
A Prosthodontic-Based Implant Patient Classification System

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Success in dental implant-supported prostheses has traditionally been measured in terms of successful osseointegration of implant fixtures. Clearly, this is not the true measure of success in terms of patient expectations. Patients expect prostheses with which they can function, without embarrassment or insecurity. Therefore, patient evaluation and treatment planning must be concerned with final prosthetic results and how patients will look and function. This article introduces a simple classification system that will help eliminate confusion in treatment-planning with implant patients and will also allow dentists to better advise patients about the goals of treatment. The classification system is based primarily on the prosthetic design that patients will receive and offers a means of quantitating the complexity and, therefore, the predictability of treatment.

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IN THE early 1980s, Dr P.I. Brånemark and others introduced osseointegration and a predictable endosseous implant system to the North American continent.^{1,2} To say that dental therapy was dramatically changed would be an understatement and yet, the benefits of Dr Brånemark's research have not reached as great a segment of the population as was originally estimated. The introduction of a predictable implant system was followed by a period of general confusion resulting from the emergence of many different competing implant systems. Next followed a period of re-evaluation with a review of failures in technique and patient expectations. Today, practitioners involved in dental implants have become more wary in their prosthodontic goals and expectations.

The Brånemark implant system was initially recommended for edentulous patients and used hybrid prostheses supported by five or six implants in the anterior region of either the maxilla or the mandible. Many patients were disappointed with the appearance and function of the original hybrid prostheses. Furthermore, the Brånemark implant system was not initially recommended for partially edentulous patients. Demand for alternative restorative forms stimulated the competitive nature of practitioners, technicians, and manufacturers, and fostered new prosthetic designs.

On the market today, no fewer than 10 major endosseous implant systems and numerous clones of the major systems exist. Manufacturers want to sell their products to dentists, and their claims are sometimes ludicrous in the description of the advantages of their system. Dental implants can make a major financial contribution to surgical practices, and many specialists have provided the surgical phase of implant treatment for general practitioners who are not well versed in the prosthodontic phase. It might be said that for the past 8 years in North America, endosseous dental implant treatment has been surgically driven, and has not always been in the best interests of the patients.

It is time to analyze what has occurred since the introduction of Brånemark's research. Dentistry should look at how implant patients are treatment-planned and informed of the benefits and risks associated with implant treatment. It is not appropriate to promise unlimited success for all implant patients.

Goals of an Implant Patient Classification System

Much has been written about factors influencing the long-term success of dental implants and variations in prosthodontic design.³⁻⁶ What is not well-defined is the success of implant supported prostheses in terms of patient expectations. Patients are not concerned with the number of implants or implant designs. What patients do care about is the *appearance, function, longevity, and cost* of implant-supported prostheses. The potential for patient disappointment exists when

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dentists do not address these issues before initiating treatment.

The purpose of any patient classification system in dentistry is to provide practitioners with information about the course of treatment and the expected outcomes. The classification system described in the present report allows practitioners to compute a complexity index that indicates how difficult it will be to complete the final treatment plan. The complexity index reflects variations in individual patients and prosthetic designs and indicates the experience and skill required of the dentists and technicians performing the prosthodontic phase of implant treatment.

Once the complexity of the treatment plan is established, it becomes possible to discuss with patients whether or not the proposed treatment will actually approach their expectations. The patients, in consultation with their dentists, can make informed decisions as to whether or not implant-supported prostheses are desirable.

Classification of Implant Patients

The prosthodontic-based implant patient classification system is initially divided into two stages (Table 1). Stage I covers prosthetic design and implant location for both edentulous and partially edentulous patients. This stage of the classification system has the greatest impact on patient acceptance. Stage II covers the individual patient considerations that dentists encounter in bone volume and density, anatomical obstacles, medical conditions, occlusion, oral hygiene, and psychological type. This stage of the classification system alerts dentists to the limitations of implant treatment.

