

## The ERA<sup>®</sup> Implant-Supported Overdenture

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The first decade of the use of endosseous, root-form dental implants in the United States (1984 to 1994) has been a time of great development. In 1984, Dr. Per-Ingvar Branemark introduced a working dental implant system that included a screw-retained prosthetic design, which was readily accepted as a standard method of treatment in Sweden. This prosthesis, however, met with some resistance in the United States because of discrepancies in comfort, accessibility to oral hygiene, and esthetics. Therefore, American dentists began to search for alternative forms of construction.

Because overdentures had long been used for dentulous patients with terminal dentitions, it seemed to be a modest jump to apply these overdenture principles to implant-supported prostheses.<sup>1-5</sup> Many designs were developed using various types of milled bars or attachments.<sup>6-12</sup> The goal of the implant-supported overdenture was to give the patient the ability to remove the prosthesis for easy oral hygiene. Recently, the profession has had the opportunity to study both the acceptance and the success of implant-retained overdentures vs fixed appliances. There seems to be a large body of evidence that overdentures are not only an acceptable restoration, but they may be, in many instances, the restoration of choice.<sup>13-15</sup>

The use of the Extracoronary Resilient Attachment (ERA<sup>®</sup>) Implant Overdenture System is well documented in conventional

### Abstract

**Extracoronary Resilient Attachment (ERA) implant-supported overdentures, Class I, Division 1 or Division 3 prostheses, provide an exceptionally stable and retentive prosthetic design for edentulous patients with osseointegrated implants. The ERA<sup>®</sup> System uses either an individual female implant abutment or plastic female patterns that can be incorporated into a bar. The male portion of the attachment is a nylon piece of varying retentive quality. The attachment is resilient, stable, and can be easily serviced.**

### Learning Objectives

After reading this article the reader should be able to:

- identify the benefits of implant-supported overdentures.
- describe the working parameters of the ERA<sup>®</sup> System and the ERA<sup>®</sup> Implant Abutment.
- explain the technique of placing and changing ERA<sup>®</sup> males.
- evaluate and treat several different clinical situations that would indicate an ERA<sup>®</sup> Implant Abutment-supported prosthesis.

dentistry.<sup>16-20</sup> It is one of the leading attachment systems and has broad applications for removable partial dentures and tooth-supported overdentures. There is a variety of configurations for the attachment's female segments, ranging from castable plastic patterns to machined metal components. The hallmark of the system has been its wide versatility and ease in which the attachments can be changed or serviced.

One of the problems with the implant-supported overdenture has been the accelerated frequency of adjustment and repair seen when compared to fixed, implant-supported prostheses.<sup>13</sup> It is generally accepted that many of the repairs and adjustments involve the metal clips that are usually used in overdenture construction. This article will explore the use of the ERA<sup>®</sup> Implant Overdenture System, which relies on a metal female component and an easy-to-service nylon male attachment.

### The ERA<sup>®</sup> Implant Abutment System

The ERA<sup>®</sup> Implant Abutment System is composed of two basic elements: a titanium

female (Figure 1) and a nylon male (Figure 2). The female implant abutment is produced in versions to fit any of the currently popular endosseous dental implants. The abutments designed for externally hexed implants have tissue heights of either 3 mm or 5 mm. Those intended for implants without external hexes have a tissue height of 2 mm and 4 mm. Abutments can be special ordered in greater tissue heights. The female comes in a one-piece, 0-degree configuration as well as two-piece components in 5-, 11-, and 17-degree configurations to correct for angulated implant placement (Figure 3). The retentive portion of the female is coated with titanium nitride to reduce wear.

The ERA<sup>®</sup> males are made of nylon and are available in five color-coded styles (Figure 4). The black male is used for processing in the overdenture. It creates an undercut male-retention socket in the denture acrylic resin. It also allows for the creation of 0.4 mm of resiliency in the final restoration. The remaining males are of varying degrees of retention: white is the least retentive, then orange, blue, and grey,



Figure 1–The female ERA® Implant Abutment.



Figure 2–The ERA® nylon male.

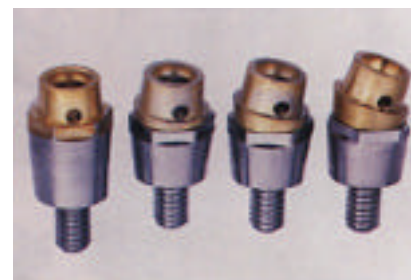


Figure 3–the ERA® Implant Abutments: 0, 5, 11, and 17 degrees.



