Clinical observation of minocycline hydrochloride ointment in the treatment of early peri-implantitis

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Abstract: To observe and analyze the therapeutic efficacy of minocycline hydrochloride ointment in the treatment of early peri-implantitis. A total of 180 patients with early peri-implantitis and treated at our hospital were enrolled. The patients were divided into control group and research group, with 90 patients in each group. Of those, patients in the research group were treated with minocycline hydrochloride ointment, while 10% of iodine was placed around the teeth in patients of the control group. The therapeutic efficacy was observed and compared between both groups. By comparing the plaque index of both groups after treatment, results showed that the improvement of the research group was obviously better than that of the control group ($p<0.05$). By comparing the probing depth and sulcus bleeding index, results showed that the situation of the research group was significantly superior than that of the control group ($p<0.05$). Application of minocycline hydrochloride ointment in the treatment of early peri-implantitis could significantly improve the therapeutic efficacy.

Keywords: Minocycline hydrochloride ointment, early peri-implantitis, therapeutic efficacy

INTRODUCTION

Peri-implantitis is a reversible inflammation occurring in the soft tissue surrounding the oral implant, which is characterized by redness and swelling of the mucosa, bleeding on probe and even pyorrhea. At present, it is generally believed that the onset of peri-implantitis is closely related to the bacterial microorganisms on the implant (Zhu *et al*., 2015; Li *et al*., 2015)). Due to poor oral hygiene, plaques are piled up around the implant, which stimulate body to produce an inflammatory response. Peri-implantitis is a key factor affecting the success rate of oral implant restoration, so it is very important to actively prevent the occurrence of peri-implantitis.

Peri-implantitis (fig. 1) is a general term for the pathological state of the implant and surrounding tissues. Minocycline hydrochloride capsule is a tetracycline antibiotic, which is mainly used for infection caused by *Staphylococcus, Streptococcus, Neumococcus, Neisseria gonorrhoeae, Dysentery bacillus, Escherichia coli*, *Klebsiella, proteus, Pseudomonas aeruginosa, Treponema pallidum* and *Chlamyd* (Wroblewska *et al*., 2015; *Moty et al*., 2016).

If the patient has a history of periodontitis, the chance of peri-implantitis will be significantly increased after five years. Also, patients with deep periodontal pockets will have a higher chance of peri-implantitis. Therefore, it is very important to take effective drugs to treat peri-implantitis. This study was conducted to observe the effect and mechanism of action of minocycline hydrochloride ointment in the treatment of peri-implantitis.

Fig. 1: Peri-implantitis

MATERIALS AND METHODS

General data

In this study, 180 patients who had been treated for peri-implantitis at our hospital from August 2015 to June 2018 were enrolled. Patients meeting inclusion criteria include those accept were implant restoration for more than 6 months; those diagnosed as peri-implantitis upon reexamination (fg. 2); those with no loosened implants, with gingival crevicular bleeding index of 1 or above, with periodontal exploration depth of 4 mm or above, or with purulent sinus tract; and those with no systemic disease upon X-ray examination (Hazra *et al*., 2015; Zheng *et al*., 2016). Patients meeting the exclusion criteria include pregnant women, lactating women, those who are allergic to tetracyclines, and those with mental disorders. The formal informed consent was obtained from the patients and their families. The study was approved by the Hospital Ethics Association.

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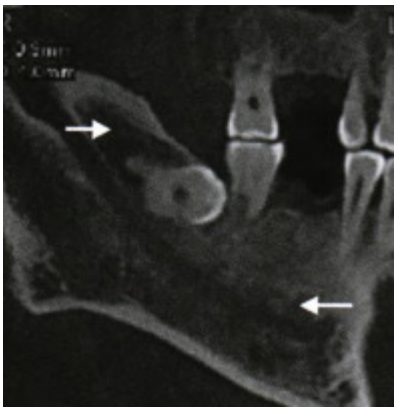

Fig. 2: Imaging examination

Patients were randomly divided into research group and control group, with 90 patients in each group. There were 45 male patients and 45 female patients in the control group, with a total of 102 implants. The average age of the control group was 56.9 ± 3.2 years old, ranging from 39 to 78. On the other hand, there were 48 male patients and 42 female patients in the research group, with a total of 108 implants. The average age of the research group was 55.7 ± 3.8 years old, ranging from 42 to 76. There was no significant difference in general data between two group, $p>0.05$.

