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TETRACYCLINE TEETH

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ABOUT ARTICLE

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Abstract: Tetracyclines have been developed as broad-spectrum antibiotics that can be used to treat common infections in children and adults. One of the side effects of this group of substances is their incorporation into tissues with the formation of calcinates. The first mention of the discoloration of teeth in children caused by tetracyclines dates back to 1956, and subsequently a number of reports appeared in which tetracycline led to enamel hypoplasia. Nowadays, it is known that this group of antibiotics has the ability to chelate calcium ions and thus integrate into teeth, cartilage and bones. Although this side effect has been repeatedly demonstrated in children, there are also some reports of teeth staining with tetracycline and derivatives in adults.

INTRODUCTION

Tetracyclines have been developed as broad-spectrum antibiotics that can be used to treat common infections in children and adults. One of the side effects of this group of substances is their incorporation into tissues with the formation of calcinates. The first mention of the discoloration of teeth in children caused by tetracyclines dates back to 1956, and subsequently a number of reports appeared in which tetracycline led to enamel hypoplasia. Nowadays, it is known that this group of antibiotics has the ability to chelate calcium ions and thus integrate into teeth, cartilage and bones. Although this side effect has been repeatedly demonstrated in children, there are also some reports of teeth staining with tetracycline and derivatives in adults.

Pharmacology of tetracyclines

Tetracyclines are broad-spectrum antibiotics with activity against both gram-positive and gram-negative bacteria, as well as mycoplasma, rickettsia and chlamydia infections. All tetracycline compounds consist of four condensed cyclic rings, which gave the name to tetracyclines.

Tetracycline derivatives consist of only slightly modified chemical components associated with this basic ring structure. Tetracycline, oxytetracycline, chlortetracycline, doxycycline and minocycline are commonly used in this capacity. They all have a similar spectrum of activity, and resistance to one may indicate resistance to all of them.

Tetracyclines are considered bacteriostatic, but in high concentrations they can have a bactericidal effect. The drugs bind to the 30s subunits of bacterial ribosomes and specifically inhibit the binding of aminoacyl-t-rna to the acceptor site of the ribosome and, thus, inhibit protein synthesis in sensitive microorganisms. These antimicrobials are usually taken orally, but absorption from the gastrointestinal tract is incomplete and unstable, and it is negatively affected by the presence of food and bivalent or trivalent cations. Two exceptions are minocycline and doxycycline, which are well absorbed in the gastrointestinal tract even in the presence of food.

These drugs penetrate the placenta and can have a toxic effect on the developing fetus, therefore they are contraindicated during pregnancy. Toxic effects on the developing fetus include discoloration of teeth, enamel hypoplasia and inhibition of bone growth by 40%. The binding of tetracyclines to plasma proteins is highly variable, but the distribution is widespread and occurs in all tissues and fluids, including bones and teeth.

Tetracyclines are excreted in urine and faeces, with the urinary tract being the most important for most of these drugs. The drugs should not be given to nursing mothers, as they are also excreted in breast milk. Pregnant women are particularly susceptible to tetracycline-induced liver damage.

Serious reactions are rare. Nausea, heartburn, epigastric pain, vomiting and diarrhea are more common with tn than with most other orally administered antibiotics.

Photosensitization can occur, especially in sunny climates, and consists in increased skin sensitivity to sun exposure.

A superinfection associated with candida albicans has been reported. Minocycline has been reported to cause dizziness, dizziness and tinnitus. All tetracyclines are deposited in calcifying areas of bones and teeth, and can cause discoloration.

The effect of tetracyclines on the bones and mucous membrane of the oral cavity

These drugs have an affinity for calcified tissues, are deposited and stored in osteogenetic areas of normal bone. The affinity for mineralizing tissue is the result of binding to calcium to form the tetracycline-calcium orthophosphate complex. The faster the mineralization rate, the more tetracycline is deposited.

When exposed to ultraviolet (uv) light on a bone stained with tetracycline, it exhibits yellow fluorescence. Consequently, tetracyclines are used in bone research as a vital fluorescent dye to measure the rate of bone formation. These agents usually remain in the ossification zones for some time after systemic administration.

Minocycline hydrochloride, a semi-synthetic tetracycline derivative often used to treat acne, has been shown to cause pigmentation of various tissues, including skin, thyroid gland, nails, sclera, teeth, conjunctiva, tongue and bones.

A remarkable side effect of minocycline on bones is the occasional occurrence of "black bones". The bone stained with minocycline does not fluoresce in uv light. Bone pigmentation is most common under

the translucent mucous membrane of the anterior alveolar process of the upper and lower jaw, followed by the mucous membrane of the posterior tongue and hard palate.

The attached gum, tongue and mucous membrane of the cheeks are usually not affected, the incidence increases with prolonged use, and about 10% of patients who took minocycline for more than one year developed black bone pigmentation in the oral cavity. Moreover, this figure increased to 20% after 4 years of taking minocycline.

The effect of tetracyclines on teeth

The ability of tetracycline to stain teeth during odontogenesis has been well known for almost five decades. Tetracyclines can cause discoloration and hypoplasia of the enamel of both milk and permanent teeth if they are used during the period of tooth development. The main factors influencing the amount of tetracycline deposits are dosage, duration of treatment, stage of mineralization of teeth and activity of the mineralization process.

