SUNSTAR AWARD: PROJECTS

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CODE 75: operative protocols and a case report in preventive dental care in a department of neurorehabilitation for acquired cerebral lesions

Abstract: CODE 75 is a neurorehabilitation department at the General Hospital of Versilia, which specializes in serious acquired cerebral lesions. Objectives: The therapy and the maintenance of oral hygiene in patients with cerebral lesions are critical to the overall success of the rehabilitation therapy. The purpose of our project was to improve patients' quality of life, reducing the quantity of oral bacteria caused by the presence of layers of plague on the tooth surfaces and in the oral mucosa. Methods: The dental department of Versilia Hospital conducted a 1 year follow-up study to develop specific protocols designed to obtain and improve the maintenance of these patients' oral hygiene. The oral prevention project was directed primarily at the department's medical staff and carers, and focused on improving the information available to the medical team and their direct involvement. A case report is described to show an application of the protocol. Data were recorded before the start of the protocol (T0) and after 1 month (T1). Results: The analysis of the periodontal parameters shows a difference in values between T0 and T1. In T1 no bleeding on probing was recorded. After the causal therapy, the gingival hypertrophy and oedema disappeared as confirmed by the absence of BOP. Discussions: Results show that teamwork plays a fundamental role in this multi-professional approach for the rehabilitation of patients with acquired cerebral lesions. The success of this protocol depends on the cooperation between personnel with specific skills in the department.

Key words: cerebral lesions; neurorehabilitation; preventive dental care

Introduction

CODE 75 is the rehabilitation department for acquired cerebral lesions at the Versilia General Hospital, and on the 1st of January 2003 it acquired official recognition as a centre of excellence in the region of Tuscany. This department, specifically dedicated to neurorehabilitation, is based on a multi-professional (1) approach aimed at improving the state of health of patients with cerebral lesions. The rehabilitation protocol conducted individual therapy which focused on neuromotor, neurocognitive, logopaedic and neurobehavioural rehabilitation, and was supported by psychological assistance.

Regarding the patients at CODE 75, 66% have difficulties in swallowing and in the mobility of the perioral and masticatory muscles. These patients show limited masticatory function which often results in being severely inhibited (2). These factors induce the bacterial colonization of tooth surfaces as well as the oral mucosa, thus encouraging plaque formation. The maintenance of patient oral hygiene at CODE 75 becomes critical in the course of rehabilitation and is part of a wider multidisciplinary approach. The Istituto Stomatologico Tirreno created in cooperation with CODE 75 runs individual oral hygiene maintenance protocols with the aim of improving the oral hygiene and therefore the quality of life of these patients. Furthermore, our protocol highlighted the key role of a patient's family which can be considered a fundamental resource in the development of the rehabilitation process. (3) CODE 75's patient oral prevention project is directed towards the department's paramedics and the patients' families. This protocol is based on the involvement and instruction of the paramedical team regarding the right procedure to maintain a correct oral hygiene in these patients. The following parameters have to be evaluated to obtain the success of our protocols: responsiveness, cognitive function and the rehabilitation programme.

The goal of this study was to reduce the quantity of oral bacteria, which in CODE 75 patients is found to be higher because of the presence of stratified plaque layers on tooth surfaces and on oral mucosa. The success of the rehabilitation process depends on the favourable outcome of our therapy and the level of oral health achieved. As an additional benefit, it is well documented in the literature that a correct oral hygiene is the basic prerequisite for interpersonal relationships.

Operative protocols

The operative protocols designed for specific targets are explained below:

- Professional Protocol for Odontologist and Dental Hygenist
- Maintenance Protocol for Paramedics
- Home Maintenance Protocol for Carers

Professional Protocol

All the patients included in this study underwent a professional oral hygiene session to recreate favourable oral health. Bacterial decontamination was obtained by using both ultrasonic as well as manual instrumentations specifically used for removing bacterial plaque above and below the gums. The following operative steps should be performed before the professional hygiene session:

1 Regarding patient preparation, prior to the professional oral hygiene session, the paramedical team pass gauze soaked in chlorhexidine (0.3%) (4) over the gum and tongue mucosa (5) twice daily for 1 week.

