Analysis of procedures used in tooth avulsion by 100 dental surgeons

Manfrin TM, Boaventura RS, Poi WR, Panzarini SR, Sonoda CK, Sundefeld MLMM. Analysis of procedures used in tooth avulsion by 100 dental surgeons.

Abstract – Accurate diagnosis and adequate treatment plan may constitute very complex tasks, particularly in tooth avulsion, because several variables are involved. In addition to the technical knowledge and clinical experience directed toward the quality of treatment, patient education may favorably influence the survival of replanted teeth. The aim of this study was to analyze the procedures used in the management of tooth avulsion by 100 dental surgeons (DSs). Thus, by means of a descriptive questionnaire, information was obtained about the profile of the professionals interviewed, procedures used in cases of tooth avulsion, and patient orientation and education. One hundred properly filled questionnaires were obtained. Descriptive statistics was used for the data, and the chi-squared statistics was employed (EPI-INFO 3.2 software). According to the results, this type of trauma is part of the routine of 15 DSs, although 71 have reported some experience with avulsed teeth. Great deficiencies were found regarding root surface treatment and occlusal adjustment. Positive findings were related to socket treatment, adjunctive therapy, and patient education and orientation (extra-alveolar period, storage medium, manipulation of the avulsed tooth, replantation by the own patient). It was possible to conclude that 47.5% of the procedures reported by 100 professionals interviewed are adequate, and patient education is favorable in 87.7% of cases, a fact that can positively interfere with the prognosis of tooth replantation.

Thais Mara Manfrin, Renata Santos Boaventura, Wilson Roberto Poi, Sônia Regina Panzarini, Celso Koogi Sonoda, Maria Lúcia Marçal Massa Sundefeld

Araçatuba Dental School, Sao Paulo State University – UNESP, Araçatuba, São Paulo, Brazil

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Wilson Roberto Poi, Department of Surgery and Integrated Clinic, Dental School, São Paulo State University – UNESP, Rua José Bonifácio, 1193, Vila Mendonça, Araçatuba, São Paulo, 16015-050, Brazil
Tel.: +55 (18) 3636 3240
e-mail: poi@foa.unesp.br

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Dental trauma has been gradually receiving epidemiological expression as an emerging public health problem (1, 2), as the caries prevalence is reduced with the preventive advances (3) and the increase in violence rates, as well as in the popularity of radical contact sports (2).

Within this context, there may be a simple enamel fracture up to tooth avulsion. Avulsions, in turn, should be emphasized because of the several factors involved, especially the prompt and proper initial care (4), besides long-term clinical and radiographic follow-up (5, 6). On the other hand, the integrity of the periodontal ligament, advocated by many as being essential for the success of replantation, cannot be controlled by the dental professional, as it depends on the interaction of factors, such as extra-alveolar period, storage medium, and contamination of the avulsed tooth (7–10). In clinical practice, patients in need of replantation attend the office hours or days after the accident, with the tooth in their hands, pockets, or involved by paper, gauze, or cotton (11).

Moreover, tooth avulsion changes the dental routine, as the professional then needs to perform treatment plans different than usual (12), which may be a complex task. Combined to the re-establishment of esthetics and function, there is also the patient management from a psychological standpoint (13).

Studies conducted on lay individuals (parents, teachers, sport instructors, nurses, lifeguards) reveal

that the dentist is the professional searched for in cases of dental trauma (13, 14), especially close to the place where the accident occurred (15). Thus, professionals should give attention to a significant portion of the population in need of adequate treatment, demonstrating the importance of wide diffusion of this issue among general practitioners (15), as a traumatized tooth is not within the limits of any specialty (16).

Besides the technical knowledge and clinical experience acquired, which direct the treatment of tooth avulsion (17), the dental professional plays another important role in society: to offer preventive care and educational information (15). Integration of these factors may positively influence the prognosis of tooth replantation. The importance of knowledge and treatment of avulsion by dental professionals led to the accomplishment of the present study.

