REVIEW

SKIN TESTING FOR IMMEDIATE HYPERSENSITIVITY TO LOCAL ANESTHETICS IN DENTISTRY: PRACTICAL INDICATIONS, STANDARDIZED METHODOLOGY, AND CLINICAL UTILITY

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Abstract: *Background*: Immediate IgE-mediated hypersensitivity reactions to amide local anesthetics (LAs) in dentistry are extremely rare. Despite this, dental practitioners often refer patients for allergy skin testing based on histories of unrelated drug allergies or nonspecific adverse events, resulting in unnecessary diagnostic procedures and delays in care. This narrative review discusses skin prick testing (SPT) and intradermal testing (IDT) with non-irritant concentrations for assessing immediate hypersensitivity to dental LAs. *Methods*. A search of literature was conducted in PubMed, Wiley and Science Direct Databases. *Results*. Confirmed cases of genuine allergy to articaine and mepivacaine, the most commonly used local anesthetics in Romania, have remained scarce worldwide over recent decades. Rigorous testing protocols require preservative-free amide LAs without epinephrine, appropriate negative and positive controls, and careful assessment for dermographism, which affects about 5% of the general population. Additionally, alternative causes of periprocedural adverse events, including vasovagal syncope, local anesthetic systemic toxicity, and bradykinin-mediated angioedema, should be thoroughly evaluated. *Conclusion*. Adhering to standardized testing protocols with non-irritant concentrations, as recommended by the European Academy of Allergy and Clinical Immunology (EAACI) guidelines, enhances patient safety and diagnostic precision.

Keywords: local anesthetics, skin tests, immediate hypersensitivity.

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1. Introduction

Local anesthetics (LAs) are among the most frequently administered drug classes in contemporary dental practice, essential for periprocedural pain control during routine restorative procedures, endodontic therapy, oral surgery, and periodontal interventions. Modern amide-type LAs available in Romania for use in dentistry (lidocaine, mepivacaine, and articaine) exhibit excellent safety profiles and are widely considered among the safest pharmacological agents in medicine [1-3].

Nevertheless, many adverse events occurring during or shortly after LA administration are frequently misinterpreted by both patients and dental practitioners as an immediate allergic reaction [4]. This diagnostic mislabeling generates profound patient anxiety, leads to the unwarranted avoidance of local anesthesia, and fuels over-referral to allergology services for skin testing [5]. Moreover, many referrals are often initiated based on completely unrelated drug hypersensitivities, such as a history of penicillin or nonsteroidal anti-inflammatory drug hypersensitivity, even in patients with no prior LA exposure [5]. Real-world data confirm that true IgE-mediated reactions account for less than 1% of all reported local anesthetic adverse events [4,6]. Such over-referral patterns induce substantial diagnostic delays, increase healthcare expenditure, and, in extreme cases, lead to unnecessary use of general anesthesia for routine procedures that could otherwise be safely managed with local blocks. Occasionally, patients are referred to an allergist because the dental practitioner performed an in-office allergy skin test with an LA, which is often unwarranted and is erroneously interpreted as positive due to methodological flaws. Such technical errors include using irritating concentrations; administering the agent subcutaneously rather than intradermally, with an inappropriate syringe or needle caliber; and omitting both positive and negative controls, the latter of which is essential for evaluating potential underlying dermographism.

The present review aims to provide a clear, guidelines-based clinical framework for the allergy evaluation of suspected immediate hypersensitivity reactions to dental LAs, focusing specifically on skin prick testing (SPT) and intradermal testing (IDT) for IgE-mediated reactions in accordance with established European Academy of Allergy and Clinical Immunology (EAACI) recommendations [1,6]. Emphasis is placed on the extreme rarity of true IgE-mediated amide-type LA allergies, the rigorous methodology required to prepare non-irritating concentrations, common technical pitfalls, and the differential diagnosis of non-allergic periprocedural events, such as vasovagal syncope or local anesthetic systemic toxicity (LAST), regularly encountered in daily dental practice [3,7].