The initial examination should delineate the extent of edentulism and initiate a dialogue regarding possible methods of tooth replacement. A decision is made at this point as to whether or not conventional dental prostheses or implant-supported prostheses will be used for tooth replacement. Together patients and dentists decide on the final configuration of treatment. It is important to note that the more implant-retained prostheses approach the configuration of natural teeth, the more difficult they will be to produce, but the more likely they will be accepted by the patient. Once the prosthetic design is established, dentists can complete stage I by evaluating potential implant locations and then proceed with the stage II evaluation to determine if patients are indeed candidates for the selected implant-sup-

Table 1. A Prosthodontic-Based Implant Patient Classification System

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|--|
| Stage I: Prosthodontic Considerations |
| Class I: Edentulous |
| Prosthetic design |
| Division 1: Simple overdenture |
| Division 2: Hybrid prosthesis |
| Division 3: Complex overdenture |
| Division 4: Crown-and-bridge restoration |
| Implant location |
| Subclass 1: Anterior mandible |
| Subclass 2: Anterior maxilla |
| Subclass 3: Anterior/posterior mandible |
| Subclass 4: Anterior/posterior maxilla |
| Class II: Partially Edentulous |
| Prosthetic design |
| Division 1: Free-standing multiple units |
| Division 2: Single nonrotating units |
| Division 3: Using natural abutments |
| Implant location |
| Subclass 1: Anterior mandible |
| Subclass 2: Anterior maxilla |
| Subclass 3: Posterior mandible |
| Subclass 4: Posterior maxilla |
| Stage II: Patient Considerations |
| Surgical Type (grades 0-4) |
| Available bone volume |
| Bone density |
| Anatomical obstacles |
| General medical condition |
| Immediate implants |
| Physiological Type (grades 0 or 1) |
| Age |
| Occlusal factors |
| Oral hygiene |
| Psychological type |

ported prostheses. In the team approach, surgeons can be invaluable in the stage II evaluation process.

Completion of the two-stage evaluation process gives dentists and patients a clear picture of the course of treatment. They are alerted to difficulties that might exist before initiating treatment and to the complexity of the treatment. Characteristics of each prosthetic design can be discussed more easily with patients, and treatment expectations can be better explained. The classification system can also be used to determine costs involved in producing prostheses and to explain these expenses to patients.

Consultation Forms

To make the classification system more applicable to consultation procedures in the dental office, two patient consultation forms have been developed. One form addresses edentulous patients (Table 2) and the other addresses partially edentulous patients

(Table 3). There are slight scoring differences between these two forms. The differences reflect variations in treatment modalities and complexity levels for edentulous and partially edentulous patients. The general rule is that partially edentulous patients will be more difficult than edentulous patients, so one point will be added to the overall complexity index of partially edentulous patients.

At the initial visit, classify patients according to desired prosthetic designs. After discussion with the patient, merely circle the appropriate prosthetic design. On the completion of the initial records and appropriate consultations, determine implant location, patient surgical type, and patient physiological type. The surgical portion of the form looks at five

Table 2. Consultation Form for Edentulous Patients

| Name: Patient #1 | | Date: 11/90 | |
|-----------------------------|--------------------------------|------------------------|-------|
| CIS | Factor | Comments | Score |
| <i>Prosthetic type</i> | | | |
| 1 | Simple overdenture | Clip-bar | 1 |
| 2 | Hybrid prosthesis | | |
| 3 | Complex overdenture | | |
| 5 | Crown and bridge (ceramometal) | | |
| <i>Implant location</i> | | | |
| 1 | Anterior mandible | | |
| 2 | Anterior maxilla | 4 fixtures | 2 |
| 3 | Anterior/posterior mandible | | |
| 4 | Anterior/posterior maxilla | | |
| <i>Surgical type (0-4)*</i> | | | |
| | Available bone volume | | |
| | Bone density | | |
| | Anatomical landmarks | | |
| 2 | General medical condition | Smoking/ Alcohol | 2 |
| 1 | Immediate implants | Membrane/ F.D. Bone | 1 |
| <i>Physiological type</i> | | | |
| 1 | Age | | |
| 1 | Occlusal factors | Class III | 1 |
| 1 | Oral hygiene | Poor | 1 |
| 1 | Psychological type | | |
| Complexity Index: 8 | | | |

Abbreviations: CIS, complexity index score.