Materials and methods

For accomplishment of the present study, a descriptive questionnaire (Annex I) was prepared comprising questions on the professional profile (year and institution of graduation, training, specialization, or postgraduation courses), approach as to tooth replantation (root surface treatment, endodontic treatment, socket treatment, splint, occlusal adjustment and drug therapy), as well as patient orientation and education (extra-alveolar period, storage medium, manipulation of the avulsed tooth, and replantation by the own patient). One hundred and fifty questionnaires were distributed to dental offices at the central area of São Bernardo do Campo, during a 6-month period, from January to June 2004. Questions were responded without presence of the interviewer and according to the convenience as to the available time of interviewees. As a prerequirement for composition of the sample (non-probabilistic), 100 (66.7%) properly filled questionnaires were selected, and the others were excluded because of incompleteness or because most responses were lacking. According to protocols available in the literature (17–19) and with a view to analyze the related procedures (questions 9–14), the approaches were divided into adequate or inadequate. The orientations provided to the patients (questions 15–18) were classified as favorable or unfavorable for the prognosis of tooth replantation. Participation in the study was voluntary and strict confidentiality was assured, as names of the dental surgeons (DSs) were not required on the questionnaires. Three authors reviewed each questionnaire. There was no disagreement between examiners. Descriptive analysis was initially performed, while the chi-squared statistic was employed to test the significance of association between variables (EPI-INFO 3.2 software) at a significance level of 5% ($P < 0.05$).

Results

The professionals interviewed presented the following characteristics: 11 DSs graduated between 1960 and 1979, 34 DSs between 1980 and 1989, 54 DSs between 1990 and 2001, and 1 DS did not respond to this question. Sixty-two professionals graduated from private schools and 38 from public schools; 77 DSs had attended or were attending training, postgraduation courses, or some form of continuing dental education; the mean age was 33.37 years; 54 DSs were females and 46 DSs were males.

As to the experience with tooth avulsion, even though for only 15 DSs this type of trauma is considered a routine in dental practice, 71 professionals had already assisted some case of avulsion. Statistically significant differences were found between interviewees with more years of practice (graduated before 1989) and the care to cases of avulsion.

The age range of patients assisted by professionals was as follows: 0–7 years (33 DSs); 7–12 years (32 DSs); 12–18 years (12 DSs); 18 years or more (8 DSs), and 26 DSs did not respond to this question.

Concerning the ideal time for accomplishment of replantation, the following numbers were found: 56 signed immediately, 15 up to 30 min, 33 up to 1 h, 1 within 2 h or more, and 1 was unable to respond. In questions 7 and 8, more than one item was marked in each response, and thus the frequencies were larger than the number of DSs interviewed (100).

According to literature guidelines (17–19), there are distinct treatments for permanent avulsed teeth with open or closed apex and with extra-alveolar period shorter or longer then 60 min. With regard to the methods of root surface treatment, only nine DSs interviewed adopt different treatments for replantation performed with extra-alveolar period shorter than 60 min (SR) and longer than 60 min (LR). The other approaches presented seem to be adopted in both cases (Table 1).

Concerning the endodontic therapy applied, 28 DSs perform clinical and radiographic follow-up of teeth replanted at SR, and at LR endodontic therapy is initiated with changes of calcium hydroxide dressing; 12 DSs initiated endodontic treatment after 7–14 days; 7 DSs mentioned to begin endodontic treatment as soon as possible, before replantation or after splint, and seven professionals refer the patient to a specialist (endodontist). The procedures regarded as inadequate were those that not define the period onset of endodontic therapy (Table 2).

With regard to the socket treatment, 21 DSs perform irrigation with saline solution at SR and disorganization of the clot at LR with curette and saline solution. The other approaches presented seem to be adopted in both cases, for SR and LR: 38 DSs reported to irrigate the socket thoroughly with saline solution; 20 DSs stated that they treated the socket with gentle curettage for removal of blood

SURVEY: Procedures used in tooth avulsion

1. When did you conclude your graduation ?.....
2. What institution did you study ?.....
3. How old are you?.....Sex.....
4. Did you attend or are attending training, specialization or post graduation ?.....
Which ?.....

