness of macrophages even more.^{21,22} As the clastic cells responsible for dental resorption come from mononucleated phagocytic cells represented by monocytes and macrophages,¹ one could suppose that there would be a decrease in the activation of these cells in an atopic patient, by the decrease in cytokines such as IL-12 and INF-gamma, thus favoring the prognosis of the dental root.¹⁵

Moreover, the receptor systems of receptor activator of nuclear factor-kappa B (RANK), RANK ligand (RANKL), and osteoprotegerin, responsible for the metabolism of the hard tissue, are regulated by proteins, cytokines, and calciotropic hormones, and they are important for modulating the immune system. Cells that present RANKL with stimulus of the cytokines, such as IL-1b and IL-17 and TNF-a, cause inflammation and resorption. Osteoprotegerin, IL-4 and IL-10, and cytotoxic T-lymphocyte antigen 4 inhibit inflammation and osteoclastogenesis.^{16,23,24} This axis and its regulation are critical for pathologic lesions involving chronic inflammation.²⁵

The results of this study showed the importance of the extra-alveolar dental time and patient's predominantly Th2 immunologic profile, represented by atopy in patients who suffered replantation after dental avulsion.

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