*A 0 grade indicates no impact on surgical success of implant placement. A 4 grade indicates no chance of successful implant placement.

Table 3. Consultation Form for Partially Edentulous Patients

| Name: Patient #2 | | Date: 6/91 | |
|-----------------------------|-----------------------------------|----------------------------|-------|
| CIS | Factor | Comments | Score |
| <i>Prosthetic type</i> | | | |
| 1 | Multiple unit—Freestanding | | |
| 3 | Single tooth | | |
| 5 | Utilizing natural tooth abutments | 4 copings/ 11 units C&B | 5 |
| <i>Implant location</i> | | | |
| 1 | Anterior mandible | | |
| 2 | Anterior maxilla | 3 Fixtures | 2 |
| 4 | Posterior mandible | | |
| 5 | Posterior maxilla | 2 Fixtures | 5 |
| <i>Surgical type (0-4)*</i> | | | |
| 3 | Available bone volume | Post. max = 7 mm | 3 |
| | Bone density | | |
| 2 | Anatomical landmarks | Max sinus | 2 |
| | General medical condition | | |
| | Immediate implants | | |
| <i>Physiological type</i> | | | |
| 1 | Age | | |
| 1 | Occlusal factors | | |
| 1 | Oral hygiene | | |
| 1 | Psychological type | | |

Complexity index: 18
(1 added for partially edentulous classification)

*A 0 grade indicates no impact on surgical success of implant placement. A 4 grade indicates no chance of successful implant placement.

variables that significantly influence the ability to place implants. These factors are scored from zero to four. A grade of zero indicates that there is no hinderance from this factor to the placement of implants, whereas a grade of four indicates that this factor would most likely prevent the successful placement of implants. The physiological portion of the form is less critical in determining the success of implants; therefore, a score of either zero or one is used indicating whether the factor should be considered in the overall treatment plan. The forms provide a means of discussing with patients the surgical and prosthodontic treatment plans.

Dentists can review each potential prosthetic design in terms of the procedures that are used and the results that patients might expect. Discussing

the considerations on the forms allows dentists and patients to make decisions about treatment based on the complexity of the prosthetic design and the predictability of result. The consultation forms alert dentists to patient treatment beyond their expertise and likewise warn patients against treatment that might not meet their expectations.

Complexity Index

The difficulty, and therefore the level of skill required of the dental professionals providing the treatment, can easily be assessed by the complexity index. The novice level is indicated by a complexity index of 2 to 8. There is an entry level in any endeavor, and dental implants are no different. Unfortunately, most practicing dentists were not taught implant techniques in dental school. They learned the surgical and prosthodontic phases of implant treatment through continuing education courses of varying content and duration. Novices can be defined as dentists capable of providing simple prosthetic designs using well described clinical and laboratory techniques with predictable results. The novice level, however, does require adequate education and skills to work within these parameters.

After gaining significant experience in treating dental implant patients, whether it be in the surgical or the restorative phases, dentists can be considered to have intermediate-level skills and are ready to treat patients in the complexity index range of 8 to 16. The question, of course, is how to define significant experience? At this point, it seems safe to say that dentists who are going to challenge intermediate-level treatment should have favorably completed at least 10 novice-level patient treatments.

Practitioners who have successfully completed at least 10 intermediate-level patient treatments and have a wide range of experiences in the surgical and prosthodontic phases of dental implant treatment can be considered ready to proceed to the advanced complexity levels above 16. Specialists would normally treat these patients. However, this does not preclude the well-trained generalists from performing at the advanced levels.

The complexity index provides a simple means of evaluating potential implant patients in terms of their difficulty of treatment. The index can be used to determine skill levels required of the dentists and technicians participating in the treatment. Dentists can easily decide from the outset if patient treatment will need novice, intermediate, or advanced skills

from the team. This information can also be used to initiate a discussion of patient expectations and treatment outcomes.

Patient Presentations

The following section will discuss how patients are evaluated and scored in terms of their complexity index scores (CIS) and how their treatment followed expectations.

