FULL ARCH REHABILITATION IN SEVERE MAXILLARY ATROPHY WITH PALATAL APPROACH IMPLANT PLACEMENT: A CASE REPORT

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SUMMARY
Purpose. The edentulous severely atrophic maxilla, as consequence of alveolar bone resorption and pneumatisation of the maxillary sinus, represents a serious limitation to the implant rehabilitation. Implants insertion via palatal approach (PA), in combination with relatively minimally invasive techniques aimed at increasing bone volume without the use of autologous bone harvesting is a valid alternative among the options for the rehabilitation of the upper jaw.
Clinical case. In a 70-year-old female, with a severe maxillary atrophy, 6 spiral taper implants were placed with the PA, combined with the bilateral transcrestal elevation of both the sinus floors and nasal cavities; a further GBR, with resorbable pericardium membrane covering a termoplastic allograft associated to a xenograft, was performed. The second stage was performed after 6 months. Implant prosthetic functionalization was carried out in 4 months by placing the removable prosthesis in direct contact with the healing cup screws. After that period the case was finalized with a hybrid prosthesis. Clinical and radiographic follow-ups were carried out at 6 months and at one year after prosthetic finalization, during which no pathological signs were recorded.
Conclusions. The PA implant insertion described by the Authors, combined with bone augmentation procedures, performed in the same stage, may represent a valid and reliable solution to rehabilitate maxillary edentulous patients.

Key words: maxillary atrophy, palatal approach, GBR, dental implants, implant placement, taper spiral implants, combination syndrome, transcrestal sinus lift.

Introduction

In edentulous patients, especially for the maxilla, implant placement is often most challenging and frequently complicated by unfavorable post-extraction bone patterns, pneumatisation of the maxillary sinus, poor quality of the remaining alveolar bone, which results to be more medullar and thinner than in the upper jaw (1, 2).
Furthermore prolonged edentulism in the maxilla leads to severe centripetal ridge resorption (3).
The original protocol proposed by Brånemark recommended to place implants upright, centered in the bone crest and completely surrounded by bone (4). According to Cawood and Howell classification, this position can only be achieved in class III maxillae (5).
To bypass this occurrence, different surgical techniques have been proposed through the years. These procedures can be classified into bone grafting techniques to regenerate de ridge

volume, such as guided bone regeneration (GBR), block grafts (5), and techniques that avoid bone grafting, thus placing implant fixtures residual bone areas, such as tilted implants (6), implant insertion in the maxillary tuberosity (7), pterygoid implants (8) and zygomatic implants (9).
The aim of this article is to report a case of full arch rehabilitation in severe maxillary atrophy, using a palatal approach implant placement associated with GBR and combined, at the same stage, with the bilateral transcrestal elevation of both sinus floor and nasal cavity.

Case report

A 70-year-old female was selected for this case report. She was referred to this clinic for the rehabilitation of the partially edentulous maxilla. At radiographic examination a severe atrophy was identified, both in the frontal and the posterior region of the maxilla (Figure 1a). The medical history did not reveal any systemic diseases but the patient reported to have taken oral bisphosphonates for 4 years, for osteoporosis treatment. It was therefore requested the patient to undergo Serum C-telopeptide cross-link of type 1 collagen analysis (sCTX), as it is both a biomarker of bone resorption and a predictor of the development of bisphosphonate-related osteonecrosis of the jaws (BRONJ). The sCTX patient's value was 200pg/ml, thus the risk of developing BRONJ was comparable to that of normal subjects (10). The patient asked to rehabilitate the upper jaw with a fixed implant-supported hybrid prosthesis, without the extraction of the two first molars (1.6, 2.6) since they provided anchorage to her old denture that she wanted to wear, throughout the postoperative period, until the finalization with the new prosthesis.
Cone beam computerized tomography was performed in order to better evaluate the case. A se-