Figure 4–The ERA® males (black, white, red, blue, and grey).

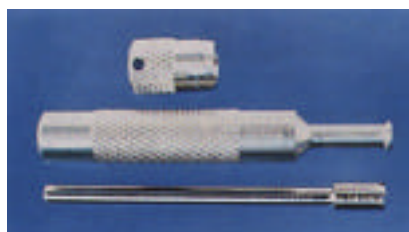


Figure 5–The abutment insertion tool, coring drill, and male insertion tool.



Figure 6–The plastic pattern for the ERA® partial denture female.

which is the most retentive. The males act as a hybrid ball-and-socket attachment, allowing for movement in all directions, including resilient, vertical movement.

There are three tools used in the ERA® technique (Figure 5). The first is an abutment insertion tool that is used to place the female abutments into the implants. The other two tools are used for changing males. The coring tool is used to remove the center of a male attachment without damaging the retentive areas of the acrylic socket. It is then possible to pry out the remainder of the male and replace it using the seating tool. The entire replacement technique would normally take about 30 seconds, and does not require the addition of any new acrylic resin. When a bar is used on an implant-supported restoration, the partial denture ERA® attachments are used on the distal aspect of the bar (Figure 6). The females for the ERA® Partial Denture System are cast from plastic patterns. Typically, they are placed on the distal extensions of the bar and incorporated into the casting. The partial denture males come in a standard size and the reduced vertical size. The Reduced Vertical Partial Denture ERA® is the lowest-height, extracoronary partial denture attachment available. There is also a plastic pattern overdenture female attachment that can be used within the confines of the bar.

### Technique for Individual ERA® Abutments

The use of the ERA® System should be planned from the outset of treatment so that

## Table I-Class I: Fully Edentulous

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

#	DIVISION (PROSTHODONTIC TYPE)	COMMENTS	FEE
1	Simple Overdenture		
2	Hybrid Prosthesis		
3	Complex Overdenture		
5	Crown and Bridge (Ceramo-Metal)		
	<b>SUBCLASS (IMPLANT LOCATION)</b>		
1	Anterior Mandible		
2	Anterior Maxilla		
3	Anterior/Posterior Mandible		
4	Anterior/Posterior Maxilla		
	<b>SURGICAL TYPE (0-4) *</b>		
	Available Bone Volume		
	Bone Density		
	Anatomical Landmarks		
	General Medical Condition		
	Immediate Implants		
	<b>PHYSIOLOGICAL TYPE</b>		
1	Age		
1	Occlusal Factors		
1	Oral Hygiene		
1	Psychological Type		

\*A 4 grade in any surgical type is an indication to re-evaluate the procedure for an alternative treatment

COMPLEXITY INDEX: \_\_\_\_\_

implants can be placed in their proper positions with regard to the final restoration. To do this, treatment planning is completed using the Patient Classification Forms (Table 1) developed by Davidoff and Steinberg.<sup>21</sup> The simple implant-supported over-denture (Class I, Division 2) uses the ERA<sup>®</sup> female abutments. The complex implant-supported overdenture (Class I, Division 3) uses a bar with Distal ERA<sup>®</sup> and usually an anterior clip attachment.

The ERA<sup>®</sup> Implant Abutment technique is suitable for two or more implants, and requires that they be placed in a favorable position with regard to the final restoration. The system is capable of compensating for a total divergence in implant placement of up to 34 degrees, but the technique is much less complicated if the implants are in line, and the one-piece, O-degree abutment can be used. The placement of the female and male attachments can be done either directly, in the mouth, indirectly, on a cast in the laboratory.

