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 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 supercillii, 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