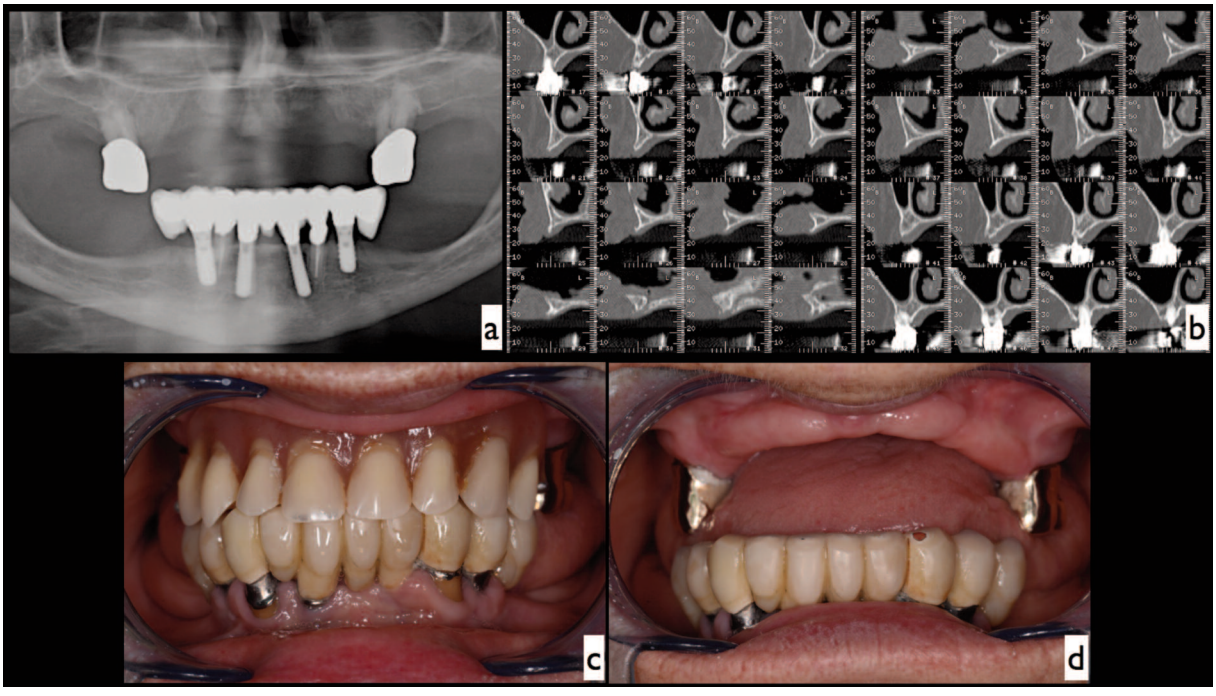

Figure 1
a, b) Panoramic X-ray and CBCT showing preoperative condition of severe maxillary atrophy;
c, d) preoperative intraoral condition, with and without the removable partial denture.

vere bone atrophy was found pertaining to V class according to Cawood and Howell classification (5) (Figure 1 b). In particular the patient shows a combination sindrome in the premaxilla due to the presence of a metal-ceramic fixed prosthesis in the lower jaw and an edentulism condition on the upper jaw (11). The patient also reported to have been edentulous, in anterior area of the maxilla for over 10 years, during which she has always worn the same denture.
It was thus proposed a treatment plan which provided the simultaneous placement of 6 implants in the edentulous anterior region, followed by the second stage after six months. In the second stage surgery the teeth 1.6 and 2.6 would be extracted. The case would be finalized by means of a hybrid prosthesis.
The patient gave her informed consent for the therapies.

Clinical procedure

An antimicrobial prophylaxis was administered with amoxicillin clavulanate (Clavulin, GlaxoSmithKline, Verona, Italy), 1g every 8h for 7 days, beginning 3 hours before the operation. After an initial rinse with chlorhexidine digluconate 0.2% (Corsodyl Mouthwash, GlaxoSmithKline, Verona, Italy) for 1 minute to disinfect the mouth, loco-regional anesthesia was performed with articaine hydrochloride 4% with epinephrine 1:100,000 (Citocartin, Molteni Dental, Milan, Italy). The bony area was exposed through reflection of a crestal mucoperiosteal flap combined with a median releasing incision. Then the incisive vascular nerve bundle was isolated (Figure 2b).
The palatal implant placement implies the bone osteotomy to be performed on an inclined plane (Figure 3a).