5. Have you ever attended to tooth avulsion ?
□ Yes □ No
6. Is this type of trauma common in your dental practice ?
□ Yes □ No
7. What is the age range more frequent among the patients assisted by you ?
□ 0 to 7 years □ 12 to 18 years
□ 7 to 12 years □ 18 years or more
8. What is the ideal time for accomplishment of replantation ?
□ immediately □ up to 30 minutes
□ up to 1 hour □ within 2 hours or more
□ I don´t know

According to literature guidelines (International Association of Dental Traumatology; American Association of Endodontics) there are distinct treatments for permanent avulsed teeth with open or closed apex and with extra-alveolar period shorter or longer then 60 minutes in dry environment. Considering this affirmative, answer the questions from 9 to 14.

9. Describe your procedures employed for root surface treatment in cases of avulsed permanent tooth with extra-alveolar period shorter (SR) and longer (LR) than 60 minutes:
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10. Describe your procedures employed for endodontic treatment in cases of avulsed permanent tooth with extra-alveolar period shorter (SR) and longer (LR) than 60 minutes:
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11. Describe your procedures employed for socket treatment in cases of avulsed permanent tooth with extra-alveolar period shorter (SR) and longer (LR) than 60 minutes:
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12. Describe your procedures employed for tooth splinting in cases of avulsed permanent tooth with extra-alveolar period shorter (SR) and longer (LR) than 60 minutes:
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13. Describe your procedures employed for drug therapy in cases of avulsed permanent tooth with extra-alveolar period shorter (SR) and longer (LR) than 60 minutes:
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14. Describe your procedures employed for occlusal adjustment in cases of avulsed permanent tooth with extra-alveolar period shorter (SR) and longer (LR) than 60 minutes:
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Oral health education is a way to contribute to tooth replantation prognosis. What recommendations do you offer to your patients about avulsed tooth ?

15. About extra-alveolar time ?
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16. About storage medium ?
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17. About tooth handling ?
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18. About tooth replantation by the own patient?
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Table 1. Procedures employed for root surface treatment

Approach	Responses achieved as to the root surface treatment (question 9)	Number
Adequate	SR: Irrigation with saline solution; LR: chemomechanical removal of periodontal ligament	9
Inadequate	Irrigation with saline solution	62
	Chemical methods: antibiotics, antiseptics, or hypochlorite	6
	Removal of dirt or washing in tap water	11
	Not applied	11
Total		99

One professional did not respond to this question.
SR, tooth replantation performed with extra-alveolar period shorter than 60 min; LR, tooth replantation performed with extra-alveolar period longer than 60 min.

Table 2. Procedures employed for endodontic treatment

Approach	Responses achieved as to endodontic treatment (question 10)	Number
Adequate	SR: Clinical and radiographic follow-up; LR: endodontic therapy with calcium hydroxide dressing	28
	Onset of endodontic treatment at 7–14 days after reimplantation	12
	Referral to an Endodontist	7
	Immediate endodontic treatment	7
Inadequate	Postponement of endodontic treatment for an undetermined period	24
	Description of conventional technique, without definition of the treatment period	12
	Not applied	9
Total		99

One professional did not respond to this question.
SR, tooth replantation performed with extra-alveolar period shorter than 60 min; LR, tooth replantation performed with extra-alveolar period longer than 60 min.

clot or foreign bodies, which may be associated to irrigation with saline solution, and four professionals suggest achievement of radiographs for detection of possible dento-alveolar fractures. The inadequate approaches (16.2%) involve responses in which no procedure is performed (5 DSs) and responses not applied to the issue (11 DSs). An interviewee did not respond to this question.

Concerning the type of tooth splint (Table 3), several materials are employed, even though there is no standardization, as well to the period of maintenance. The procedures regarded as adequate were those involving flexible splint: light cured resin and orthodontic wire (25 DSs); light cured resin and nylon wire (10 DSs) and orthodontic brackets (4 DSs). The other approaches presented seem to be inadequate, represented by rigid splint (Table 3).