Different therapeutic regimens were applied on patients in both groups. The patients in the research group were treated with minocycline hydrochloride ointment, and patients in control group were given 10% of iodine.

For the control group, the periodontal plaque of the implants was removed before drug administration, then the saline was rinsed according to the standard procedure. 10% iodine solution was injected into the periodontal pocket with Medical syringe (Model: 20ML/CC) and drug administration was given once a week. The patients were instructed to refrain from drinking water and avoid gargling within 30 minutes after taking the drug, and allowed to eat after 1 hour.

For the research group, the patient was treated with minocycline hydrochloride ointment (Sunstar INC, SFDA approval number 20100244) once a week. The minocycline hydrochloride ointment was slowly injected into the periodontal pocket to wrap the implant until it slightly overflowed. The other treatments were the same as the control group, and both groups were treated for 4 consecutive weeks.

Observation indexes

After treatment, the plaque index (PLI), the sulcus bleeding index (SBI), and the probing depth (PD) of both groups were observed and compared. PLI include 0 points (sterile spot), 1 point (the plaque can be observed by gently tapping the implant surface with a plastic probe tip), 2 points (the plaque can be directly seen by the naked eye) and 3 points (large plaque) (Liu *et al*., 2016). For evaluation of PD, the plastic probe was controlled with a force of about 20 g to detect the distance from the gingival margin to the bottom of the periodontal pocket. For evaluation of SBI, a force of about 20 g was used to control probe along the gingival margin of the implant. 0 points means no bleeding, 1 points means punctate bleeding while probing, and 2 points means bleeding on probing presented as linear, 3 points means severe bleeding on probing.

STATISTICAL ANALYSIS

Statistical analysis software SPSS21.0 was used to process data. The measurement data were expressed by mean ± average ($\bar{x}$ ± s), with t test conducted for intergroup comparison. Enumeration data were expressed by natural (n) and percentage (%), with chi-square used for intergroup comparison. The intergroup difference is of statistical value when $p<0.05$.

RESULTS

Comparison of the number of plaques between two groups

As shown in table 1, there was no significant difference in the number of plaques between two groups before treatment ($p>0.05$). When different therapeutic methods were implemented, the number of plaques in the research group was significantly less than that in the control group ($p<0.05$). After 6 weeks of treatment, the number of plaques showed an increasing trend for both groups, which was significantly different from that before treatment ($p<0.05$).

Comparison of the probing depth between two groups before and after treatment

As shown in table 2, there was no significant difference in the probing depth between both groups before treatment ($p>0.05$). After treatment, the probing depth of the research group during all therapeutic periods was significantly less than that of the control group ($p<0.05$). After 4 weeks of treatment, the probing depth in both groups showed an increasing trend, which was significantly different from that before treatment ($p<0.05$).

Comparison of the sulcus bleeding index between two groups before and after treatment

As shown in table 3, there was no significant difference in the sulcus bleeding index between two groups before treatment ($p>0.05$). After implementation of treatment, the sulcus bleeding index of the research group at all periods was significantly decreased as compared with that of the control group ($p<0.05$). After 4 weeks of treatment, the sulcus bleeding index in both groups showed an

Table 1: Comparison of the number of plaques between two groups ($\bar{x} \pm s$)

Time	Research group (n = 90)	Control group (n = 90)	t	p
Before treatment	2.68 ± 0.55	2.69 ± 0.47	0.72	>0.05
2 weeks after treatment	1.68 ± 0.30	2.04 ± 0.56	4.28	<0.05
3 weeks after treatment	1.45 ± 0.23	1.67 ± 0.58	4.68	<0.05
4 weeks after treatment	2.02 ± 0.21	2.18 ± 0.50	5.06	>0.05

Table 2: Comparison of the probing depth between two groups before and after treatment ($\bar{x} \pm s$)

Time	Research group (n = 90)	Control group (n = 90)	t	p
Before treatment	4.10 ± 0.52	4.16 ± 0.40	0.66	>0.05
2 weeks after treatment	3.12 ± 0.28	3.69 ± 0.51	5.60	<0.05
3 weeks after treatment	2.78 ± 0.19	3.26 ± 0.49	5.07	<0.05
4 weeks after treatment	3.62 ± 0.22	3.79 ± 0.50	4.23	>0.05