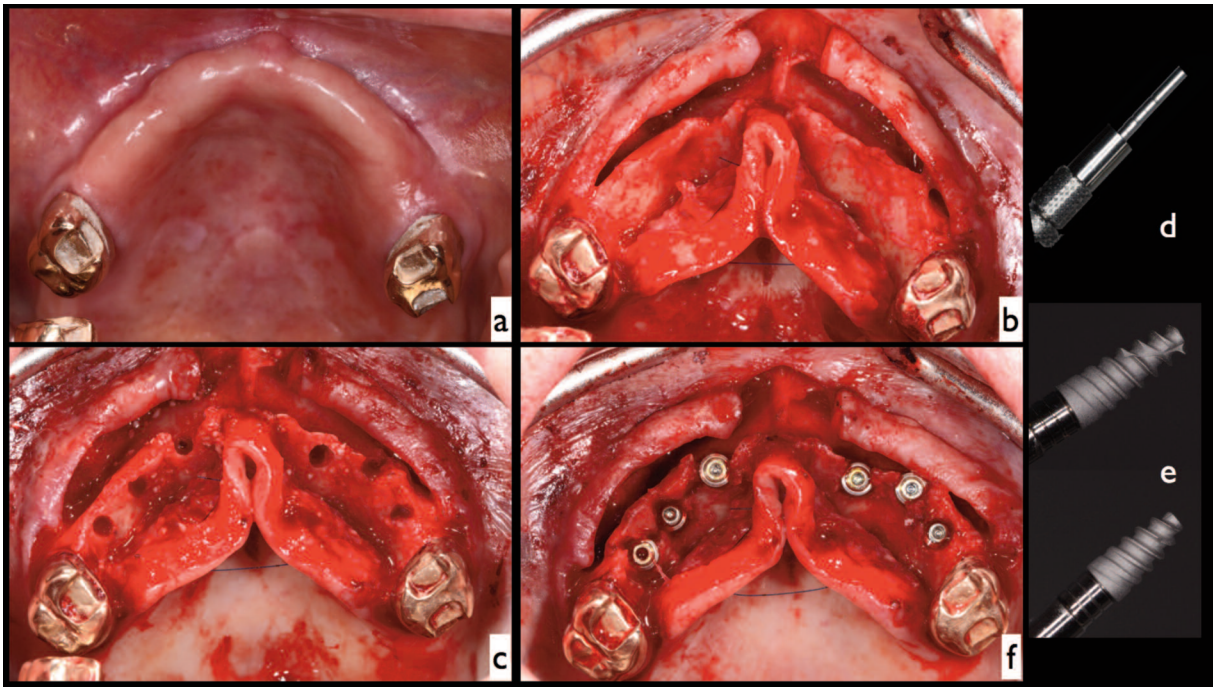

Figure 2
a) Preoperative occlusal view; b) bony area is exposed by means of a crestal mucoperiosteal flap, combined with a median releasing incision on the buccal side; c) six implant sites have been prepared; d) the straight concave Zaninari's osteotome (tip Ø2.2mm); e) the taper spiral implants used; f) implants in place.

The pilot drill should be therefore positioned perpendicular to the cortical bone, on the palatal side. Once engaged in the cortical bone, keeping the drill in continuous rotation, its insertion axis should be progressively changed becoming parallel to the main axis of the ridge, up to reach the final axis for the implant placement. Characteristic of this technique, is to place the pilot drill not on top of the ridge but on its palatal surface, at about 2-3 mm from its top. The use of Lindemann type bur is suggested, in this initial phase of preparation of the implant site, useful if a tilt correction is required during the drilling sequence (i.e. in case of cortical perforation) as it allows a minimal lateral relocation of the implant tunnel. Subsequent implant drills must always repeat, in continuous rotation, the pathway made by the pilot drill, in order to preserve the inclination of the implant tunnel.

Then the surgical drill sequence (up to the drill Ø2.3mm), to allow insertion of the osteotome under the sinus floor, was performed. The working depth (WD) was equal to the height of the ridge less 1 mm. The osteotomic crestal sinus floor elevation technique proposed by Zaninari (12), of both sinus floors and nasal cavities, was adopted in this case. In particular a straight, concave, Zaninari's osteotome (SCMZO) (tip Ø2.2mm), provided of a double depth stop, especially made for the purpose, was used (FMD, Rome, Italy) (Figure 2 d). The SCMZO was placed into each implant tunnel reaching the WD, while its double depth stop was fixed at the WD plus 1 mm. The SCMZO was then pounded with a surgical hammer until reaching the new WD thus fracturing bilaterally the floor, in a controlled manner, of both the maxillary sinuses and the nasal cavities. Then the mucous membrane was detached gently condensing, with the SCMZO, into the 6 implant sites, as many pieces of collagen adsorbable