Concerning the drug therapy employed, 79.4% of approaches may be considered adequate, since 55

Table 3. Procedures employed for tooth splinting

Approach	Responses achieved as to tooth splinting (question 12)	Number
Adequate	Light-cured composite resin and orthodontic wire	25
	Light-cured composite resin and nylon wire	10
	Orthodontic brackets	4
Inadequate	Immobilization, fixation, semi-rigid – without definition of the material employed or retention period	27
	Light-cured composite resin	14
	Utilization of metallic wires	5
	SR: Semi-rigid for 15 days and LR: rigid for 45–60 days	4
	Rigid	3
	Surgical dressing	3
	Splinting is not performed	2
Total		99

One professional did not respond to this question.
SR, tooth replantation performed with extra-alveolar period shorter than 60 min; LR, tooth replantation performed with extra-alveolar period longer than 60 min.

professionals indicate utilization of antibiotics in tooth replantation. Analgesics (four DSs), anti-inflammatory (nine DSs), mouthrinses (two DSs), tetanus booster (six DSs) and vitamin C (one DS) were cited by some interviewed in association with antibiotics. The inadequate approaches are related to the routine non-prescription of antibiotics for tooth replantation (20 DSs). Three professionals did not respond to this question.

In the question related to occlusal adjustment (Table 4) of the replanted teeth, there are only 19 reports of removal of premature contacts or occlusal interferences (adequate procedures). For the majority, the replanted tooth should be kept in infraocclusion (49 DSs), as well as with occlusal adjustment or removal of contacts (20 DSs).

Based on the detailed report of procedures employed for the treatment of cases of tooth avulsion (questions 9–14), it was possible to establish a graph representing the adequate and inadequate

Table 4. Procedures employed for occlusal adjustment

Approach	Responses achieved as to occlusal adjustment (question 14)	Number
Adequate	Removal of premature contacts or interferences	19
Inadequate	Infraocclusion	49
	Occlusal adjustment or removal of contacts	20
	Not applied	8
	SR: no occlusal adjustment and LR: infraocclusion	2
	No adjustment	1
Total		99

One professional did not respond to this question.
SR, tooth replantation performed with extra-alveolar period shorter than 60 min; LR, tooth replantation performed with extra-alveolar period longer than 60 min.

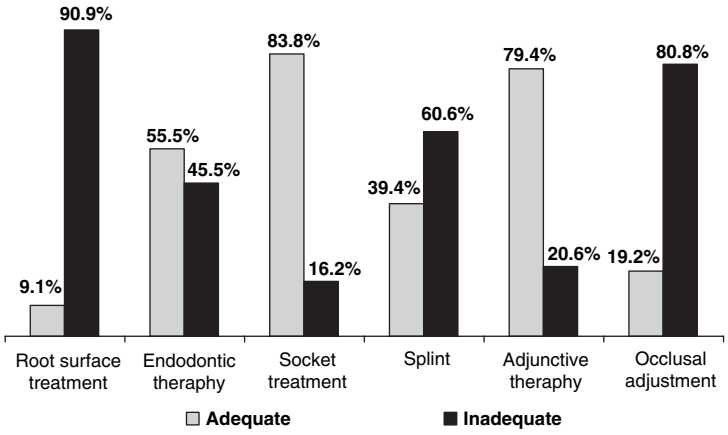

Fig. 1. Procedures used in avulsion case.

approaches, according to each question (Fig. 1). In general, 47.5% of the procedures reported by the DSs interviewed are adequate.

Concerning the education and orientation of patients, 97 DSs advise an extra-alveolar period as short as possible; one DS suggests up to 12 h in proper medium, yet did not specify which; one DS up to 2 h; and one interviewee did not respond. Saliva (80), milk (79), and saline solution (75) were the media most often mentioned; water (16 DSs); Hank's balanced saline solution (one DS); sodium hypochlorite (one DS), and one DS did not respond to this question. The frequencies were higher than 100, as there was more than one response to the same question. Minimum handling of the avulsed tooth is recommended by 93 DSs, with orientation to handle the tooth by its crown; five advocate washing the tooth in tap water and placing it in a proper storage medium, yet without mentioning which; an interviewee suggests, besides washing in tap water, placing the tooth in sodium hypochlorite solution; and one professional (one DS) did not respond. Sixty DSs encouraged the accomplishment of replantation by the own patient, followed by the search for professional help; 12 DSs indicated it only if a DS was not close; for six DSs, it depends on the case (conditions of the socket, type of dentition, emotional status of the patient); 18 professionals contraindicated this approach; two DSs suggested clinical and radiographic follow-up; two DSs advocated only maintenance of the avulsed tooth in saline solution. Favorable or unfavorable approaches as to the education and orientation of patients (questions 15–18) were expressed as frequencies (Fig. 2), and in general, 87.7% of the orientations provided to patients are favorable for the prognosis of replantation.