Patient 1

The patient is a 65-year-old woman. She is a heavy smoker and drinker. Previous dental care in the maxillary arch is failing. Radiograph scans show no salvageable teeth in the maxillary arch, but adequate bone in the anterior maxilla to accommodate 13- to 15-mm implants. The sinuses are large and the posterior maxilla is ruled out as a site for implants. She has class III skeletal occlusion. Based on this information, a consultation form was completed (Table 2).

A complex overdenture and a crown and bridge restoration were ruled out at the outset because of financial considerations. A simple overdenture (CIS of 1) with a bar and retaining clips was chosen for the final prosthetic design. For stability, the use of four implants was discussed. The proposed site of those implants was the anterior maxilla (CIS of 2). The patient's smoking and drinking (CIS of 2) were significant, as was the use of immediate implants (CIS of 1). Under the physiological section, the class III skeletal occlusion (CIS of 1) and the poor oral hygiene (CIS of 1) warranted consideration in the overall treatment plan. The total complexity index for this patient was 8. A discussion was initiated based on this complexity level and the predicted outcome of the treatment. The patient was advised about the problems associated with smoking, drinking, and poor oral hygiene. The patient gave final approval for the proposed treatment plan.

The remaining maxillary teeth were extracted and implants were placed. An immediate denture was inserted. Healing was uneventful, and 6 months later, the implants were uncovered. A bar was constructed and the final prosthesis was processed with four retaining clips. The patient's drinking was a problem throughout treatment in terms of her remembering the type of prosthesis that was being constructed. However, the consultation form served as a written reminder of the original treatment plan,

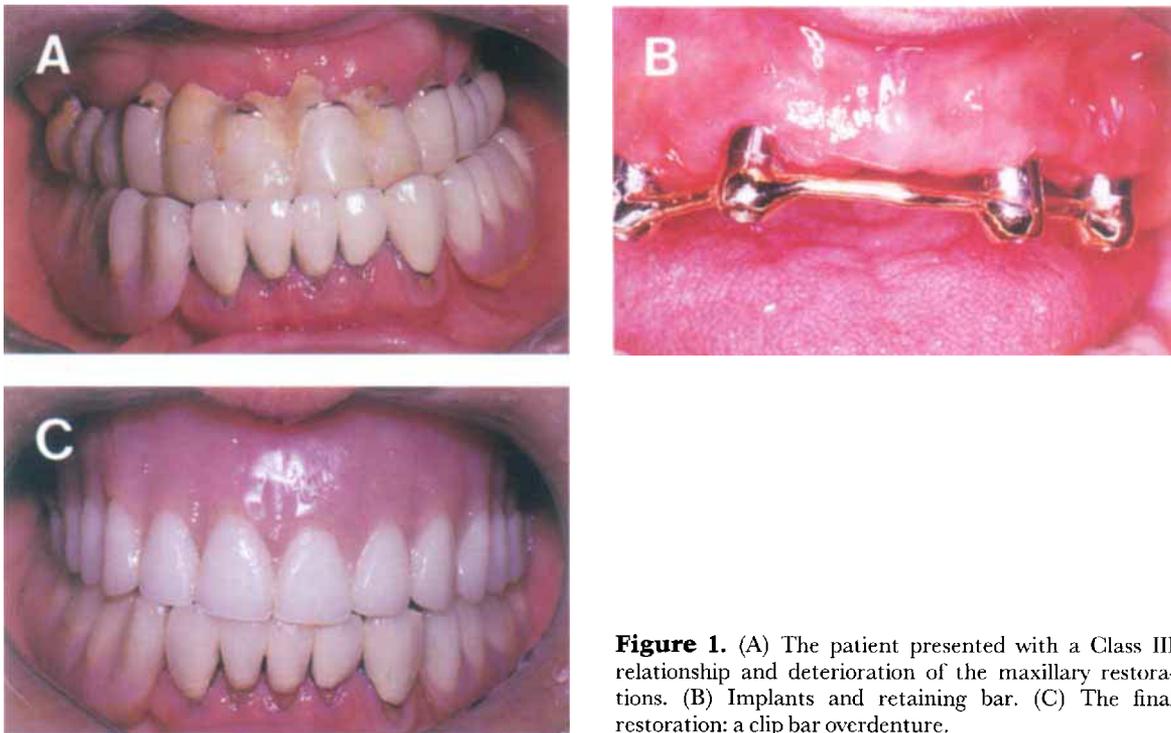


Figure 1. (A) The patient presented with a Class III relationship and deterioration of the maxillary restorations. (B) Implants and retaining bar. (C) The final restoration: a clip bar overdenture.