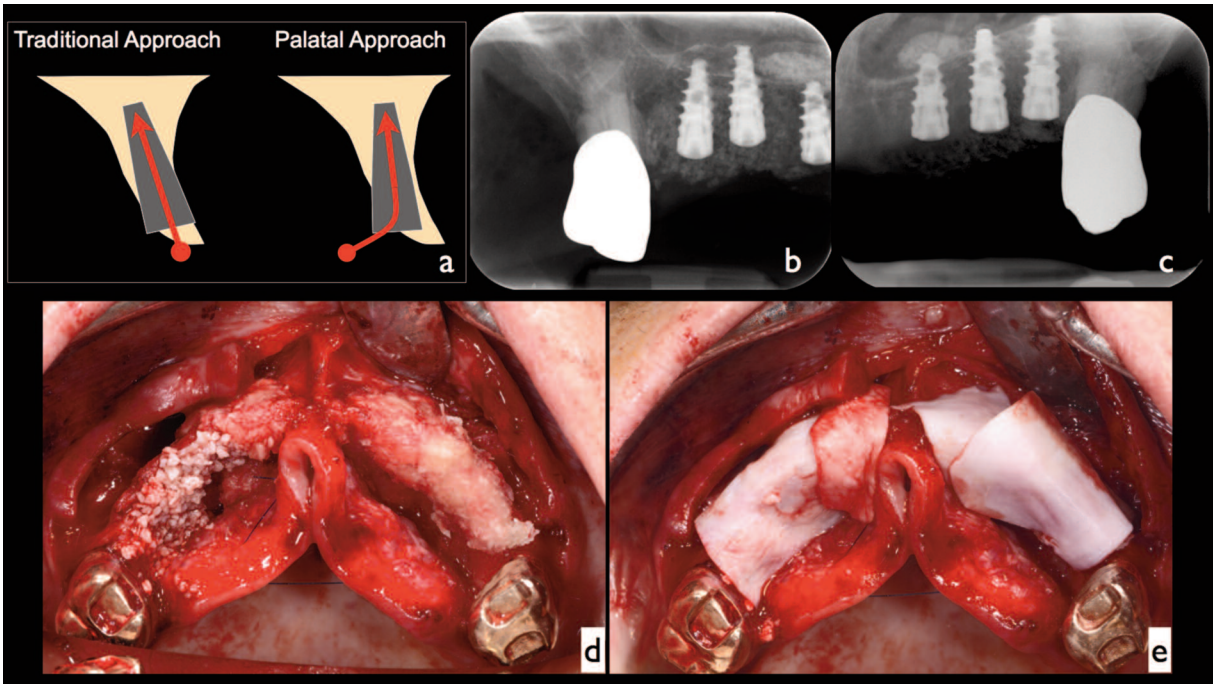

Figure 3
a) Figure illustrating the difference between implant placement via traditional approach and via palatal approach; the red arrow shows the progressive change of implant orientation, essential for the palatal approach; b, c) intraoperative X-rays, of the right and left maxillary ridges, showing the implants in place with the sinus floor elevations and the crestal graft material; d) the moldable allograft, in combination with a xenograft on the right side only, placed after implant insertion; e) pericardium membranes over the grafted sites.