Implants are placed using normal procedures and are allowed to integrate. At stage II surgery, the implant is uncovered and healing abutments are placed. The healing abutments should project at least 2 mm out of the tissue. Healing should occur for 2 to 4 weeks before proceeding to the next step. Normal procedures are then carried out to construct a complete denture. In the direct technique, when the complete denture is finished, the appropriate ERA<sup>®</sup> Implant Abutments are placed and tightened securely with the insertion tool (Figure 7). The cor-

responding areas of the denture should be hollowed out and a lingual or palatal window should be formed. The black processing male should be placed securely on the abutment and any undercuts should be blocked out. The authors recommend using a temporary endodontic stopping material, Term<sup>®</sup>,<sup>b</sup> for the block-out procedure. The denture should be tested to make sure it seats without any interfer-

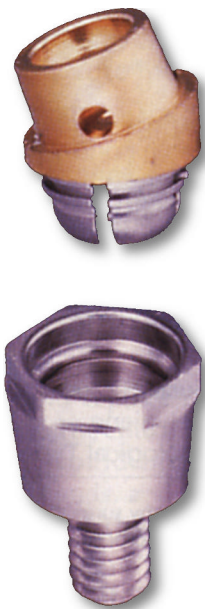


Figure 7—Inserting the ERA<sup>®</sup> Implant Abutments (the Abutment wrench is in place).

ence from the processing male or the block-out compound. Autopolymerizing or light-curing resin can be used to pick up the processing male (Figure 8). It is important that the resin be well adapted to the processing male because it will form the ongoing housing that will retain future males.

After the processing males have been incorporated into the complete denture, they can be cored out and the white retentive males can be substituted (Figures 9A through 9C). If the restoration does not have sufficient retention, the white males can be removed and the orange males can be inserted to increase the retention. It is estimated that the males will last approximately 3 years before there is a need to change them. Because most of the wear takes place on the nylon males, the usual scenario is to replace them with new males of the same color originally used.

### Angulated ERA<sup>®</sup> Implant Abutments

In cases where the implants are divergent, it is necessary to choose a two-piece, angulated ERA<sup>®</sup> Abutment (Figure 10). The dentist must determine exactly how much angulation will be necessary to get all of the ERA<sup>®</sup> females within 5 degrees of divergence. To do this, a plastic gauge is available, which, when properly orientated in the mouth, will give the operator the angulation necessary. The base piece of the abutment is inserted into the implant using the insertion tool. An alignment handle is placed in the female component and the female is temporarily snapped into the abutment base. The angulated female is rotated in the base until all of the alignment handle is within 5 degrees of parallel with

Figure 10—The two-piece angulated abutment.



Figure 8—the black processing male in place in the denture.

the denture path of insertion. When multiple ERA<sup>®</sup> Abutments are used, all of the alignment handles must line up (Figure 11). At this point, the dentist will mark the relationship of the two pieces of the ERA<sup>®</sup> Abutment, remove them from the mouth, and cement them together maintaining the marked intraoral relationship. The cement



Figure 9A—Coring out the black processing male.

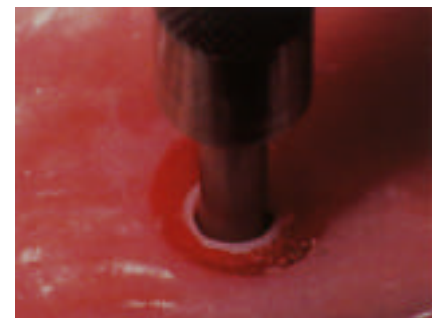


Figure 9B—Inserting the white nylon male.



Figure 9C—The completed restoration showing the white males in place.

<sup>b</sup> LD Caulk Division, Dentsply International, Inc, Milford, DE 19963

of choice is ERA Lock<sup>®</sup>, a resin cement. The completed ERA<sup>®</sup> Abutment is returned to the mouth, and the males are added according to normal procedures, outlined above.

### Indirect Technique

In the indirect technique, a thread-timing impression must be made that will record the location of the implants and the starting location of the implant threads. Because the ERA<sup>®</sup> Abutment itself is a nonhexed, one-piece abutment, it is essential that the impression be made with a nonhexed, one-piece implant impression coping. If a two-piece implant impression coping is used, the position of the hex will be recorded, not the thread timing of the implant, causing the relationship of the ERA<sup>®</sup> Abutment on the cast to be different than when in the mouth. An implant analog, or replica, is threaded onto the one-piece impression coping, which is then placed back into the same site in the impression, so that an accurate working cast is poured. The impression coping must be designed to fit in the impression in only one rotational orientation. Also, the threads of the analog must start at the same distance from the top of the analog as the implant threads start from the top of the implant. All remaining procedures, including denture construction, relevant to placing the abutment females and the retentive males, can then be completed on the working cast.