2. Key Epidemiological and Pathophysiological Considerations

Although adverse reactions to LAs are reported relatively frequently in dental settings, true immunologically mediated hypersensitivity remains exceedingly rare [1,2,8]. Comprehensive literature reviews have identified only a limited number of well-documented cases of confirmed, genuine allergy to the LAs most widely used globally and in Romania [2,3]. Among these confirmed

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cases, the majority of patients presented with immediate IgE-mediated reactions, whereas a smaller subset exhibited delayed, cell-mediated hypersensitivity [2,8]. IDT has consistently emerged as the most sensitive diagnostic skin test [2,9], with cross-reactivity among amide-type agents documented in only a small fraction of cases [2,10]. Recent real-world clinical data further highlight the substantial disparity between suspected local anesthetic allergies and confirmed hypersensitivity following standardized allergy evaluation, reinforcing the clinical consensus that the vast majority of referred cases do not represent true immunologic hypersensitivity [11-14].

Pharmacologically, LAs are classified as either esters or amides [10]. Injectable ester-type local anesthetics have been entirely phased out of routine contemporary dentistry worldwide. Modern amide LAs, such as lidocaine, mepivacaine, and articaine, differ structurally from esters by possessing an intermediate amide linkage. True IgE-mediated allergy to amide LAs is extraordinarily rare, given their ubiquitous deployment in clinical practice [8,15,16].

Critically, most reported adverse reactions, often mistakenly considered allergic, are non-immunological in origin; these are predominantly vasovagal or psychogenic episodes, or dose-dependent toxic reactions resulting from inadvertent intravascular injection of the anesthetic agent or its epinephrine/adrenaline component [7, 17]. While delayed-type hypersensitivity to amides is occasionally documented, cross-reactivity within the amide group can occur in both immediate and delayed-type reactions [10,18]. Crucially, there is no cross-reactivity between the amide and ester groups [10].

Scientific data underscore that true IgE-mediated allergies to modern amide-type LAs account for less than 1% of all reported periprocedural adverse events [3,14,19]. The overwhelming majority of acute clinical presentations lack an immunological basis and are instead driven by vasovagal responses, localized or systemic toxicity, or the sympathomimetic side effects of epinephrine, such as acute tachycardia, palpitations, and heightened anxiety [7,17,20].

Pathophysiological, a genuine IgE-mediated immediate hypersensitivity reaction to an LA requires a prior sensitization phase, meaning it depends on previous exposure, during which allergen-specific IgE antibodies are synthesized in response to the anesthetic molecule. These specific IgE antibodies bind with high-affinity IgE receptors constitutively expressed on the surface membranes of tissue-resident mast cells and circulating basophils. Upon subsequent re-exposure, the LA molecule acting as an allergen binds to membrane-bound IgE molecules. This critical cross-linking event initiates an intracellular biochemical cascade and triggers mast cell and basophil degranulation, precipitating the systemic release of potent preformed biogenic amines and neutral proteases, most notably histamine and chymase/tryptase, de novo synthesis of lipid-derived eicosanoid mediators, including prostaglandin D2 and leukotriene C4, alongside the downstream transcription of pro-inflammatory cytokines. Conversely, non-allergic periprocedural events completely lack this adaptive immune cascade [1,20-22].

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On extremely rare occasions, when the anesthetic molecule itself is tolerated, potential involvement of excipients may be discussed [23]. If a patient presents with a suspected immediate hypersensitivity reaction to an LA cartridge in the dental office, the allergy investigation should not be directed toward methylparaben, EDTA (sodium edetate), or latex. Methylparaben is absent from modern, sterile, single-use formulations; similarly, EDTA's clinical relevance is negligible, as it has been systematically eliminated from contemporary articaine and mepivacaine cartridges.

Furthermore, natural rubber latex is absent from current manufacturing standards; modern dental cartridges are strictly latex-free, utilizing synthetic bromobutyl or chlorobutyl rubber for both the internal plunger and the penetrable diaphragm seal. The only excipient in the vasoconstrictor dental cartridge that has the potential for adverse reactions is sodium metabisulfite (an antioxidant that stabilizes the vasoconstrictor adrenaline/epinephrine).