sponge (5x10 mm) (Condress Collagene, Euroresearch, Milan, Italy) wetted with Clindamicine (Dalacin C, 4ml-600mg, Pfizer Italia, Rome, Italy). The graft material (Biocoral, Biocoral Inc, Saint-Gonnery, France), always wetted with Clindamicine, was then gradually injected by means of a surgical syringe (FAL-4030, FMD, Rome, Italy) and subsequently condensed with SCMZO. In the same surgical phase, 6 taper spiral implants were placed (I-fix Adapta, FMD, Rome, Italy) (Figure 2e). In order to achieve the maximum bone implant contact, the most anterior implant on the left side was placed in a more palatal position but still compatible with a prosthetic guided placement (Figure 2f). Furthermore a bilateral GBR was performed, using a composite graft made of demineralized freeze-dried allograft, mineralized cortical cancellous chips, and a biologically degradable thermoplastic carrier (Regenaform, RTI Surgical Inc., Alachua - FL, US), to regenerate the crestal bone defects, on the left side, while, on the right site, the same material was used in combination with the graft material previously used in both the sinus and nasal cavity floor elevation procedure (Figure 3d). The grafts were covered with a resorbable heterologous mesenchymal membrane (Osteobiol Evolution STD, ROEN, Pianezza - TO, Italy) (Figure 3e). Then the flaps were sutured without tension. Ibuprofen (Brufen 600mg, Abbot, Aprilia – LT, Italy), every 8-12 hours for 5 days was administered to control postoperative pain and edema. Rinses with chlorhexidine digluconate 0.2% (Corsodyl Mouthwash, GlaxoSmithKline, Verona, Italy) were prescribed for the disinfection of the surgical wound, 2/3 times/day for 7 days. After 14 days the sutures were removed and oral hygiene instructions were provided. The postoperative course was uneventful, except for a mild swelling. Periapical X-rays were performed: immediately after the surgery (Figure 3 b, c); at both 14 days and 6 months post operative; at both 6 months and one year post prosthetic finalization (Figure 4e).

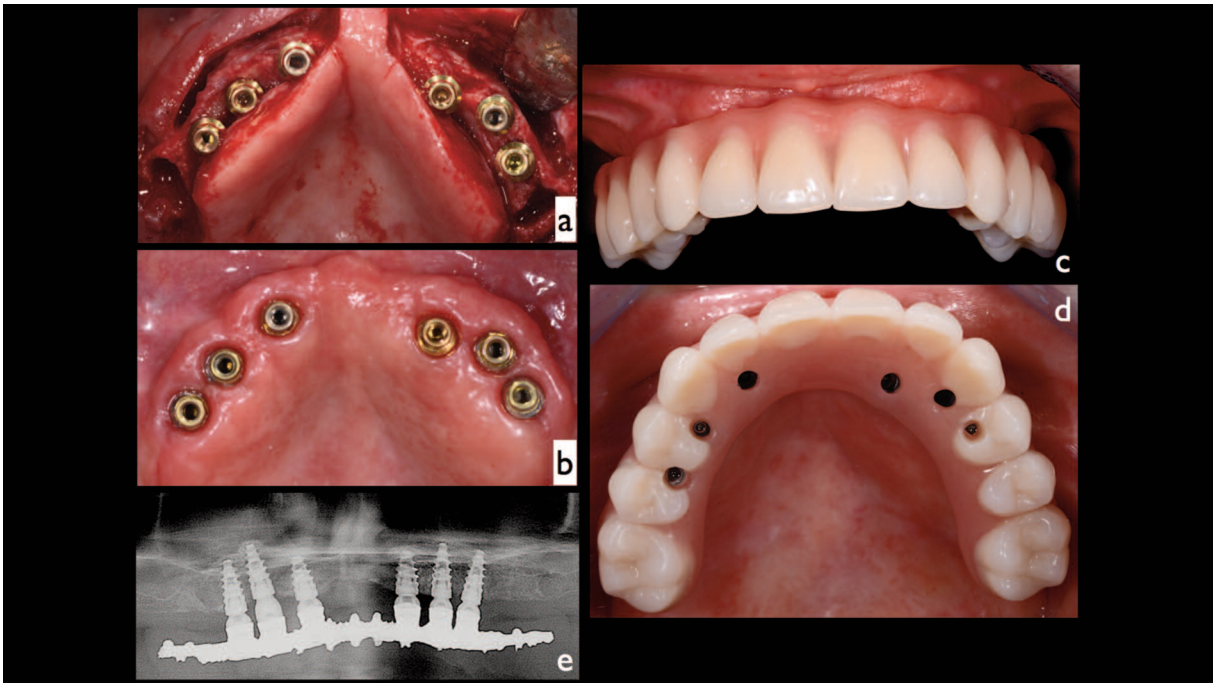

Figure 4
Second stage surgery at 6 months and prosthetic finalization: a) implants are exposed then the titanium abutments are placed; b) healthy tissue condition around the abutments; c, d) frontal and occlusal view of the hybrid prosthesis; e) panoramic X-ray of the finalized case at one year follow-up.

