Popularity of Cocaine as a Drug for Medical Treatment

Most medicines of the late nineteenth century with the exception of bottles with coca-extract products and/or opiates, were quite ineffective. So it's no wonder that coca extract products were considered a boon to medicine; at least they worked (Fig. 14). It also has been reported that Queen Victoria and young house-guest Winston Churchill took cocaine gum to relieve ailments whilst at Balmoral Castle. Among others, it was used as a means to stop bleeding and as a muscle relaxant. Later, in the nineteenth century it was promoted as a cure for respiratory ailments such as asthma and whooping cough. The "wonder" drug was used by many of the great minds of the nineteenth century, many of which became addicted. For instance, Oscar Wilde or John Hopkins, who discovered nerve block anesthesia, became cocaine addicts. Cocaine is also of literary interest since Sherlock Holmes supposedly took it, though it is alleged that Watson soon began to disapprove it. Unfortunately, with the cure came the problem. In 1920 cocaine was banned in the UK following reports of "crazed soldiers" in the First World War, and also due to alarming reports about the addictive potential of the drug and its ability to induce paranoia.

In the late nineteenth century more than 200 deaths were attributed to the intoxication of cocaine. In 1906, the United States population consumed as much cocaine as the US population consumed in 1976. By 1914 as crime was beginning to be attributed to cocaine usage, cocaine was started to be extracted from medicinal elixirs and Coca-Cola. As research discovered cocaine as an addictive and having the potential for abuse by users it later became illegal in the United States.

While official approval of coca-based tonics began to wane towards the end of the nineteenth century unfortunately, people who were prescribed cocaine to combat morphine dependence become addicted to both. For instance, the young Sigmund Freud (Fig. 15a), being a neuropathologist, pioneered cocaine as a treatment for postnatal depression. Though these experiments were later discontinued due to the unwanted addictive side effects, he exalted the substance, which became widely used as a panacea [2].

His "Interpretation of Dreams" and the later development of psychoanalytic method may have been aided by cocaine. Aschenbrandt (1883) and Freud (1884) were the first to describe the effect of cocaine on the central nervous system (euphoria

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Fig. 14 Cocaine toothache drops in the late eighteenth century. At that time scores of patent medicines appeared, which contained extracts of coca leaves, not purified cocaine, however, some did, and lots of it

a

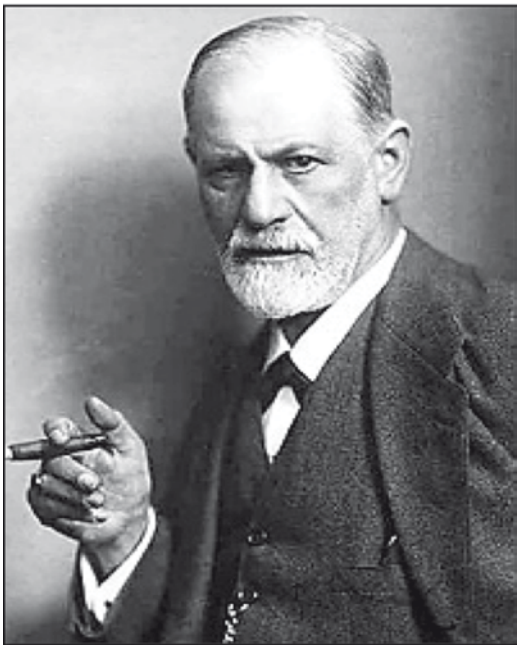

Fig. 15a Freud wrote his famous paper "On Coca" in 1884, when he was 28. In it he described the history and effects of cocaine and spoke glowingly of its therapeutic benefits

b

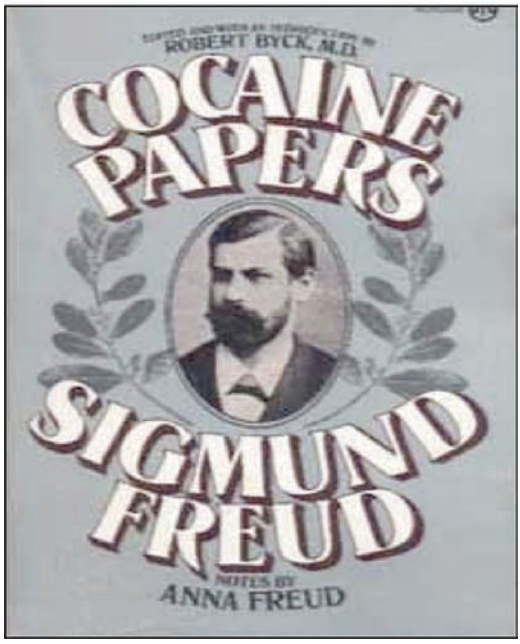

Fig. 15 (continued)

and a decrease in fatigue). In addition, cocaine was incorrectly used as a cure for morphine and alcohol abuse (Fig. 15b). Dr. Ernst von Fleischl-Marxow, who suffered from amputation (neuropathic) pain of the peripheral nerve at one hand and had become a morphine addict while attempting to ease the pain was treated by his close friend Freud with cocaine. Freud thought cocaine might cure the addiction. Soon von Fleischl-Markow, who was consuming a gram of cocaine a day, became a cocaine addict and developed a classic case of "cocaine psychosis".

