Chlorodontia: Minocycline induced staining of permanent dentition
- A case report

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ABSTRACT

Tetracycline staining the developing teeth is a well known and documented condition. But newer tetracycline derivatives like minocycline can even stain the permanent teeth. We report a case of 45 year old female patient, a known case of multiple myeloma who developed green discoloration of her permanent teeth following minocycline therapy for treatment of acne vulgaris.

INTRODUCTION

Minocycline is a second generation tetracycline derivative. It is a bacteriostatic drug which is administered orally and mainly used in the treatment of acne vulgaris due to its anti-inflammatory effect\(^1\). It is a well absorbed, broad spectrum antibiotic that is both highly bound to plasma proteins as well as lipid soluble. Therefore it penetrates easily into the body fluids. Minocycline concentration in saliva is 30%-60% of the serum concentration\(^2\). Its concentration in the gingival crevicular fluid is five times that of the serum\(^3\). Although the effects of tetracycline on developing teeth are well recognized, side effects of its derivatives like minocycline on skin, sclera, nails and permanent dentition are not widely reported. We report a case in which minocycline caused staining of permanent teeth to make clinicians better aware of a potential oral side effect of this drug.

CASE REPORT

A 45 years old female patient was referred to our department for consultation regarding the greenish discoloration of teeth. The patient was a known case of multiple myeloma and was admitted to the hospital for treatment. On intra oral examination, her physician observed greenish discoloration of her teeth and referred the case to the department of oral medicine and radiology for opinion.
The patient reported that she first observed the discoloration about a year back but as her teeth were asymptomatic she deferred any consultation for the same. Since then she is observing progressive grayish green discoloration of her anterior teeth. She had multiple infections in the past and also had acne vulgaris. For the treatment of acne vulgaris she was advised to take minocycline 50mg twice daily for 4 months. But the prescription was prolonged to almost 3 years. Her other medications mainly included chemotherapeutic drugs for treatment of multiple myeloma.

On extra oral examination, there was minimal evidence of acne vulgaris. On intra oral examination, a greenish-gray discoloration was observed on the cervical and middle third of both the maxillary and mandibular anterior teeth while the posterior teeth were normal (Fig-1). The discolored tooth surface was scratched with care by using a dental explorer; discoloration could not be removed by using this scratch test. No pigmentation was observed on the oral mucosa and other soft tissues.

**DISCUSSIONS**

Tetracyclines can cause discoloration of teeth during tooth development because tetracycline calcium orthophosphate complexes are formed and deposited at the time of calcification. The initial pigmentation appears to be bright yellow but with age it becomes brown or grey. This drug induced pigmentation usually appears as a band around the tooth corresponding with the duration and time of administration of the drug. Tetracycline does not cause discoloration of the erupted permanent teeth because of lack of free calcium available to form tetracycline complexes.

On other hand minocycline can cause pigmentation of the bone, oral mucosa as well as the permanent teeth. Minocycline forms insoluble black quinine formed by degradation of the aromatic ring of minocycline and it is thought that this may be responsible for pigmentation of bone and other calcified tissues. The differences between tetracycline and minocycline tooth staining are described in table-1.

<table>
<thead>
<tr>
<th></th>
<th>Tetracycline</th>
<th>Minocycline</th>
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</thead>
<tbody>
<tr>
<td><strong>Color of staining</strong></td>
<td>Yellow to brown</td>
<td>Green / blue / gray</td>
</tr>
<tr>
<td><strong>Fluorescence</strong></td>
<td>Yellow fluorescence</td>
<td>None clinically but fluoresce in acidic medium</td>
</tr>
<tr>
<td><strong>Severity</strong></td>
<td>Severe</td>
<td>Less severe</td>
</tr>
<tr>
<td><strong>Resolution after stopping drug therapy</strong></td>
<td>None</td>
<td>Resolution can rarely occur in teeth</td>
</tr>
</tbody>
</table>

The exact mechanism of minocycline induced discoloration in permanent teeth remains controversial. A proposed intrinsic theory suggests that minocycline is directly deposited in teeth by binding to plasma proteins and diffusing into collagen rich tissues like dental pulp and slowly being oxidized upon exposure to light. Although this may be theoretically possible but intrinsic minocycline deposition is not likely to have a profound influence on the apparent color of permanent dentition. Some reports have also suggested that the drug may solely get deposited in the dentin matrix during secondary and reparative dentin formation that occurs through out life.