After 6 months the second stage was performed, the implants were exposed through 2 crestal incisions and the titanium abutments, for the hybrid prosthesis, were placed (Figure 4a). Drug prescriptions, before and after surgery, were identical to those of the first stage surgery. Implant prosthetic functionalization was carried out in 4 months by placing the removable prosthesis in direct contact with the healing cup screws. After this span of time the case was finalized, within 5 weeks, with a hybrid prosthesis (Figure 4 b, c, d). Both at six months and at one-year follow ups, after prosthetic finalization, the clinical appearance of the soft tissues was optimal and no pathological signs were recorded during probing exam. Radiographic examination did not show substantial changes in the peri-implant bone volume in accordance with success rate parameters (13).

Discussion

To rehabilitate the severely atrophic maxilla (SAM), it's often required to perform regenerative techniques for both sinus floor elevation and ridge augmentation, in order to recreate the right bone volume for implant placement (1). The complexity and morbidity of these procedures has motivated the development of less invasive procedures for the implant rehabilitation (6-9). Among these certainly the use of both tilted and pterygoid implants has allowed to by-pass the anatomical limit represented by the maxillary sinus (6). However, even in these cases, the amount of residual bone respectively on the anterior and posterior regions of the maxilla must be sufficient for the implant placement (7, 8). In case of severe atrophy the use of zigomatic implants is advisable, even if a greater experience is required by the surgeon to perform this procedure (9).

In this case report, among the different approaches present in literature, to enable implant placement in SAM the Authors chose to perform techniques that would be, as well as valid and predictable, also well-manageable in a private clinic environment and less traumatic for the patient. For this reason a combination of surgical procedures, feasible to be performed in the same stage, aimed both to the implant placement and to bone augmentation without harvesting autologous bone, has been proposed.

In particular, concerning the transcrestal sinus floor elevation techniques, the osteotomic procedures (OPs) are safe, predictable and extensively documented in literature (14, 15). Different OPs have been developed through the years, and their protocols have been progressively modified and simplified (16). Using Zaninari's technique, thanks to the use of cylindrical osteotomes, it's possible to reach an easy discontinuation of the sinus floor giving access to the sub-antral space without doing any bone lateral condensation, typical of that produced by the Summers' trunk conic shaped osteotomes. In fact, these latter are more traumatic for the patient, particularly if the bone marrow is poor, due to bone atrophy (17, 18).

Regarding the ridge augmentation technique adopted, in case of limited availability of intraoral grafting bone, especially in edentulous patients with severe maxillary atrophy, the surgery finalized to bone regeneration, if performed in an ambulatory setting, imposes the use of allograft materials, provided with osteoconductive and osteoinductive properties, if a second operation is not advisable, to harvest autologous bone from the lower jaw (19). These materials must be associated with a membrane barrier in order to prevent the competitive growth of soft tissues in the area of bone augmentation. In our case the GBR was performed using a heterologous mesenchymal resorbable membrane for several reasons: its placement is simplified (20); it has been proved to be effective in horizontal ridge augmentation (19, 21); in case of dehiscence of the surgical wound the case is more easily manageable in comparison to non-resorbable barrier membrane (22). Full arch rehabilitation in severe maxillary atrophy with palatal approach implant placement may influence prosthodontic (23-26) and endodontic (27, 28) clinical outcomes. In addiction the use of general and local anesthesia may have side effects (29-32) and se-

vere complications (33).

Furthermore the PA technique, described above, represents a valid procedure to reach a good primary stability of implants, even in this condition of severe atrophy. In this case, the reduced bone volume available made it necessary to condense the residual bone at the augmented sites, increasing the implants primary stability. For this reason a tapered spiral implant has been chosen, for the purpose, because of its characteristics of: self drilling; self tapping; self bone condensing; ability to modify its inclination during placement, thus ideal for palatal implant placement (10, 12, 34).

In case of limited availability of intraoral grafting bone, especially in edentulous patients with severe maxillary atrophy, as the Authors described in this article, implant placement via PA represents a reliable and safe procedure to place dental implants with a great primary stability. This procedure can effectively be combined, in the same stage, with simplified and predictable surgical techniques aimed to bone augmentation.

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