A history of contact dermatitis to it does not predispose to immediate systemic reactions. Although genuine systemic hypersensitivity reactions to sulfites remain rare in the general population, clinical manifestations may be significant in a few patients with severe asthma. In those with a suspected or documented history of sulfite hypersensitivity, epinephrine-containing LAs are recommended to be avoided.

This type of antioxidant is systematically absent from vasoconstrictor-free formulations, commonly designated as "plain" formulas [1,23].

3. Indications for skin testing in suspected immediate hypersensitivity to LAs

In accordance with international consensus guidelines, SPT, followed by IDT, is strictly indicated only when a patient presents with a highly convincing clinical history of an immediate hypersensitivity reaction. These clinical circumstances are characterized by objective manifestations such as acute urticaria, angioedema, bronchospasm, acute hypotension, or anaphylaxis that occur within minutes to 1 hour after LA administration [3,15,16]. Conversely, formal allergy testing is explicitly not recommended and is considered clinically counterproductive in the following scenarios [1,3,10,11,24]:

- Patients with no prior LA exposure: Pre-exposure screening or prophylactic testing lacks any diagnostic validity or predictive value. Routine screening by subcutaneous or inappropriate concentrations frequently yields false-positive results, leading to the erroneous mislabeling of non-allergic patients.
- Concomitant hypersensitivity to unrelated drug classes: A documented history of allergy to structurally disparate pharmacological agents, such as beta-lactam antibiotics or nonsteroidal anti-inflammatory drugs (NSAIDs), does not elevate the baseline risk for an LA allergy. Cross-reactivity between these classes is biochemically impossible.
- Patients with unrelated respiratory or food allergies, considered to have a so-called "atopic background": A common clinical misconception is that individuals

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with allergic rhinitis, asthma, or polysensitization to environmental allergens (e.g., pollen, dust mites, or animal dander) carry a higher risk for LA hypersensitivity. Pathophysiological, these involve specific IgE directed against complex airborne proteins that show no structural or immunological cross-reactivity with low-molecular-weight synthetic amide molecules.

- Prior uneventful tolerance to LAs: Individuals who have previously tolerated the index or an alternative amide-type LA without adverse consequences should not undergo skin testing, as the clinical probability of a newly acquired IgE-mediated amide allergy is virtually non-existent.

Routine, precautionary allergy testing requested by dental practitioners "just to be safe" prior to scheduled dental treatments represents a major misuse of specialist resources and must be strongly discouraged. This defensive medical practice introduces substantial systemic harm: it drives clinical overdiagnosis, encourages the unwarranted avoidance of highly effective local pain control, induces unnecessary patient anxiety, and drastically escalates overall healthcare expenditure.

More critically, this approach may introduce severe, preventable patient risks; driven by unfounded apprehension, dental practitioners may shift to general anesthesia or deep sedation, replacing a remarkably safe local procedure with interventions carrying inherently higher morbidity and mortality rates [1,15,16].

4. Methodology of skin testing for immediate hypersensitivity to LAs: an overview

The in vivo diagnostic evaluation of suspected immediate hypersensitivity reactions to LAs must be performed by an allergist or a qualified specialist in accordance with national regulations [1,3,25]. Given the inherent, albeit low risk of provoking an acute systemic reaction during diagnostic testing, the entire investigation must take place in a monitored clinical setting where emergency support is readily available. To balance diagnostic accuracy with patient safety, the testing algorithm must comply with standardized protocols established by the EAACI and the European Network for Drug Allergy (ENDA) [1,3,22].

Allergy evaluation begins with SPT on the volar aspect of the forearm, maintaining a minimum distance of 2-3 cm between testing sites to avoid overlapping wheal-and-flare fields, after cleansing with an isopropyl or ethyl alcohol solution to minimize surface bacterial loads (Figure 1a). Crucially, the skin must be allowed to air-dry completely, as residual liquid alcohol can cause localized micro-vascular irritation [1,3]. In accordance with ENDA guidelines, a droplet of the index anesthetic agent is applied to the epidermis. To ensure reproducibility and avoid nonspecific tissue trauma, the procedure must be performed using standardized, single-use, sterile metal lancets for SPT with a 1 mm tip [9]. The prick lancet is pressed vertically through the allergen droplet into the superficial skin layer at a 90-degree angle for about 1 second without inducing bleeding [9]. This localized pressure introduces a minute volume, on the order of nanoliters, of the