Use of Cocaine as a Local Anesthetic

In 1884 Karl Koller (Fig. 16) was the first to discover cocaine to be a local anesthetic and a vasoconstrictor resulting in the first effective treatment for nasal congestion associated with seasonal allergies.

When the substance was applied to a nerve trunk, it either blocked or reversibly interrupted the passage of nervous impulses which transmit the sensation of pain to the nerve centers of the brain, and more importantly, without loss of consciousness. This peculiarity, since called the local anesthetic effect, is produced by the following mechanism (Fig. 17). The membrane of the axon (nerve trunk) is formed by a

Fig. 16 Karl Koller found that cocaine rendered the eyes insensitive to pain. A report presented on his behalf at a medical meeting in September 1884 galvanized the medical world as the only effective local anesthetic. Promoting cocaine as a local anesthetic it opened up vast new fields for surgery

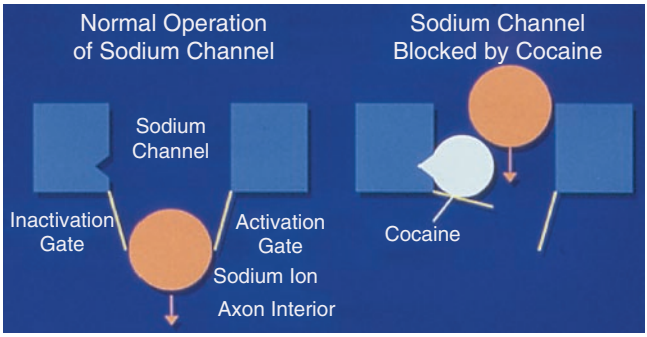

Fig. 17 Mode of action of the local anesthetic effect of cocaine

bimolecular layer of lipids, which possess hydrophilic protein layers on both sides. The local anesthetic is linked by its hydrophilic portion to the corresponding receptor of the nerve membrane and by its lipophilic portion to the other. This changes the

properties of the conductor nerve membrane by blocking free flux of the sodium ions and altering the capacity of depolarization of the axon membrane, which is the mechanism through which the nerve conduction is produced. Thus, local anesthetics such as cocaine and other synthetics, inhibit the conduction of nerve impulses, which transmit the pain sensation to the brain. With greater concentrations of the drug, the sensitivity to heat and cold at first, and then the sensitivity to tact and pressure are also blocked. Very high concentrations will even impede motor impulses. The assimilation of the drug into the blood stream, however, can also produce systemic or general analgesic effects; one reason why cocaine presently is not being used as a local anesthetic any more.

Cocaine, however, boosted knowledge related to nerve function and conduction. It was Erlanger's research into nerve function with a profitable collaboration with Gasser, one of his students at the University of Wisconsin, Madison (1906–10), which culminated in profound insight into nerve function. Soon after Erlanger's appointment as professor of physiology at Washington University, St. Louis (1910–46), Gasser joined him there, and they began studying ways in which the recently developed field of electronics could be applied to physiological investigations. By 1922 they were able to amplify the electrical responses of a single nerve fibre and analyze them with a cathode-ray oscilloscope that they had developed using different agents for blockade. The characteristic wave pattern of an impulse generated in a stimulated nerve fibre, once amplified, could then be seen on the screen and the components of the nerve's response studied. In 1932 Erlanger and Gasser found that the fibres of a nerve conduct impulses at different rates, depending on the thickness of the fibre, and that each fibre has a different threshold of excitability – i.e., each requires a stimulus of different intensity to create an impulse. They also found that different fibres transmit different kinds of impulses, represented by different types of waves. As early as 1929 the two physiologists Erlanger and Gasser experimented with pressure to evaluate the capacity of cocaine to block nerve conduction in frogs.

Thanks to its local anesthetic property, it is possible to apply a 2% cocaine solution on the nerve of a diseased molar and remove it without having the patient suffer and be tortured by pain. The doctor is able to find a calm and passive subject on whom he could work at ease and carefully. One can only imagine that the benefits were momentous in the history of buccal surgery. It marked the passing of the traumatic, painful, dangerous and primitive surgical methods to the painless surgery of the twentieth century, which permitted great advances in the medical sciences. The coca leaves and the miraculous substance against pain, cocaine, soon rose to the pinnacle of pharmacology and medicine, which most of all showed no development of tolerance [3]. For instance, a 2% cocaine solution for odontological and ophthalmological work, as well as ocular surgery became a reality (Fig. 18). The anesthetic properties of cocaine were used to an advantage for making medications against birth pains, ointments for hemorrhoids, solutions to relieve dentition pains in infants, drops for earaches, in addition to the myriad of applications in all surgical cases of the various medical specialties: traumatology, abdominal surgery, gynecology, etc. (Fig. 19).

