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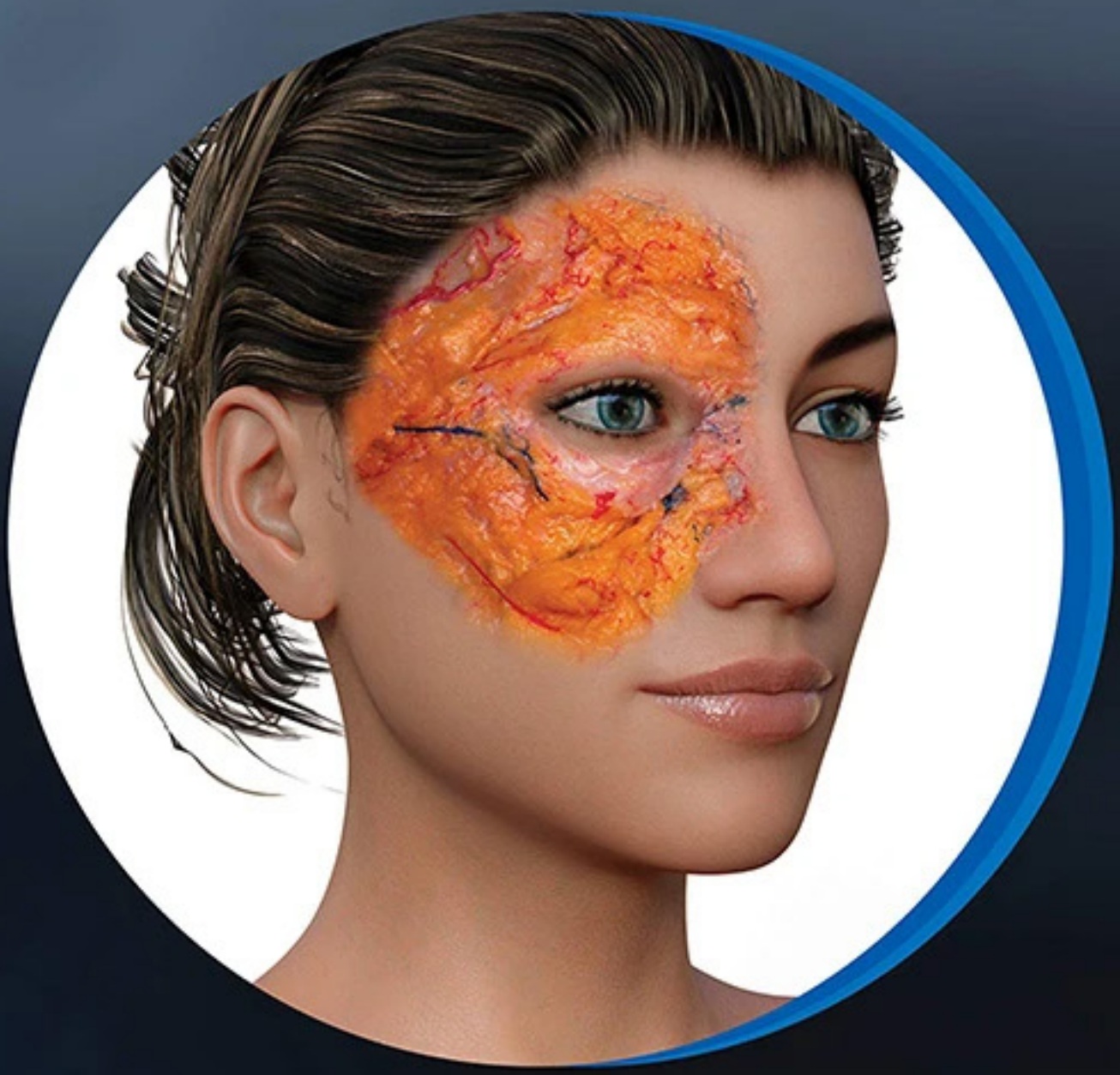
AESTHETIC FACIAL ANATOMY

ESSENTIALS FOR INJECTIONS



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WORLD SOCIETY OF INTERDISCIPLINARY AESTHETIC & ANTI-AGING MEDICINE

PRIME

E BOTULINUM TOXINS

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MOLECULAR STRUCTURE AND MODE OF ACTION

Clostridium botulinum is an anaerobic, gram-positive bacterium that secretes an extremely large neurotoxic molecule (900 kDa), which produces food poisoning or botulism. It is now also used in medicine to treat diseases according to Paracelsus's paradigm that the difference between a poison and a drug lies in the dose. Although seven different serotypes of the bacterium (A to G) are known, type A is the one mostly used for the production of clinical formulations. Type B also has clinical applications for those patients who may have developed clinical resistance to type A, but this is seldom the case in aesthetic treatments.

Of the 900 kDa natural molecule, only the central 150 kDa segment (the neurotoxic core) is responsible for its biological activity. The surrounding portions have no pharmacological activity and simply act as a protective shield ensuring unchanged toxin absorption from the host's gastrointestinal tract. These surrounding molecules are named accessory proteins and are both hemagglutinin and non-hemagglutinin in nature. Once the toxin has entered the host by ingestion or injection, the biological role of the accessory proteins is largely terminated and the 150 kDa neurotoxin comes into play. Here again, the structure is complex and each portion of the segment plays a relevant role.

The 150 kDa neurotoxic protein is divided into a 100 kDa heavy and a 50 kDa light chain. The heavy chain has a two-fold action. The first part (binding domain) links to the specific receptors at the level of the axonic presynaptic endings; the second (translocation domain) then carries the light chain through the membrane and into the actual nerve ending. Once there, the light 50 kDa chain accomplishes its task by cleaving a group of proteins, named SNARE, which are responsible for the release of the neurotransmitter acetylcholine. Inhibition of acetylcholine release impairs muscular contraction and flaccid paralysis ensues. The effect of botulinum toxin is only temporary, and within a few months neuromuscular efficacy is spontaneously reestablished.

The details of this process have not been fully elucidated. For the purposes of this chapter, however, it should be made clear that regeneration always and completely occurs.

Interruption of neuromuscular transmission is not the only medical application of the drug. Indeed,