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EDITORIAL

Therapeutic Botox in the Management of Myofascial Pain

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Myofascial pain is the most common subtype of temporomandibular disorders (TMD) (1,2), characterized by pain originating from trigger points in the masticatory muscles and their connective tissue. This pain can be localized or spread beyond the jaw muscles, often accompanied by referred pain patterns, and may result in limited mandibular movement and functional impairment (3-5). Although oral appliances, physiotherapy, behavioral therapy, and pharmacological interventions remain first-line treatments, these modalities may not fully relieve symptoms in a subset of patients (6,7). Chronic cases can perpetuate a self-sustaining loop of muscle hyperactivity and pain that is difficult to interrupt (8). When conservative treatments are not sufficient (9), botulinum toxin type A (BTX-A) provides a unique method by inhibiting acetylcholine release at the neuromuscular junction and causing antihyperalgesic effects along nociceptive pathways (10). The literature discussed indicates promising reductions in pain and functional improvement, though variability in methodology and outcomes continues to challenge interpretation.

BTX-A is a biologic medication that was first adopted in ophthalmology for strabismus and blepharospasm and later expanded to a range of neurologic and autonomic indications (11,12). At present, BTX-A is approved by the United States Food and Drug Administration for the prophylaxis of headaches in adults with chronic migraine (13), and its benefit is supported by the PREEMPT (Phase 3 REsearch Evaluating Migraine Prophylaxis Therapy) trials and subsequent guidance (14,15). Mechanistically, BTX-A cleaves Synaptosomal-associated protein 25 (SNAP-25) (16) and suppresses activity-dependent exocytosis of nociceptive transmitters from trigeminal afferents (17), including Calcitonin Gene-Related Peptide (CGRP), substance P, and glutamate, thereby reducing peripheral and central sensitization that drives facial and head pain (18). These same mediators and pathways are engaged in myofascial TMD pain: CGRP-positive trigeminal fibers innervate the joint and masticatory muscles (19,20), CGRP levels rise with temporomandibular joint inflammation or masseter injury (20), exogenous CGRP in these tissues evokes pain, and blockade of CGRP signaling attenuates pain in experimental TMD models (21). Given this shared trigeminal and CGRP biology between migraine and TMD, the analgesic actions of BTX-A provide a biologic rationale for adjunct use in myofascial TMD, whether or not headaches are present (21). In clinical use, protocols for dosing, dilution, injection mapping, and retreatment intervals vary across studies (22). Common target muscles for TMD-related myofascial pain include the masseter and temporalis (23), while headache protocols based on PREEMPT typically include frontal, temporal, occipital, cervical, paraspinal,

and trapezius regions at twelve-week intervals (15).

Clinical indications suggest that BTX-A may be beneficial for certain people suffering from refractory myofascial TMD pain. Across reports, the most consistent benefits are reductions in pain and better jaw function, especially in localized myalgia after an adequate trial of education, self-care, physiotherapy, and oral appliances (24,25). Variation in case definition, dose, and injection mapping explains many of the differences between studies, but the overall pattern is encouraging, with reviews and meta-analyses noting benefit over saline in some outcomes and supporting adjunct use in refractory cases (26-28). At the level of individual and smaller clinical series, a single-patient case report described improvement in muscular-origin TMD with BTX-A (29). Earlier open-label work in chronic tension-type headache with TMD reported at least fifty percent reductions in headache intensity and frequency after injections to the masseter and temporalis (30). In a surgical setting, adding BTX-A for patients with chronic migraine and TMD arthralgia who were undergoing temporomandibular joint arthroscopy was associated with larger reductions in pain, fewer headache days, and a greater increase in mouth opening than arthroscopy alone (31). In another case series, ten adults with TMD-related myofascial pain refractory to conservative care, all coexisting with neck and shoulder pain, received targeted bilateral injections to the masseter and temporalis with selective suboccipital and shoulder sites, and experienced marked pain reductions without significant adverse events (32). Complementing these observations, a prospective series of forty two patients with temporomandibular joint dysfunction, masseter pain, and tension type headache found that 21 units in each masseter lowered pain scores from about five (out of 10, numeric Visual Analogue Scale, VAS) to near one at follow-up and reduced temporal pain and analgesic use, although the authors cautioned about long term muscle and bone effects with repeated treatment (33). At the cohort level, and in women with chronic migraine with and without TMD, BTX-A reduced monthly headache days in both groups, and those with TMD also described improvement in jaw symptoms (34).