Minocycline has less affinity to bind with calcium as compared to other tetracyclines derivatives and theoretically it is less likely to produce any intrinsic staining in permanent dentition. In spite of this there are number of
reports of minocycline causing green-gray or blue gray staining in the erupted permanent teeth. It is suggested that tetracycline can demineralize the enamel invivo. The staining may be on the tooth surface rather than incorporated into dentine and is possibly a demineralization/remineralization phenomenon related to high local levels of drug. This theory is also supported by the fact that concentration of systemically administered minocycline in the gingival crevicular fluid is five times that of serum. It has also been suggested that minocycline may etch the tooth surface due to its acidic nature during its long term contact after initially attaching to the glycoproteins of the acquired pellicle and then becoming oxidized on exposure to air or bacterial activity. This along with drug's strong affinity to iron and its ability to form insoluble salts, provides an explanation for surface discoloration of teeth. Another theory suggests that hemoesiderin, the breakdown product of minocycline may chelate with iron and form an insoluble complex.

The discoloration can develop as early as one month after initiation of therapy and affects about 3-6% of patients receiving 100mg of minocycline per day. But this complication is not entirely dose dependent and requires an inherent predisposition. Therefore not all the patients on minocycline therapy will develop staining of permanent teeth. Poor oral hygiene and intense sunlight exposure can further make the staining more prominent.

Our patient had an inherent predisposition due to unknown factors that resulted in greenish gray discoloration of her cervical and middle third of anterior teeth following minocycline therapy for almost 3 years. This patient also had poor oral hygiene and only developed staining in the UV exposed upper and lower incisors. Therefore the most probable reason for discoloration in the present case could be due to the oxidation of the minocycline internalized into the tooth structure because of demineralization/ remineralization phenomenon related to high local levels of drug within the plaque.

Therefore patients must be advised to maintain a good oral hygiene and avoid sunlight as far as possible. Also reduction of minocycline dosage to less than 100mg/day and use of vitamin C have been reported as alternative prophylactic measures which can reduce the chances of teeth staining. Alternatively, reducing the therapeutic dose of minocycline to below 100mg/day for long term therapy may itself prevent dental staining. An effective therapeutic regimen for acne is 100mg daily initially reducing to 50mg daily after 15 days and this may reduce chances of teeth staining. Alternative drugs to minocycline can also be used like tetracycline, systemic and topical retinoids, systemic hormonal therapy, zinc gluconate after consultation with the physician.

For the patient who has developed minocycline staining a wide variety of treatment options are available. In a case reported by Ayaslioglu et al abrasive dental cleaning and oral hygiene maintenance reverted the minocycline staining suggesting that it was mainly due to extrinsic factors. Therefore we must first use prophylactic measures to remove these stains and only if they persist, we should go for other esthetic treatment modalities. The different modalities of esthetic treatment available for managing such discolored teeth include vital bleaching, microabrasion, composite /ceramic veneers or ceramic crowns. Our patient was hospitalized and was at terminal stage of multiple myeloma so we did not proceed for any dental treatment.

In conclusion, all clinicians including the physicians must be aware that tetracycline derivatives like minocycline can also cause greenish grey staining of permanent teeth. Therefore, color of permanent teeth should be carefully monitored for any patient on therapy with tetracycline or its derivatives, along with proper oral hygiene maintenance, so that staining of the teeth can be prevented.

**REFERENCES**