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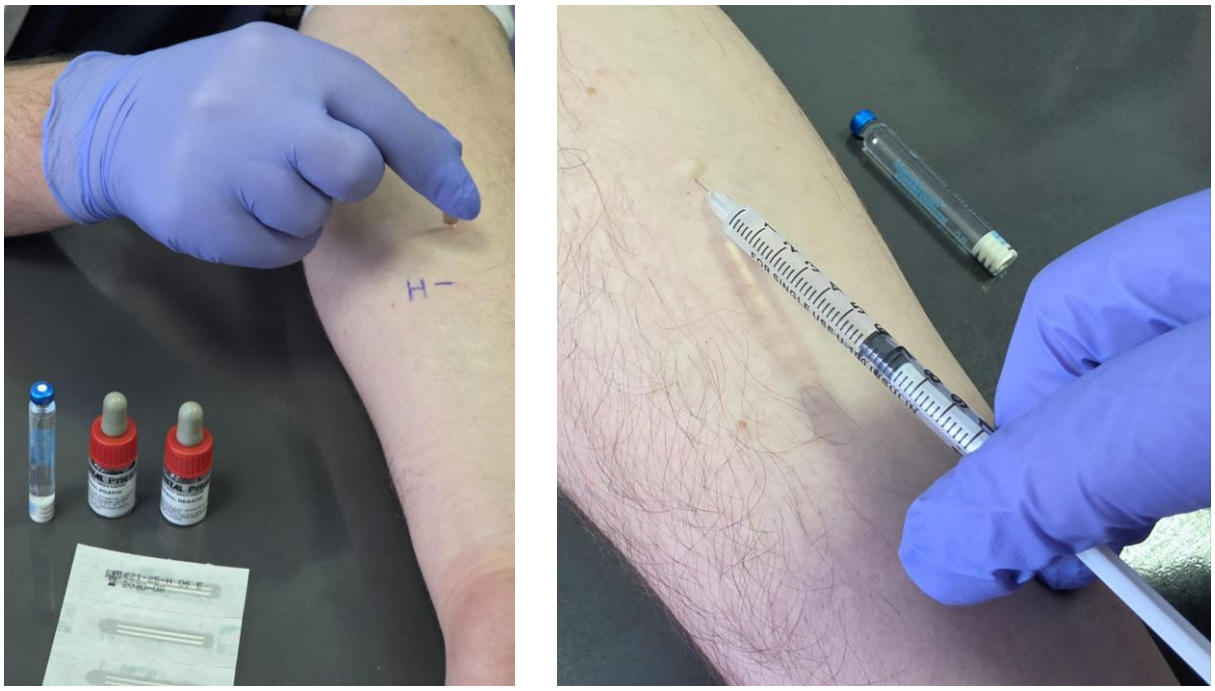
anesthetic agent directly to the epidermal mast cells. The average volume introduced by a standard 1 mm metal lancet is approximately 16 nanoliters, with a broad distribution ranging up to 80 nanoliters, depending on individual epidermal density and localized tissue compliance [26]. The index agent is routinely tested as an undiluted solution unless an exceptionally hyperacute initial systemic reaction is documented, in which case a 1:10 dilution is indicated as a safety precaution [1].



(a) (b)

Figure 1. (a) SPT procedure in suspected LA hypersensitivity; (b) IDT procedure in suspected LA hypersensitivity.

If the SPT yields negative results after a formal 15- to 20-minute observation period, the clinician proceeds sequentially to IDT. The IDT must be performed using a sterile 1 mL low-dead-space syringe paired with a fine-gauge hypodermic needle, specifically 26-gauge or 27-gauge (Figure 1b) [3, 9]. The mechanical delivery of the solution is structurally critical. The needle must be inserted into the superficial dermis at a shallow angle of 10 to 15 degrees, with the bevel facing upward [9]. The clinician then slowly injects 0.02 to 0.03 mL of the solution, creating a clearly visible, tense, pale superficial bleb measuring approximately 3 to 4 mm in baseline diameter. Accidental deeper delivery into the subcutaneous tissue space is a technical error; it allows the fluid to dissipate rapidly without creating a localized bleb, rendering the test invalid and increasing the risk of systemic drug absorption [1, 9]. To prevent false-positive irritant responses or systemic flares, the IDT sequence must be initiated using validated, non-irritating concentrations, starting at a 1:100 or 1:10 volume/volume dilution [1, 3].