### Implant-Supported Bars With ERA<sup>®</sup>s

The choice is often made to unite the implants with a bar, creating greater stability for the overall restoration. In this case, the bar will be constructed with distal partial denture ERA<sup>®</sup>s. The partial denture ERA<sup>®</sup> are supplied as plastic patterns. They must be lined up with a surveyor so that they are parallel when they are attached to the bar. A surveyor tool is available for this procedure. It is possible to combine the distal ERA<sup>®</sup>s with other anterior attachments, such as a Hader Bar<sup>®a</sup> or metal clips. Overdenture ERA<sup>®</sup>s can also be used in the anterior sections of the bar.

The bar is waxed to form on an accurate working cast and the ERA<sup>®</sup>s are attached. The entire component is cast from the metal of choice and finished (Figure 12). The bar is usually tried in the mouth at this point to confirm accuracy. A complete denture is then fabricated over the bar and the processing males are incorporated. When there is minimal interocclusal

height, the reduced vertical males are used. The black processing male is picked up in either cold-cure or light-cure composite resin. It is possible to cure the denture directly to the black processing males. The processing males are cored out of the prosthesis and the white males are substituted. The prosthesis is checked for fit and function with adjustments made as necessary (Figure 13).

### Servicing the ERA<sup>®</sup> Implant-Supported Prosthesis

The ERA<sup>®</sup> System is designed so that wear will occur on the replaceable male components and not the metal female. There is no metal-to-metal contact that could eventually cause both components to wear, thus decreasing the level of retention and function. Even if there is a slight degree of wear on the metal female over the years, it is usually handled by merely increasing retention to the male attachment.

When the patient is no longer satisfied with the degree of retention, the existing male attachment is removed and replaced, usually by a new male of the same color, which indicates the same original retentive component. To do this, the coring drill is used in the straight handpiece to remove the central element of the attachment. This should be done with intermittent pressure so it does not generate too much heat. The center portion of the male will sometimes be retained in the coring tool, but it can easily be removed with a sharp instrument. A Bard-Parker blade is usually used to collapse the remaining sides of the male attachment and remove it from the acrylic housing. What remains is a retentive acrylic housing that will accept a new male attachment. The new male attachment is placed onto the insertion tool and pressed into the denture. A snap should be heard, which indicates complete seating. It should be noted that the retentive males in the overdenture design include a slot cut out of the perimeter. This slot is not present in the black processing males. The slot will allow the retentive males to “collapse” slightly on insertion so that they press into the acrylic housing.

When the dentist ascertains that it is time to relin the prosthesis, the retentive male is removed, and the black processing male is used during the relining procedure to again create the necessary amount of resilience. After the relin is completed, the appropriate retentive male can then be replaced.

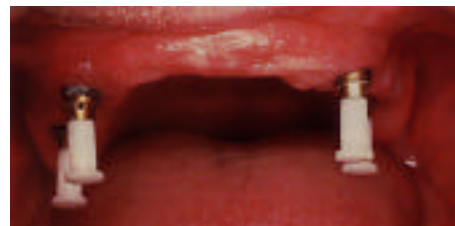


Figure 11—Patient treatment showing the alignment handles in proper orientation. (Courtesy of Dr. Franklin Jerry Meeks, San Antonio, Tex.)

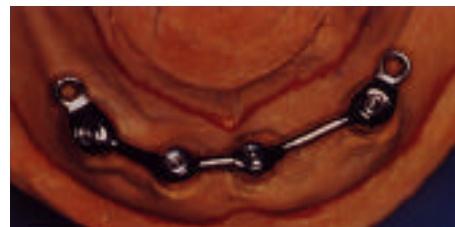


Figure 12—A cast gold bar with two distal ERA<sup>®</sup> partial denture female attachments.



Figure 13A—The completed overdenture showing the white retentive males and a Hader bar<sup>®</sup> clip in place.

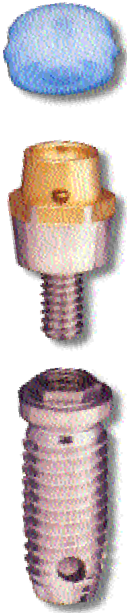


Figure 13B—completed restoration.