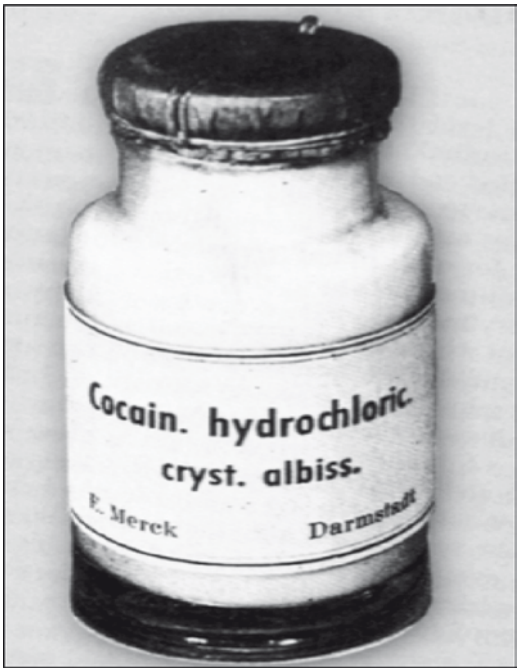

Fig. 18 Cocaine hydrochloride the basic salt as it was used in pharmacy as a base for various preparations

NEW MAGISTRAL FORMULARY
OF CLINICAL AND PHARMACOLOGIC
THERAPEUTICS
by
DOCTOR ODILLON MARTIN

(Former Chief Laboratorist of the School of Medicine of Paris)

EYE DROPS
Cocaine Chloride..... 10 cg
Distilled Water ..... 10 g

INTRA RACHIDIAL INJECTIONS
Cocaine Chloride..... 10 cg
Boiled Distilled Water ..... 20 cc

Sterilize: the solution to be applied must always be recently prepared, inject into the preferred site (See dispensing methods) 2 or 3 cc of the cocaine solution. Preparatory surgical anesthetic.

OINTMENTS
Alcohol coca extract..... 1 g
Benzoate pork fat or starch glycero ..... 15 g
To relieve continuous painful locations, fissures, sores, etc.

SUPPOSITORY
Alcohol coca extract..... 1 g
Cocoa Butter ..... 4 g

To relive the pain of anal fissures and hemorrhoids

Fig. 19 Few examples of the vast assortment of cocaine preparations being used in medicine, ca 1910

The Different Forms of Cocaine

The drug cocaine comes in five different forms

1. ***Coca Leaves***: The cocaine content in the coca leaf is only 0.1–0.8%. The plants in the higher altitudes tend to have a higher cocaine content then those at lower altitudes. There are different styles in using the leaves to extract the stimulant. The leaves can be rolled into cigarettes or cigars and smoked, the leaves can be infused with a liquid to form a tea or they are chewed.
2. ***Coca Paste***: The paste is the middle step between the leaf and the powder cocaine. It cannot be injected or snorted, therefore the only use of the coca paste is to burn the substance and inhale. Coca paste is much more popular in South American countries then in the United States.
3. ***Powder Cocaine***: Powder cocaine in general, is derived from dissolving coca paste with hydrochloric acid. Powder cocaine is the most widely used form of cocaine, and it is cocaine at its purest form. Usually street cocaine is not necessarily pure as it is mixed with different additives such as sugars, local anesthetics, or other drugs. Powder cocaine can be snorted, injected, or ingested. Because it decomposes easily at temperatures above 198ºC or 388ºF, unlike crack cocaine the powder cocaine cannot be smoked. Powder cocaine loses its potency when the drug is heated. Because the cocaine alkaloid decomposes at high temperatures it does not produce the physiological or psychotropic effects.
4. ***Cocaine Base***: Cocaine base is obtained from powder cocaine, which chemically is cocaine hydrochloride and is formed by reacting with a base at controlled conditions. It resembles much the crude cocaine paste, however, having a higher purity. At the melting point of 98ºC the cocaine base loses its mind altering effects. The cocaine base is poorly absorbed throughout the body and thus does not carry a similar level of potency of powder cocaine.
5. ***Crack Cocaine***: Crack results from heating powder cocaine with, for instance baking soda. By this reaction the hydrochloride acid escapes from the salt while carbon dioxide is formed from baking soda. Since this reaction results in crack-like noises, the final constituent is called “crack”, which is more volatile at low temperatures. Thus crack cocaine allows the user to smoke the cocaine instead of injection or insufflation. A crack cocaine rock can be anywhere between 75–90% pure.