Simultaneously, negative and positive controls must be integrated into the test procedure to establish valid reference parameters. Every testing session requires a

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negative control consisting of 0.9% sterile saline solution administered via both SPT and IDT modalities, along with an SPT positive control using 10 mg/mL histamine dihydrochloride [1,3].

All testing sites are precisely evaluated after 15 to 20 minutes using a millimeter-marked medical ruler. A true positive response for either SPT or IDT is defined as a palpable wheal with a mean diameter greater than or equal to 3 mm above the negative control baseline, typically surrounded by localized erythema [1, 3, 22]. Omitting the saline control represents a critical methodological failure, particularly in patients with underlying symptomatic dermographism [3]. In these individuals, minor mechanical trauma from the lancet tip or the intradermal needle triggers a non-immunological, pressure-induced release of histamine from local mast cells. Without an adjacent saline reference, the resulting mechanical wheal would be erroneously interpreted as a true, drug-specific IgE-mediated LA hypersensitivity [3].

To prevent false-positive irritant reactions, skin testing must be performed not exceeding maximum non-irritating concentrations (Table 1), as validated by EAACI guidelines and clinical trials [1,3,27]. LA preparations selected for skin testing should ideally be free of vasoconstrictors (such as epinephrine) and preservatives (such as parabens or sulfites) [3,9].

Table 1. Recommended maximum non-irritative concentrations for SPT and IDT with LAs.

Local Anesthetic	SPT Concentration	IDT Concentration
Lidocaine	10 mg/mL (Undiluted)	1 mg/mL (1:10 dilution)
Mepivacaine	20 mg/mL (Undiluted)	2 mg/mL (1:10 dilution)
Articaine*	20 mg/mL (Undiluted)	2 mg/mL (1:10 dilution)

* Methodological note on articaine availability: In Romania, all commercially available dental articaine preparations are formulated with epinephrine co-constituents, rendering them unsuitable for allergy skin testing.

Because true immunologically IgE-mediated hypersensitivity to modern amide LAs is extremely rare, the definitive gold standard for ruling out allergy is a graded drug provocation test (DPT) [28, 29]. Acute, non-allergic periprocedural events, such as vasovagal syncope, panic-induced hyperventilation, or mild systemic toxicity from accidental intravascular entry, frequently masquerade as hypersensitivity, yet these episodes typically lack cutaneous symptoms like generalized urticaria or angioedema [8].

Skin testing is mandatory prior to a DPT when a genuine immunologic etiology is highly suspected, or when anxious patients require strong objective reassurance before dental interventions [29]. Due to the high prevalence of procedural anxiety in patients reporting "anesthetic allergies", a placebo-controlled DPT (using a sterile saline injection as a blind baseline) should routinely be considered [10, 29]. Furthermore, conducting a subsequent unblinded subcutaneous provocation using an LA formulated with a vasoconstrictor can reproduce the patient's prior experience of localized tachycardia or palpitations; this serves as an invaluable tool to reassure the patient that these sympathomimetic symptoms are benign,

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expected pharmacological side effects of epinephrine rather than signs of anaphylaxis [8, 16].

The clinical reality of dental practice in Romania introduces specific parameters for patient management. Because all standard commercial articaine cartridges available on the Romanian market are formulated with epinephrine to prolong localized anesthesia, they cannot be used directly for SPT or IDT. In these clinical scenarios, initial allergy screening should safely be conducted using pure, preservative-free lidocaine or mepivacaine [3]. Dental practitioners should actively resist requests for "complete LAs allergy panels" for patients presenting with completely unrelated hypersensitivities, such as a documented history of penicillin or NSAID allergy, or for patients who have previously tolerated an amide LA without incident.