Discussion

Even though the prevalence of dental trauma reported in the literature seems to increase to epidemiological levels (1–3), the treatment of tooth avulsion may be considered a rare occurrence for most dental professionals. In the present study, even though the type of trauma is common only in the dental practice of 15 professionals, 71 interviewees reported having had some clinical experience with tooth avulsion, finding that may be related to the years of clinical practice, because DSs who graduated

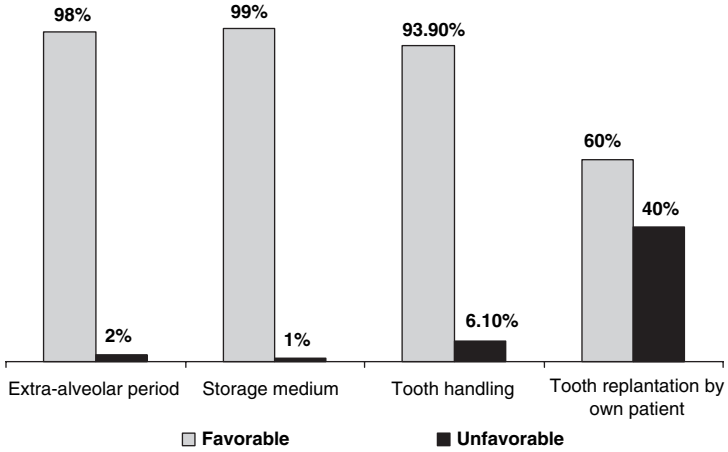

Fig. 2. Patient education and orientation.

before 1989 assisted proportionally more cases when compared to the other interviewees. However, every dental professional may receive a patient with tooth avulsion at the office, as treatment is usually searched for at the area of the accident (15).

This reality highlights the importance of diffusion of knowledge on the issue among those involved in dental care, i.e. DSs and related personnel (20–23).

Dental traumas are often treated empirically, and the etiology of complications is poorly understood (3). These deficiencies are not isolated facts and were demonstrated in some surveys, as in New Zealand (21), England (20, 21) and Tanzania (23), demonstrating lack of diffusion of information and lack of preparation of interviewees when facing this type of trauma.

In order to provide guidelines and inform the professional on the management of tooth avulsion, treatment protocols were created (17–19), and according to the International Association of Dental Traumatology (19), there have been distinct treatments for permanent avulsed teeth with completely or incompletely formed roots and with extra-alveolar period shorter or longer than 60 min in dry environment.

However, these guidelines always give rise to controversies, as in the clinical practice it may not be possible to perform replantation within an ideal period as 5 min (24), 15 min (25) or 18 min (8), in which there is predictability of repair of the periodontal ligament and absence of sequels with as root resorptions.

Thus, there is a great dilemma: which type of treatment should be indicated? The difficulty to establish different treatment plans for replantation (questions 9–14) was observed in this study, as most interviewees adopted the same type of treatment for avulsed teeth with extra-alveolar period up to 60 min and longer than 60 min. Certainly, besides the available classifications and protocols, the treatment and prognosis of cases should be combined to good sense, classifying the replantation as favorable or unfavorable.

The success of tooth replantation requires clinical skills, diagnostic knowledge of the problem, excellent emergency treatment and appropriate long-term follow-up (4, 20, 21).