2 Prophylaxis with antibiotics carried out the day before the oral hygiene session. It is in fact scientifically demonstrated (6–8) that during a dental hygiene session, especially when

there is a great amount of plaque as in this case, a high quantity of bacteria and toxins are released that can cause bacteraemia and fever. The antibiotic prophylaxis should be planned in conjunction with the department's doctor according to the patient's medical history.

3 A dental examination to establish the real dental needs and whether a local anaesthetic would be necessary during the treatment.

The operative protocol:

1 Limited session duration to allow the patient to rest at frequent intervals (9).

2 The use of further aids (mouth prop, rubber-wedge) that while maintaining the patient's mouth open without constrictions provides a comfortable support for the patient (Fig. 1).

3 The use of small instruments, counter-angled with the handle covered in a rubber or elastomer sleeve to prevent accidental traumas to the teeth (Cavitron magnetostrictive ultrasonic hand piece, angled universal curettes – M23 Deppeler and 3/4 & 5/6 Langer; and a Novatech periodontal probe (Fig. 2).

4 Irrigation of the crevicular sulcus with a chlorhexidine gel (0.2%) (Fig. 3).



Fig. 1. Rubber aids used in order to maintain the patient's mouth open.



Fig. 2. Ultrasonic hand pieces and angled universal curettes used for the professional protocol.



Fig. 3. Irrigation of the crevicular sulcus with a chlorexidine gel.

Maintenance protocol

Immediately after the professional dental hygiene session, it is very important to maintain the results achieved through the bacterial decontamination, by following all the instructions aimed at removing plaque on the tooth surfaces and the oral mucosa. The protocol suggests training the nurses and paramedics in the specific principles and instruments for the maintenance of each patient depending on their pathological and functional conditions. In particular, a personalized record card will be drawn up containing the specific oral hygiene instructions in relation to the patient's level of disability. The personal protocol must seek to:

1 Teach instrumentation techniques for a single tooth and for small groups of teeth;

- 2 Make use of the following instruments (Fig. 4):
- Rubber-wedges (mouth props) to facilitate the operator in the cleaning procedures and to keep the patient's mouth open.
- Toothbrushes the choice of toothbrush is consequential to the clinical conditions of the patient and their relational skills. The following toothbrushes can be used:
 - (i) Electric toothbrush ('Rotapower' Gum);

(ii) Manual (To be assessed, possibly with a small head to facilitate use in the distal areas);



Fig. 4. Instruments used in the maintenance protocol: toothbrush, tongue cleaner and interproximal aids.

(iii) End-tuft toothbrush ('End-tuft' Gum) with an adaptable handle to suit the anatomical conditions of the mouth.

Interproximal instruments (Proxabrush Bi-Direction Gum).

Tongue cleaner ('Dual Action' Gum) for the mechanical removal of the layers of bacterial plaque on the surface of the tongue.

Gauzes soaked in mouthwash containing chlorhexidine to cleanse the mucosa (0.12%).

Home maintenance protocol

This protocol is designed for patients with a stable general condition and who do not need hospitalization or 24-h daily assistance. These patients begin a multi-professional and prolonged rehabilitation programme. In this context, occupational therapy can be introduced as its aim is to reintegrate these subjects into an operative domestic sphere. In this phase the most responsive subjects can be directed towards oral hygiene procedures, preferably to be carried out by themselves or with the help of the paramedics. However, the maintenance principles previously listed must always be applied. The use of an electric toothbrush can be suggested to facilitate a correct brushing movement for the removal of bacterial plaque and food debris. If necessary it is advised to secure the patient's hand to the toothbrush when unable to hold onto objects with sufficient strength (10).

Case report

The following clinical case is shown as a paradigmatic example of the professional operative protocol and maintenance of oral hygiene on a CODE 75 patient at the Versilia General Hospital. The following results are completely superimposable to those of the study group being examined.

The pathological medical anamnesis shows that the patient was admitted to Code 75 on the 27th of June 2009 with a diagnosis of cerebral haemorrhage caused by a cranial trauma in a subject with high blood pressure, paroxysmal atrial fibrillation, and suffering from chronic polyarthritis and mitral insufficiency. Prior to this date the patient had been admitted to the intensive care department, mechanically ventilated through tracheotomy and fed by PEG. The rehabilitation therapy on the patient started on the 30th of June 2009 employing a multi-professional team with the aim of restoring the essential corporal functions (weaning off the tracheostomy cannula and restoration of trunk control) and cognitive functions.