Crucially, modern dental anesthetic cartridges manufactured or distributed within Romania and the European Union no longer contain problematic additives such as EDTA (ethylenediaminetetraacetic acid or its edetate salts) or methylparabens. These compounds were historically blamed for clusters of periprocedural hypersensitivity. Modern single-use dental cartridges are sterile and require no paraben-based preservatives. Furthermore, the internal plunger and the penetrable diaphragm seal are now manufactured from synthetic bromobutyl or chlorobutyl rubbers with no natural rubber latex, eliminating the risk of latex allergen leaching. Finally, this excellent safety profile is mirrored in dentistry; thirty years of large-scale epidemiological data confirm that immediate-type LA hypersensitivity reactions are extraordinarily rare, establishing that genuine IgE-mediated allergy remains an uncommon diagnosis across all age groups [9, 12, 13, 18, 23].

Negative skin test results do not rule out nonallergic adverse reactions of varying severity, nor do they predict nonallergic systemic events such as vasovagal syncope, psychogenic hyperventilation, or LAST [7, 8]. For cases where clinical history strongly points to a delayed-type, cell-mediated hypersensitivity reaction that manifests days post-procedure, diagnostic evaluation includes patch testing protocols or delayed-reading IDT rather than classic SPT-IDT workflows [10, 18].

5. Methodology of skin testing for immediate hypersensitivity to LAs: an overview

IgE-mediated immediate hypersensitivity to LAs must be carefully distinguished from several more common non-allergic conditions that frequently may mimic allergic reactions in the dental setting. When an acute periprocedural event occurs, a precise mechanistic understanding of these alternative etiologies is essential to prevent erroneous diagnostic labeling [3, 8].

Non-immunological episodes constitute the overwhelming majority of adverse events reported in dental practice [3, 8]. Procedural anxiety and painful stimuli regularly trigger vasovagal syncope or panic-induced hyperventilation attacks [8]. A vasovagal reaction is characterized primarily by bradycardia, cutaneous pallor, and diaphoresis, and is completely lacking the hallmark respiratory or cutaneous signs of anaphylaxis, including generalized urticaria, angioedema, or pruritus [8]. Furthermore, the

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co-administration of epinephrine can induce distinct sympathomimetic side effects, including acute tachycardia, palpitations, tremors, and heightened anxiety, which both patients and clinicians frequently misinterpret as an allergic emergency [3, 8]. Because these episodes lack an immunological basis, they do not justify subsequent allergy skin testing [3].

LAST represents a dose-dependent pharmacological toxicity resulting from elevated circulating concentrations of the free anesthetic agent, typically caused by accidental direct intravascular injection or rapid systemic absorption [7]. It is entirely distinct from immune-mediated hypersensitivity. The clinical progression of LAST follows a predictable toxicological continuum [7]. Early central nervous system signs, such as circumoral paresthesia, metallic taste, tinnitus, slurred speech, and agitation, can rapidly progress to seizures and subsequent cardiovascular collapse [7]. Safety guidelines impose that patients presenting with transient neurological symptoms must be monitored for at least 2 hours, whereas any case involving cardiovascular instability or arrhythmia requires continuous critical observation for 4-6 hours [7].

Lidocaine and mepivacaine exhibit similar systemic toxicity profiles. In contrast, articaine has lower overall systemic toxicity, primarily due to its rapid plasma metabolism. While lidocaine is primarily metabolized in the liver via CYP3A4 and CYP1A2, mepivacaine is mainly metabolized through CYP3A4 (with minor CYP1A2 involvement). Articaine is unique among amide LAs: approximately 90–95% is hydrolyzed by plasma carboxylesterases, with only 5–10% undergoing hepatic metabolism. Consequently, articaine is preferred for patients with hepatic impairment because it poses a significantly lower risk of systemic accumulation. Conversely, lidocaine and mepivacaine require dose reductions and careful monitoring in patients with liver disease. Furthermore, genetic CYP polymorphisms or CYP inhibitors (such as fluvoxamine, fluoroquinolones, and grapefruit juice) can significantly prolong the clearance of lidocaine and mepivacaine, increasing the risk of LAST. Articaine is largely unaffected by these hepatic metabolic factors [7, 32-34].