The color change, which is permanent, varies from yellow or gray to brown depending on the dose or type of drug received in relation to body weight. After teething and exposure to light, the fluorescent yellow discoloration gradually changes over months or years to a non-fluorescent brown color. The labial surfaces of the yellow-colored front teeth will darken over time, while the palatine surfaces and buccal surfaces of the chewing teeth will remain yellow.

This transformation is probably the result of the oxidation of tetracycline under the action of light. Calcification of baby teeth begins at about the end of the fourth month of pregnancy and ends at about 11-14 months of age. Permanent teeth begin to calcify after birth and are not affected by tetracyclines during the prenatal period. Calcification of permanent teeth is completed by the age of 7-8, with the exception of the third molar ("wisdom teeth").

Therefore, tetracyclines should be avoided for pregnant women in the 2nd or 3rd trimester of pregnancy and children under 8 years of age, as this can lead to discoloration and hypoplasia of the enamel.

A link between staining and enamel hypoplasia as a result of high doses of tetracycline during calcification is possible, but also controversial. Enamel hypoplasia can also be a consequence of childhood disease, hereditary defects in enamel formation, or prematurity of the child; all of them are known to cause enamel defects.

Tooth discoloration in adults has also been reported after prolonged use of tetracycline and minocycline. It is reported that the prevalence of tetracycline and minocycline staining is 3-4% and 3-6%, respectively.

Staining with minocycline is characterized by darkening of the crowns from blue-gray to gray and "black" or "green" darkening of the roots of erupted teeth. Minocycline differs from other tetracyclines in that it is well absorbed from the gastrointestinal tract and chelates with iron to form insoluble complexes, which can provoke tooth staining.

"iron" is one of the three theories of the mechanism of discoloration of minocycline. Other theories relate to external and internal factors. The external theory is based on the fact that minocycline is released in high concentration in the gingival fluid and has the ability to mineralize enamel in vitro.

This process may allow minocycline to stain or etch enamel by diffusing through the pulp or affecting odontogenesis. The internal theory suggests that as minocycline is absorbed, it binds to plasma proteins and is distributed to various tissues of the body. Some of these tissues have a high affinity for minocycline, for example, collagen tissue present in pulp, dentin, cement and bone. In these tissues, the drug is then oxidized and converted into a pigmented by-product.

Based on the theory that the pigment is a product of an oxidation reaction, a hypothesis has been hypothesized and experimentally demonstrated that an antioxidant such as vitamin c can block the formation of minocycline pigment in an animal model. This conclusion needs to be confirmed by additional longitudinal studies.

Diagnosis of tetracycline teeth

It is important to recognize other causes of tooth staining in order to distinguish between tetracycline staining, minocycline staining, and other internal or external dental staining problems. Excellent reviews of dental anomalies with spots and discoloration have been published.

When stained with tetracycline, the place of discoloration of the tooth on the crown of the tooth coincided with the stage of development of this part of the tooth during tetracycline administration. Permanent teeth have less intense but more diffuse staining than baby teeth. The color pattern changes over time; the yellow color darkens and turns into a brownish color. The affected teeth fluoresce bright yellow in ultraviolet light in a dark room.

When staining with minocycline, it is extremely important to distinguish the bright blue-gray shade associated with this drug from other surface spots. Similarly, tooth pulp necrosis or hemorrhage may exhibit the same discoloration and may be confused with minocycline staining. Thus, checking the viability of the pulp and carefully collecting a dental history exclude the possibility of pulp pathology. There is still debate about which part of the tooth is most affected by staining with minocycline.

It is believed that minocycline pigmentation causes a distinct blue-gray band of color change in the incisor and middle third of the crown, whereas the color change caused by tetracyclines is more pronounced in the gingival third of the crown.

Tetracycline/minocycline treatment: stained teeth

The color change caused by tetracycline/minocycline cannot be eliminated. Staining permanent teeth creates an aesthetic and psychological problem, about which patients can seek advice and treatment to improve their appearance.

Treatment may include bleaching of live or depulpated teeth, which will lighten the discoloration, but leave their translucent appearance.

Since tetracycline staining is natural, the bleaching method is most often partially successful. Other options include the placement of composite resins or porcelain laminated veneers or full-coated porcelain crowns to physically cover the teeth.

CONCLUSIONS

The medical and dental literature contains extensive scientific evidence that both tetracycline and its derivatives cause their own staining of the oral cavity and teeth in children during osteogenesis and odontogenesis.

Therefore, tetracyclines are contraindicated during pregnancy and in children under 8 years of age. It has also been reported that tetracycline and minocycline cause internal staining of teeth and oral cavity in the adult population. The prevalence of these side effects is approximately 3-6%. Most of the literature consists of descriptions of clinical cases.

There are several longitudinal studies. Longitudinal clinical trials can provide comprehensive information on the prevalence, severity, etiology, and clinical picture of tetracycline and minocycline staining in the adult population, as well as how it can be dealt with most effectively.

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