In some of these items, especially the root surface treatment, a concerning finding is that many professionals (nine DSs) differentiate the vital periodontal ligament from the necrosed. Considering that replantation is a relatively uncommon trauma in dental routine and that immediate replantation is even rarer, only irrigation with saline solution, as reported by 62 DSs, could not be considered an adequate measure for late replantation. Despite the diversity of techniques suggested, standardization is well defined: hydration of the PL with saline solution at the IR (12, 17–19) and removal of the necrosed PL at LR (19), which should be associated to topical application of 2.4% acidulated sodium fluoride phosphate (19) or 2% stannous fluoride (17, 25).

The adequate treatment of the root surface may delay the occurrence of root resorptions, as the endodontic therapy of avulsed teeth is indicated for control and treatment of inflammatory root resorption (5, 26). The diagnosis of pulp necrosis or vitality should be performed based on the characteristics of the trauma, as extra-alveolar period, root formation of the avulsed tooth and in vitality and percussion tests (5). Under this aspect and according to the responses achieved in this study, doubts remain as to the ideal moment of onset of root canal treatment for 45.4% of interviewees with inadequate approaches.

The clinical and radiographic follow-up in replantation performed within 60 min and endodontic therapy with calcium hydroxide paste in replantation performed after 60 min were considered adequate measures (reported by 28 DSs). However, the professional should be aware that pulp revascularization is an uncommon finding, even in cases of short extra-alveolar period, and often a conservative approach will lead to delay in the diagnosis of inflammatory resorption, limiting the local action of endodontic treatment with calcium hydroxide paste and possibly to tooth loss, according to the speed of the resorption process.

The socket should be basically prepared for removal of foreign bodies and to facilitate repositioning of the tooth inside it (5). Gentle suction may be applied if there is any blood clot; if the bone wall is fractured, repositioning should be performed with a blunt-end instrument inside the socket (17). Good results were observed in this study (83.8%), as the procedures reported seem appropriate, facilitating the replantation.

In tooth replantation, utilization of flexible (physiological) splint is suggested, which should be removed after 7–10 days (5, 17–19, 27), or rigid in cases of dento-alveolar fracture, when the splinting period should be larger (4–8 weeks) (5, 27). From all questions applied, this one has displayed the largest diversity of responses. An aspect that gives rise to controversy is the flexibility or rigidity of splints, especially as to the material employed. Splints performed with orthodontic wire with diameter equal to or smaller than 0.5 mm and light cured resin (27), with nylon wire and light cured resin (18) or with orthodontic brackets are considered flexible (27). The term semi-rigid, reported by some interviewees (16 DSs) seems inappropriate, as it is too wide, and should specify the material employed, because it does not define if the retention is partially rigid or flexible.

Satisfactory data were found with regard to the drug therapy (79.4% of DSs interviewed prescribe antibiotics). Utilization of antibiotic therapy in tooth replantation is a consensus in the literature as a means to control root and socket contamination, especially in cases of prolonged extra-alveolar period (9, 28), and thus penicillin is the antibiotics of choice (22, 29). It is believed that this measure, combined with endodontic treatment, may be able to prevent, reduce, or eliminate the inflammatory resorption (29).

It should also be emphasized that most professionals (80.8%) state that the avulsed tooth should be kept in infraocclusion or with occlusal adjustment (contacts), which would imply a remarkable grinding of its incisal surface, when ideally removal of casual premature contacts because of tooth repositioning in the socket should be performed (5, 17, 18).

However, the most positive findings were those related to patient education, such as recommendation of replantation as soon as possible (98%); utilization of humid media (saliva, milk, saline solution) for storage of the tooth until definitive treatment is achieved (99%), and encouragement of replantation by the patients themselves (60%). Certainly, the most appropriate source of information is the patient's dentist (13).

Despite the clinical subjectivity of the questionnaire and its application, analysis of the procedures employed demonstrated that some concepts as root surface treatment and occlusal adjustment of replanted teeth should be elucidated or redefined. Greater emphasis on undergraduate and postgraduate education in this area is indicated.

Conclusion

It was concluded that 47.5% of the procedures employed by the 100 DSs interviewed are adequate, and orientations provided to the patient are favorable in 87.7% of cases, which may positively interfere with the prognosis of tooth replantation.

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