On 10th August 2009, CODE 75 requested a dental consultation. The patient was breathing spontaneously, was alert, attentive, respondent to commands and with sufficient trunk control when sitting in the chair. The medical anamnesis showed a dysphagia for food (semi-solid diet), alterations in lingual mobility and a suspected alteration in the pharyngeal phase of swallowing together with a valid cough and pharyngeal reflex. The medical notes showed a previous phoniatric examination dated the 30th of July 2009. During this exam the presence of abundant catarrhal discharge was noted in the



Fig. 5. Objective examination of the patient's mouth before the treatment (buccal visino).

trachea. During the swallowing test with gelled and liquid water only a modest stagnation was noted in the vallecula linguae and the right pyriform sinus, but there was no sign of inhalation before and after swallowing. Following a careful objective assessment of the patient's mouth, the presence of diffused gum inflammation was highlighted, profuse bleeding on probing and the presence of plaque in the entire dental arch. It was considered appropriate, on an interdisciplinary principle, to proceed with the professional protocol previously described to decontaminate the mouth (Figs 5 and 8 refer to the objective examination of the patient's mouth on the first visit carried out on 10/08/09). The preparatory phase for the procedure involved instructing the nurses and paramedics to wipe the gauze which is soaked in mouthwash containing chlorhexidine at 0.3% over the gingival mucosa twice a day to remove food debris and bacterial plaque (Fig. 6). On the day



Fig. 6. Gauze soaked in mouthwash containing chlorexidine 0.3% to be used over the gingival mucosa.



Fig. 7. Rubber wedge (mouth prop) placed to maintain the patient's mouth open.

of the professional oral hygiene session, on the 17th of August 2009, 1 h before the appointment the patient took two tablets of Augmentin 1g. The course of antibiotics was prescribed for 4 days after the session (two tablets a day).

The following periodontal parameters: PD, PAL, BOP, GA (11) were measured on six dental sextants. Prior to the session, a rubber wedge (mouth prop) was placed to facilitate and maintain the patient's mouth open (Fig. 7). The scaling session was then carried out using both mechanical instruments (Cavitron magnetostrictive ultrasonic hand piece) (Fig. 9) and manual instruments (universal curettes – M23 Deppeler and Langer 3/4 and 5/6) (Fig. 10). On the same day of the professional debridement the paramedics and patient's family were instructed on the maintenance protocol. They were advised to proceed with the oral hygiene practice twice a day in the following manner:

1 Wipe the gauze soaked in mouthwash over the gingival mucosa to remove food debris (Fig. 6);

2 Brush teeth with toothbrush and chlorhexidine gel (Figs 11 and 12);

3 The use of instruments to clean the interproximal areas – Proxabrush Bi-Direction Gum (Fig. 13);

4 The use of Gum tongue cleaner to remove plaque on the tongue (Fig. 14).



Fig. 8. Objective examination of the patient's mouth before the treatment (lingual vision).



Fig. 9. Mechanical instrumentation with a magnetostictive ultrasonic hand piece.



Fig. 12. Use of toothbrush and chlorexidine gel in the maxillary teeth in order to decontaminate the mouth.



Fig. 10. Manual instrumentation with universal curette.





Fig. 11. Use of toothbrush and chlorexidine gel in the mandibulary teeth in order to decontaminate the mouth.

In this case report two sets of time frames were analysed:

(i) Time frame 0 (T0) corresponds to when the objective examination was carried out on the patient and the periodontal indices PD and PAL were measured. During the examination, a mapping of the keratinized gingival GA of the vestibular side of both lower and upper arches was carried out. The presence or absence of bleeding on probing BOP was detected.

Fig. 13. Use of instrument to clean the interproximal areas (Proxabrush Bi-Direction - Gum).



Fig. 14. Use of the tongue cleaner to remove plaque on the tongue.