Table 3: Comparison of the sulcus bleeding index between two groups before and after treatment ($\bar{x} \pm s$)

Time	Research group (n = 90)	Control group (n = 90)	t	p
Before treatment	4.39 ± 0.46	4.28 ± 0.22	0.59	>0.05
2 weeks after treatment	1.59 ± 0.27	3.48 ± 0.36	4.30	<0.05
3 weeks after treatment	1.42 ± 0.18	3.17 ± 0.57	6.08	<0.05
4 weeks after treatment	1.95 ± 0.22	3.72 ± 0.50	4.23	>0.05

increasing trend, which was still significantly different from that before treatment ($p<0.05$). A case of bleeding on probing is shown in fig. 3.

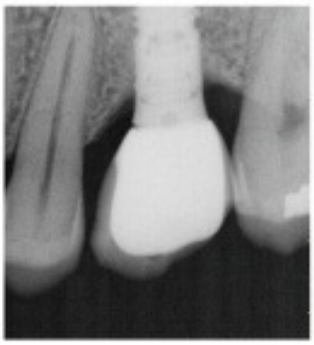

Fig. 3: A case of bleeding on probing in a patient with peri-implantitis (probing depth is 4-5 mm)

DISCUSSION

Peri-implantitis is a major complication in the course of implant treatment, which is closely related to poor oral hygiene and poor oral habits. Mainly caused by infection-induced failure of bone-implant contact, peri-implantitis is characterized by mucosal inflammatory hyperplasia, abscess and fistula around the implant. The progression of inflammation can cause bone loss around the implant and eventually lead to implant failure (Chen, 2017; Ofori-Kwakye *et al*., 2016). Timely and effective treatment of peri-implantitis is an important guarantee for improving patients' life quality.

Minocycline hydrochloride ointment is a typical antibiotic composed of minocycline hydrochloride, which can exert a high affinity to bone tissue, inhibit collagenase activity and reduce damage to periodontal tissues, thus promoting periodontal tissue regeneration (Attari et al., 2016; Wang *et al*., 2018; Rehman *et al*., 2018). The underlying mechanism is to inhibit the bacterial protein synthesis and exert antibacterial effects against staphylococcal, escherichia coli and the gram-negative bacteria in the subgingival plaque, leading to favorable improvement on the symptoms of periodontitis. Minocycline belongs to the novel semi-synthetic tetracycline, which has broad spectrum of antibacterial activity, strong antibacterial activity, high efficiency and long-lasting effect, easy penetration, etc. Moreover, it can slowly release the drug components in the periodontal pocket. In the presence of water, the minocycline hydrochloride ointment will harden and produce a film-like substance, so that the concentration of the local drug can be kept at a high level and maintained for 5 days to 1 week. Therefore, the application of minocycline hydrochloride ointment can significantly improve the effect of mechanical treatment, and fully give full play to the therapeutic effect of peri-implantitis (Podolsky *et al*., 2018; Temizi *et al*., 2017; Yadav *et al*., 2017, Li *et al.*, 2019, Li *et al.*, 2019, Wu *et al.*, 2019).

Results from this study showed that after implementation of different treatments for control group and research group, the number of plaques was significantly less in

research group than that in control group, $p<0.05$. After 6 weeks of treatment, the number of plaques in both groups showed an increasing trend as compared with that before treatment, $p<0.05$. After treatment, the reduction degree of probing depth in research group was more significant than that in control group, $p<0.05$. After 4 weeks of treatment, the probing depth in both groups showed an increasing treatment, which was significantly different from that before treatment, $p<0.05$. After treatment, the reduction degree of sulcus bleeding index in research group was more significant than that in control group, $p<0.05$. After 4 weeks of treatment, the sulcus bleeding index in both groups showed an increasing treatment, which was significantly different from that before treatment, $p<0.05$. These results are consistent with previous reports.

CONCLUSION

During the treatment of early peri-implantitis, minocycline hydrochloride ointment can be adopted to improve the treatment effect and promote the good recovery of patients. This treatment is worth of being promoted in clinics.

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