Hereditary or acquired C1-esterase inhibitor deficiency, alongside angiotensin-converting enzyme inhibitor-induced angioedema, constitutes a major class of non-histaminergic, bradykinin-mediated reactions [30, 31]. Pathophysiological, these events are driven by the localized accumulation of bradykinin rather than mast cell degranulation [30]. In a dental context, these episodes of swelling are frequently triggered by mechanical trauma, localized mucosal pressure, or surgical interventions [31]. Crucially, bradykinin-mediated angioedema presents with a complete absence of urticaria or pruritus. Therefore, these reactions are refractory to standard emergency treatments such as antihistamines and corticosteroids [35].

Delayed pressure urticaria involves wheals or angioedema appearing 4–12 hours after sustained pressure. In dentistry, it may be provoked by impressions, extractions, or prolonged manipulation. Case series describe facial or lip swelling following routine dental treatment, requiring modified protocols to minimize mechanical pressure [36]. Vibratory

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angioedema is an extremely rare physical urticaria triggered by vibratory stimuli. In dentistry, it has been reported following the use of ultrasonic scalers or high-speed handpieces [37]. Crucially, inferior alveolar nerve blocks, especially when using techniques like the Spix (traditional IANB) or Gow-Gates, frequently anesthetize the lingual nerve due to its close anatomical proximity. This can cause numbness in the anterior two-thirds of the tongue, the floor of the mouth, and the adjacent lingual gingiva. Patients often perceive this sensory alteration as localized swelling. In the differential diagnosis of post-procedural adverse events, this benign, transient phenomenon must be carefully distinguished from true angioedema or anxiety-related symptoms [38].

Regarding the potential risk of paresthesia from prolonged numbness or tingling due to inferior alveolar/lingual nerve involvement, especially with mandibular nerve blocks, some older studies reported a slightly higher incidence for articaine than with lidocaine, although many recent and in vitro studies show that it is equally or even less neurotoxic [39,40].

A series of initial attempts to detect serum allergen-specific IgE antibodies against various amide LAs using in vitro immunoassays was systematically unsuccessful. Documented cases of true IgE-mediated immediate hypersensitivity, in which allergen-specific IgE antibodies to the LA molecule were definitively detected alongside positive in vivo skin testing, have been reported in only a very small number of patients worldwide [41]. To date, serum specific IgE antibodies have been detected in only two cases: one via immunoblotting (specifically the dot-blot method) for IgE to lidocaine, and another using an experimental fluorescence enzyme immunoassay for IgE to mepivacaine. Furthermore, only three other cases have revealed positive results on the basophil activation test, a flow cytometry-assisted technique used to quantify CD63 expression on viable basophils exposed to lidocaine [42]. In routine clinical practice, concentrations of serum allergen-specific IgE against lidocaine, mepivacaine, and articaine may be measured using commercial enzyme immunoassays [41-43].

In case of suspected allergy to amino amide local anesthetics, a course of action should be followed to exclude other types of reactions, as mentioned [44]. For an allergic patient to local anesthetics of amino amide type, 1% diphenhydramine with 1:100000 epinephrine is considered a safe alternative [45].

6. Conclusions and Disclaimer

Genuine IgE-mediated immediate hypersensitivity reactions to modern dental amide LAs are extremely rare. As a result, conducting indiscriminate screening or routine prophylactic skin testing in non-stratified patient populations is neither clinically nor economically justified. When formal allergy evaluation is warranted due to a highly suggestive clinical history, diagnostic skin testing should strictly adhere to established, non-irritating concentrations. Such testing must also include mandatory positive and negative controls to avoid confounding results from false-negative or false-positive irritant reactions.

Interdisciplinary collaboration between dental practitioners and qualified allergists is crucial. From a clinical governance and

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regulatory standpoint, physicians investigating suspected hypersensitivity to LAs should use their medical judgment in accordance with local institutional protocols and national guidelines, all while continuously updating their practices based on emerging medical literature.

This review is intended solely for informational and educational purposes and does not replace the clinical expertise, diagnostic skills, or direct patient care provided by specialists.

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The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Not applicable for this review study.

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