Table 1. (a) Upper arch vestibular side, (b) upper arch palatal side, (c) lower arch lingual side, (d) lower arch vestibular side

(a)

PD 455 445 444 544 545 655 455 456 546 454 PAL 343 223 111 222 211 211 111 222 322 121 5 7 3 AG 4 6 6 6 6 5 4 *** *** *** BOP *** *** *** *** *** *** ***

(b)



PD		454		445	535	565	545	455	544	576	566	655	
PAL		342		221	111	222	221	211	111	222	232	221	
AG													
BOP		***		***	***	***	***	***	***	***	***	***	



PD			NS									
PAL			NS									
AG												
BOP			NS									

PD			545	556	556	655	656	544	555			
PAL			213	122	111	321	333	322	211			
AG			3	4	5	6	5	5	4			
BOP			***	***	***	***	***	***	***			

(ii) Time frame 1 (T1) was calculated exactly 1 month after the procedure and the periodontal parameters PD, PAL, GA and BOBOPP were remeasured.

(iii) The average global values of each index in T0 and T1 were calculated (the data obtained is described in Table 1):

(iv) In T1, the average global value of the PD measured on the vestibular side of the upper arch was equal to 4.6.

(v) In T0, the average global value of the PD measured on the palatal side of the upper arch was equal to 4.9.

(a) PD PAL AG BOP

Table 2. (a) Upper arch palatal side, (b) upper arch palatal side, (c) lower arch lingual side, (d) lower arch vestibular side



PD		342		223	111	211	211	211	211	222	232	221	
PAL		221		212	111	211	211	211	211	212	211	211	
AG													
BOP													

(c)



PD			222	111	111	331	323	211	121			
PAL			211	111	111	211	212	211	111			
AG												
BOP												

(d)



PD			212	122	111	321	333	322	211			
PAL			211	111	111	211	212	212	211			
AG			3	4	5	6	5	5	4			
BOP												

(vi) In T0, it was not possible to carry out the probing depth on the lingual side of the lower arch because the tooth surfaces and gingival margins were completely covered in tartar.

(vii) In T0, the average global value of the PD measured on the vestibular side of the lower arch was equal to 5.09.

(viii) In T0, the average global value of the PAL measured on the vestibular side of the upper arch was equal to 1.8.

(ix) In T0, the average global value of the PAL measured on the palatal side of the upper arch was equal to 1.7.

(x) In T0, it was not possible to carry out probing on the lingual side of the lower arch because the tooth surfaces and gingival margins were completely covered in tartar.

(xi) In T0, the average global value of the PAL measured on the vestibular side of the lower arch was equal to 1.9.

A maximum value of BOP was recorded for each site giving a BOP measurement in T0 equal to 100%. In T1, there was no bleeding recorded on probing in the sites examined. The global values of the parameters previously considered on periodontal sites examined in time frame 1 are reported below (the data obtained is described in Table 2):

(i) In T1, the average global value of the PD measured on the vestibular side of the upper arch was equal to 1.7.

(ii) In T1, the average global value of the PD measured on the palatal side of the upper arch was equal to 1.7.

(iii) In T1, the average global value of the PD measured on the lingual side of the lower arch was equal to 1.6

(iv) In T1, the average global value of the PD measured on the vestibular side of the lower arch was equal to 1.8.

(v) In T1, the average global value of the PAL measured on the vestibular side of the upper arch was equal to 1.3.

(vi) In T1, the average global value of the PAL measured on the palatal side of the upper arch was equal to 1.4.

(vii) In T1, the average global value of the PAL measured on the lingual side of the lower arch was equal to 1.2.

(viii) In T1, the average global value of the PAL measured on the vestibular side of the lower arch was equal to 1.3.

Results

The analysis of the periodontal parameters previously listed shows a difference in values between T0 and T1. In T0, a maximum value of BOP was recorded – an expression of a hypertrophic gingivitis with copious bleeding on probing. The average value of the PD in T0 was equal to 4.86. In T1, the average value of the PD was equal to 1.7. The difference in index values (equal to -3.16) shows a marked decrease of the PD from T0 to T1. It should be considered that in the presence of an inflammatory infiltration of the gums, the probe penetrates at the bottom of the periodontal pocket. It is well known that in presence of an inflammatory process the oedema causes the desmosomal junctions in the sulcus to become looser and less resistant to the smallest force exerted by the probe (12). This would explain the decrease of the PD between T0 and T1.