Turning to randomized trials, in bruxers with myofascial pain, Guarda-Nardini et al. found that a total dose of 100 units reduced chewing pain and the benefit was still present at six months (25). Similarly, a small double-blind pilot trial in patients with masticatory muscle pain and headache showed improved pain outcomes with BTX-A over saline at twelve weeks, though the authors noted the limited sample size and the lack of headache phenotype classification (35). In chronic facial pain associated with masticatory hyperactivity, von Lindern et al. reported that 35 units per masseter produced a mean visual analog reduction of about 3.2 points (out of 10, numeric VAS), and 91% of patients improved with a significant difference *versus* placebo (36). Finally, a single-center three-armed randomized clinical trial showed greater and longer-lasting improvement with BTX-A than with saline or lidocaine in localized myalgia, with effects lasting up to six months, while responses were less clear in referred pain, where saline and lidocaine acted as active comparators (24). Regarding safety, a contemporary overview also notes that adverse effects reported in randomized trials are usually transient, such as temporary regional weakness or an asymmetric smile, and at least one randomized study found no difference in adverse event rates between BTX-A and saline (28,37,38).

Several sources point away from the routine use of BTX-A in myofascial TMD. A double blind crossover trial found no advantage over placebo in chronic myogenous orofacial pain (38). Similarly, Reeve et al. reported similar reductions in pain and improvements in jaw function with BTX-A and with saline at one month, with no between-group superiority (39). At the evidence-synthesis level, a review concluded that confidence in BTX-A effectiveness remains low, because results are inconsistent and methods vary widely (27). At the same time, across the reports discussed above, BTX-A shows an acceptable safety profile with generally mild and transient effects and a credible signal of benefit in well-profiled refractory cases. These cautions should not preclude use in selected patients, but should motivate larger, methodologically rigorous trials with standardized mapping, appropriate comparators, and longer follow-up to validate its role.

Future research should adopt consistent methods and sharper case definitions. Studies ought to use standardized diagnostic criteria (40), specify the myalgia subtype by separating localized myalgia from pain with referral, and document any headache phenotype. Protocols should be pre-registered with explicit injection maps for masseter and temporalis and

pre-specified optional cervical and trapezius sites when headache features are present. Dose should be reported per site, per muscle, and per side, with dilution and planned retreatment interval stated in advance. Comparators need to control for procedure effects by matching the number and depth of needle passes and should include the best available conservative care. Core outcomes should include pain at rest and with chewing, maximum interincisal opening, a brief function measure, patient global impression of change, and headache days when relevant, assessed at two to four weeks, three months, and six to twelve months. A multi-center randomized program paired with a practice registry would enable real-world benchmarking, phenotype-specific analyses, and credible estimates of value.

In conclusion, basic science and clinical findings support the use of BTX-A as an adjuvant for well-profiled myofascial TMD following conservative treatment. It is not a first step, but for refractory cases following conservative treatment, BTX-A can reduce pain and improve function. The most consistent benefits are reductions in pain and improvements in function, especially in localized myalgia with clear muscle tenderness. Benefit may be more likely when headache features suggest shared trigeminal pathways. Neutral or negative trials caution against routine use, but they do not outweigh the overall benefit in selected cases. Rather, they indicate the need for standardized mapping, dose reporting, appropriate comparators, and follow-up long enough to test durability. Used in this disciplined way, BTX-A can occupy a defined, evidence-informed place in dental practice for patients with refractory myofascial pain, while ongoing studies refine indications and confirm long-term value.

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