and ultimately the treatment was completed to the patient's satisfaction (Fig 1).

Patient 2

The patient is a 45-year-old man with a maxillary fixed partial denture that is failing. He is a semi-professional singer and is quite concerned about the final esthetic and phonetic results of treatment. He will not tolerate removable prostheses of any kind and must have a prosthetic design that closely simulates his natural teeth. The diagnostic examination showed that the four remaining maxillary teeth are salvageable and can be incorporated into the new prosthesis.

Although it was possible to construct a fixed partial denture on the remaining four teeth, it was explained that this was inadvisable in terms of long-term prognosis. The use of dental implants in conjunction with the remaining teeth was discussed. The available bone seemed adequate in the anterior region, but questionable in the posterior region due to the presence of large maxillary sinuses. The mandibular fixed partial denture extends to the area of the second bicuspid, so molar occlusion was not necessary. All other factors were positive. Based on this information, the consultation form was completed (Table 3).

A final prosthesis supported by natural abutments as well as implant abutments (CIS of 5) was chosen. A prosthetic design using gold copings on the natural teeth and a single, implant-supported prosthesis was discussed. Implants located in the anterior edentulous spaces (CIS of 2) and in the posterior maxilla (CIS of 5) distal to the natural abutments were proposed. The maxillary sinuses are large (CIS of 2), and the available bone volume distal to the natural teeth is minimal (CIS of 3). Adding 1 point for a partially edentulous patient, the total complexity index was 18. The most significant factor of this complexity index was the score of 3 for available bone volume. Contingencies and alternative treatments were discussed, particularly in light of potential implant failure in the posterior maxilla. The patient elected to follow the proposed treatment plan.

The surgical phase proceeded with the placement of five implant fixtures. Six months after placement, all five implants were uncovered and found to be integrated. The prosthodontic phase was completed over a 3-month period. The patient was pleased with the appearance and the resulting phonetics (Fig 2).

Discussion

The preceding patient presentations show how simply differing patients can be classified in terms of the

