Applications of Botulinum Toxin in Dentistry

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Introduction

- Botulinum toxin formed by Clostridium botulinum
- Causes life-threatening paralysis and lead to respiratory failure
- Fit was the first toxin to be accepted for therapeutic use
    - Used for strabismus
- Botulinum toxin can be classified into 7 types A – G (only type A & B are available on the market)

Mechanism of Action

- Produces a dose-dependent weakening of muscle activity
- Inhibits the release of acetylcholine from nerve terminals
- Neuromuscular transmission is re-established by the sprouting of new axon terminals
- Muscular blockade is temporary
- Use of botulinum toxin therapeutically is palliative rather than curative

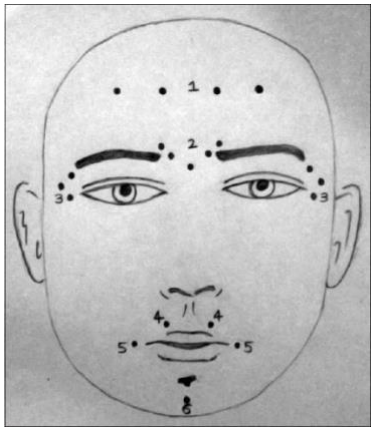
Preparation

- Dose depends on the brands, units are not the same between each brand
- Comes as a vacuum dried powder for reconstitution with 0.9% sodium chloride
- Vigorous shaking during reconstitution can lead to surface denaturation of the toxin
- The preparation should be used within 4 hours
- The preferred syringe is a tuberculin syringe with a 26-30g needle

Applications of Botulinum Toxin

Cosmetic

- Facial wrinkles
    - Temporarily treats hyperfunctional facial lines
    - Dose, injection sites and pattern of injections is dependent on desired appearance



1. Forehead lines: frontalis muscle
2. Frown lines: corrugator supercilii, procerus muscles
3. Lateral orbital lines: orbicularis oculi muscle
4. Perioral lines, gummy smile: orbicularis oris muscle
5. Marionette lines: depressor anguli oris muscle
6. Mentalis dysfunction: mentalis muscle

- Dentofacial esthetics and gummy smile
    - Effective in managing cases of excessive gingival display due to excessive contraction of upper lip muscles (levator labii superioris alaeque nasi)
    - Recommended injection point is “Yonsei point”
    - Botulinum and derma fillers have been used to increase volume of interpapillary tissue to minimize appearance of black triangles
- Dropping of corners of mouth
    - Hyperactivity of depressor anguli oris
    - Injection site is on trajectory of nasolabial fold to jaw line
- Temporalis and master muscle hypertrophy
    - Injection sites are identified by palpating the muscle during clenching
    - Inject into the thickest part of the muscles

Therapeutic

- Bruxism
    - Clenching or grinding of the teeth often associated with attrition, TMJ symptoms, headaches, muscular pain
    - Injection bilaterally into the masseter muscle
    - Reduces symptoms for 6-78 weeks
    - Equally as effective as an oral splint
- Sialorrhea and salivary secretion disorders
    - Excessive salivation often caused by poor oral and facial muscle control
    - Injection into the parotid or submandibular gland is effective to control drooling
    - Effects are seen within 1 month and last for approximately 3 months
- Facial nerve palsy
    - Reduces facial synkinesis, improving facial symmetry
    - Injection into the lacrimal gland can control hyperlacrimation
- Facial pain and trigeminal neuralgia
    - Effective in management of cervical dystonia and chronic facial pain associated with muscle hyperactivity
    - Minimally invasive approach to treating trigeminal neuralgia
- Implantology
    - Allows for unimpeded osseointegration of implants
    - Stress due to parafunctional habits may cause implant failure
    - Botulinum toxin relaxes masticatory muscles allowing osseointegration to occur
    - Body of evidence to support efficacy is limited
- Oral and maxillofacial trauma
    - Can be used to treat injuries involving maxilla, mandible, zygoma, orbital bones, and nasal bone
    - Temporary paralysis of masseter allows for fewer mini plates to be used in zygoma fracture repair
    - May be used as a pharmacological splint in the fracture of facial bones

    - Injections into the anterior belly of digastric correct posttraumatic open bite
    - Has also been proposed in the management of ranula
- Cancer and palliative care
    - Improves movement disorders such as synkinesis
    - Antispasticity agent for patients with severe pain
- Dentures
    - Helps patients adapt to dentures who are struggling with uncoordinated muscle movement
- Adjunct to orthodontic treatment to prevent relapse
    - Relapse following orthodontic treatment may occur due to strong muscle activity
    - Intensity of muscle contraction can be reduced and gradually retrained to a more physiologic movement
- Diagnostic application
    - In patients with chronic intermittent toothaches botulinum toxin can be used to verify the origin of pain

General Guidelines

- Treatment is palliative rather than curative
- Injections should not be done more frequently than once every 12 weeks
- Clinical effects should appear within 3-7 days
- Start with a lower dose then increase
- males usually require a greater dose
- muscles should not be completely paralyzed

Adverse Effects

- favourable safety spectrum
- most common side effects from injection into orofacial region: alteration in salivary consistency inadvertent weakness of swallowing, speech and facial muscles
    - more common with lateral pterygoid, palate and tongue injections
- other AE: allergic reaction, rash, allergy, itching, headache, neck or back pain, muscle stiffness, difficulty swallowing, shortness of breath
- some effects may be seen beyond the site of injection “spread of toxin effect”: generalized muscle weakness, diplopia, dysphagia, dysphonia, ptosis, urinary incontinence, breathing difficulties
- class C for pregnancy
- lethal dose of botulinum toxin dose in humans is not known but estimate to be 3000U
- maximum dose recommended for dental applications at an injection session is 80-100U

Contraindications

- known hypersensitivity
- presence of active infection at the proposed injection site
- pregnancy and lactation

- patients receiving treatment with aminoglycosides, anticholinergic drugs, or other agents interfering with neuromuscular transmission or muscle relaxant should be closely monitored as the effect of botulinum toxin may be potentiated
- patient suffering from neuromuscular junction disorders (eg. myasthenia gravis) are at greater risk for adverse reactions
- psychologically unstable patients

Conclusion

- botulinum toxin comes from *clostridium botulinum* and causes muscle paralysis by blocking the release of acetylcholine from nerve terminals
- the effect is temporary and neuromuscular transmission is re-established by the sprouting of new axon terminals
- the toxin comes as a power that gets reconstituted with 0.9% sodium chloride
- the preparation should be used within 4 hours
- botulinum toxin has shown promising results to correct facial esthetics and for therapeutic purposes in the orofacial region
- the effect is temporary and not curative, repeated administration is required
- botulinum toxin has a good safety profile, but should be used at recommended doses to minimize spread of toxin effect
- randomized control trials are lacking to investigate therapeutic efficacy
- botulinum toxin is an additional minimally invasive treatment modality which can be offered to patients in suitable cases
- practicing denture must ensure that administration is within his/her scope of practice, has appropriate training and prepared to manage potential adverse effects

References

Srivastava S, Kharbanda S, Pal US, Shah V. Applications of botulinum toxin in dentistry: A comprehensive review. *Natl J Maxillofac Surg.* 2015;6(2)152-159