In T1, no bleeding on probing was recorded – a symptom of the absence of inflammation (Figs 15–17).

After the causal therapy, the gingival hypertrophy and resulting oedema disappeared as confirmed by the absence of BOP. The average value of the PAL in T0 was equal to 1.8.



Fig. 15. Objective examination of the patient's mouth after the treatment. No redness and hypertrophy was shown.



Fig. 16. Clinical examination of the mandibulary teeth after the treatment. No BOP was recorded.



Fig. 17. Clinical examination of the maxillary teeth after the treatment. No BOP was recorded and the PD was reduced.

In T1, the average value of the PAL was 1.3. A slight decrease between T0 and T1 was recorded in the PAL value. The difference in the index values (equal to -0.5) would confirm that there was no loss of periodontal attachment between T0 and T1. One needs to be cautious and consider that the PAL calculated 30 days after the causal therapy might not be a true measurement of the loss of periodontal attachment. The inflammatory infiltration disappears and there is a neo-apposition of collagen fibres in the deepest part of the pocket. The periodontal probe might not reach the bottom of the pocket, and, therefore, the real depth of the pocket or the level of the attachment could be underestimated (11).

After the scaling session the nurses and the patient's family were instructed on the procedures of the correct oral hygiene maintenance. There was immediate active collaboration and attention in carrying out the indications provided in the maintenance protocol. During the following weekly recall, there was a considerable improvement in the appearance of the patient's oral mucosa. When interviewing the family and the paramedics regarding the execution of the oral hygiene procedures, we received positive feedback from their part because they realized the therapy's contribution to the general well-being of the assisted person. A few days after the procedure, the patient underwent another phoniatric examination. This showed that there was no food stagnation in the vallecula linguae and pyriform sinus. The absence of stagnation in these areas could be related to the capability of the personnel and the carers in following the oral hygiene instructions after meals.

Discussion

The present case report is taken as a paradigm in the context of a 1 year prospective study carried out with the contribution of the Istituto Stomatologico Tirreno within the rehabilitation department for serious acquired cerebral lesions at the Versilia General Hospital. The aim of this collaboration was to provide a valid contribution to the rehabilitation project of the patients at CODE 75. In this context, the work of the Istituto Stomatologico Tirreno has to be considered as part of a multi-professional approach for the rehabilitation of patients with acquired cerebral lesions. It is clear that to obtain the success of this protocol, the active and positive cooperation between personnel with specific skills in the department is fundamental.

In the case report, the exchange of opinions between the dental hygienist and the doctors assigned to the rehabilitation of deglutition was crucial. Patients suffering with dysphagia need a rehabilitative approach that restores deglutition through exercises that involve the perioral muscles, reinforcing the pharyngeal-reflexes and promoting the restoration of masticatory function. The control of oral hygiene in these patients is a necessary premise for the development of this project. In the clinical case previously described, we carried out a scaling session to disinfect the patient's mouth. The decrease in the periodontal indices between time frame 0 and the time frame 1 showed that the study's objective had been reached.

The paramedics and the carers were then instructed in the maintenance protocol with the ultimate goal of preserving over time the results achieved by the bacterial decontamination. The protocol not only resulted in the immediate well-being of the patient but also facilitated the work of the rehabilitation therapists. This study cannot be considered as concluded because the objectives that were achieved still need to be maintained over a long period of time. A further study is necessary in the future, based on a more extended follow-up period and on a higher number of patients to validate our hypothesis. With regard to the maintenance protocol given to the paramedics and the carers, it will be necessary to adapt it according to the evolution of the patient's clinical and cognitive picture. In the eventuality of an improvement in manual control, the use of an electric toothbrush with the active involvement of the patient in the oral hygiene procedures could be included in this protocol.

Finally, patients and their families spend a long time – sometimes months – in a rehabilitation department. A close relationship is created between the entire team and the patients and their families, which can prove to be an active resource in a project for the person's recovery. Our study was therefore structured with a view to provide valuable assistance to this project.

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