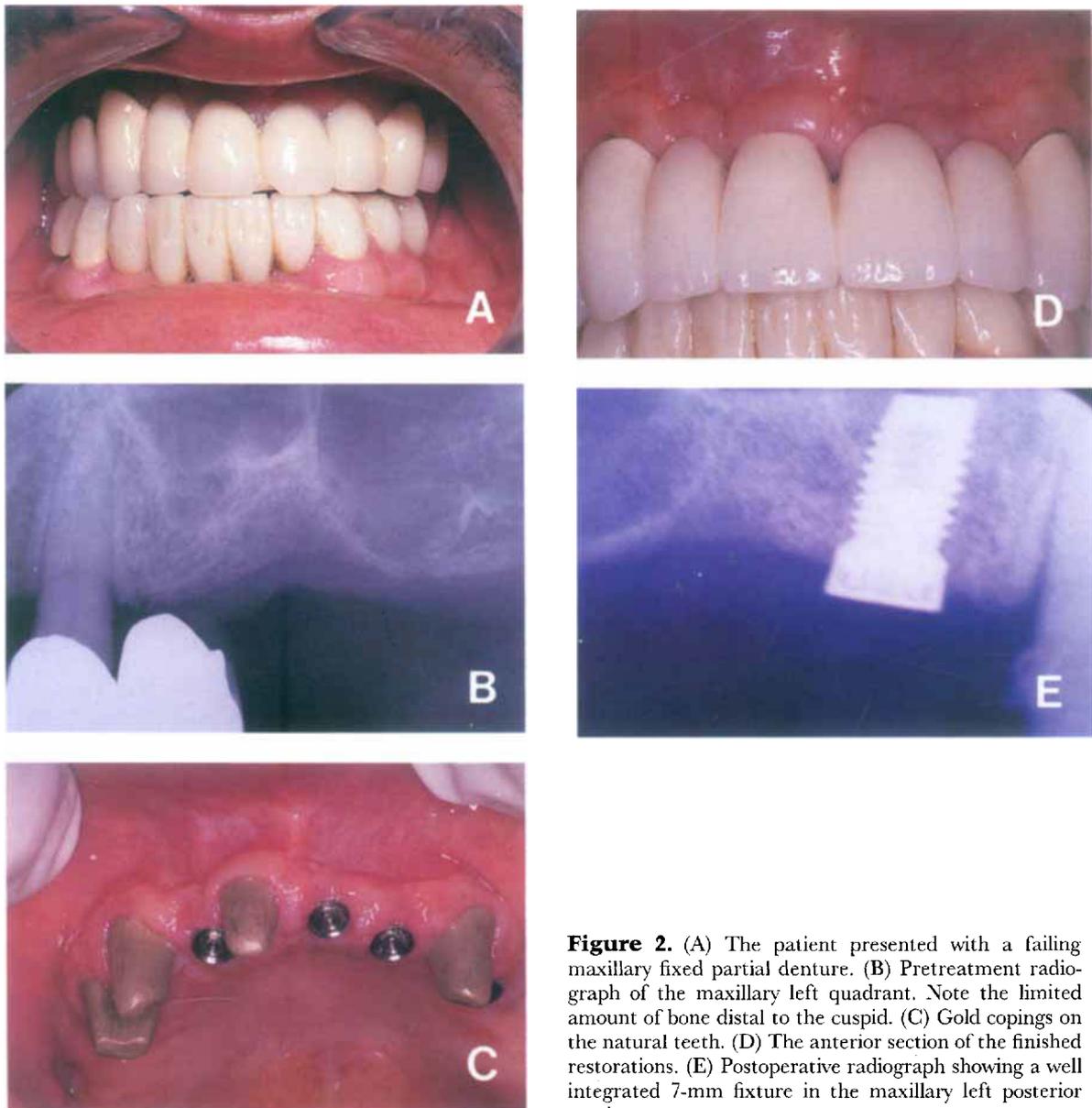


Figure 2. (A) The patient presented with a failing maxillary fixed partial denture. (B) Pretreatment radiograph of the maxillary left quadrant. Note the limited amount of bone distal to the cuspid. (C) Gold copings on the natural teeth. (D) The anterior section of the finished restorations. (E) Postoperative radiograph showing a well integrated 7-mm fixture in the maxillary left posterior quadrant.

complexity of their dental implant treatment. It is not necessary to make the evaluation process so complex that it becomes overwhelming for patients or practitioners. The patient classification system is merely a means of allowing practitioners to decide if proposed treatments are within their abilities, and to ensure that patients are in agreement with the proposed outcomes of treatment.

As more patients are evaluated and classified according to the classification system, treatment challenges presented by patients become more obvious, and it is easier for dentists to discuss the treatment. Patients differ in the complexity of the

treatment that is being undertaken because every situation is unique. It takes a prosthetically based classification system to easily identify the differences and guide dentists in treatment-planning individual patients.

Dentists will still have to decide who will perform the surgical phase and which implant system to use. There will still be a responsibility for fulfilling the goals of osseointegration and providing patients with stable, predictable implants to support prostheses. Furthermore, there will still be failures. However, practitioners should be able to minimize the failures that arise out of unfulfilled patient expectations and

should have the adequate information to determine whether or not to initiate the patient treatment.

Conclusions

A prosthodontic-based implant patient classification system that functions as a means of treatment-planning potential implant patients has been presented. This system offers the ability to quantitate complexity of individual treatment and offers a means of conversing with patients about the goals and outcomes of the proposed treatment. This classification system gives dentists and patients the opportunity to understand whether or not the proposed treatment plan has a good chance of being successful.

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