### Troubleshooting

Under certain conditions, the ERA<sup>®</sup> Implant Abutment might loosen from the implant. To correct this, it is necessary to use a silicon sealing agent, ERA Seal<sup>®a</sup>, and to make sure that a force of approximately 20 N-cm is used in seating the abutment. If the problem persists, the clinician might decide to move from individual ERA<sup>®</sup> abutments to a bar.

In situations where there is minimal interarch distance, the supporting acrylic may be inadequate to house the males. A reinforcement product, such as RIB-BOND<sup>®c</sup> bondable reinforcement ribbon,



can be used to strengthen the minimal acrylic. Currently, there is a new design for a metal housing that can be incorporated into the framework for greater support in these circumstances.

### Conclusion

The ERA® System for implant-supported overdentures is a unique and easy system to use. It incorporates the concepts of tissue resiliency, adjustable retention, and stability for constructing an implant-supported prosthesis with high patient acceptance. It has the advantage of minimal repairs and adjustments

by virtue of the replacement technique for the nylon males. The technique is suitable with either individual implant abutments or stabilizing bars. The technique is economical, universal in its appeal, and it incorporates principles that have been used in natural tooth situations for years.

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## Quiz 3

*This article qualifies for 1 hour of Continuing Education credit from the University of Pennsylvania School of Dental Medicine. Record your answers on the enclosed answer sheet. If you do not have an answer sheet, submit your answers on a separate sheet of paper. You must be a paid subscriber to participate.*

1. One of the problems with the implant-supported overdenture has been:
  - a. the inability to properly clean the prosthesis.
  - b. the accelerated frequency of adjustment and repair.
  - c. soft-tissue support.
  - d. difficulty of construction.
2. The Reduced Vertical ERA® partial denture attachment is:
  - a. the lowest height extracoronal attachment available.
  - b. used only with partial dentures.
  - c. never used with an overdenture bar.
  - d. used when the dentist wants to "close the bite."

3. The female portion of the ERA® Implant Abutment is composed of:
  - a. stainless steel.
  - b. gold alloy.
  - c. silver palladium alloy.
  - d. titanium.
4. In the ERA® System, there is one processing male attachment and how many retentive male attachments?
  - a. two
  - b. three
  - c. four
  - d. five
5. The black nylon male attachment:
  - a. is the least retentive.
  - b. provides 30 degrees of divergence.
  - c. is used for processing only.
  - d. is the most retentive.
6. The nitrite coating on the female abutment.
  - a. provides an adhesive surface for the male attachment.
  - b. is used just because of its pleasing gold color.
  - c. prevents wear of the female portion of the attachment.
  - d. provides for resilience.
7. A bar configuration would use:
  - a. overdenture ERA®.
  - b. only the white males.

- c. partial denture ERA®.
  - d. zest anchors.
8. Which of the following statements is (are) true?
    - a. The reduced vertical partial denture male is the lowest height extracoronal attachment on the market today.
    - b. The ERA® System gains its resiliency from the 0.4-mm vertical drop that is derived from the use of the black processing male in the incorporation of the attachment
    - c. The coring drill is used to remove only the center of the male attachment.
    - d. all of the above
  9. The angulated abutment is available in which of the following configurations?
    - a. 5, 11, and 17 degrees
    - b. 20 and 30 degrees
    - c. 15, 25, and 30 degrees
    - d. 5, 10, and 15 degrees
  10. When a patient returns for normal recall with a restoration that has become loose, the ERA® males should be replaced with:
    - a. the white males.
    - b. males of the same color as those with which the patient presented.
    - c. black processing males.
    - d. the most retentive male available.

# Stern ERA<sup>®</sup> Attachments

A **"SNAP"** to Use and Maintain

*For Partial Dentures and Overdentures,  
For Natural Teeth and Implant Abutments,  
Tough, Resilient Attachments that are  
Literally a **"SNAP"** to Place.*

All ERA males **snap** into a holding site formed directly in the denture base acrylic or into an optional metal jacket permanently processed in the denture. Long lasting, but instantly replaceable, the color-coded nylon males provide a choice of four retentive strengths. Their vertical resilience and hinging movement protect abutment teeth and implants - yet cause minimal wear to the intraorally fixed female component. So,



replacing a worn ERA male renews the attachment with no change in occlusal relationships. Use cannot be more reliable. Maintenance cannot be easier.

*Prescribing ERA attachments  
is a SNAP, too.*

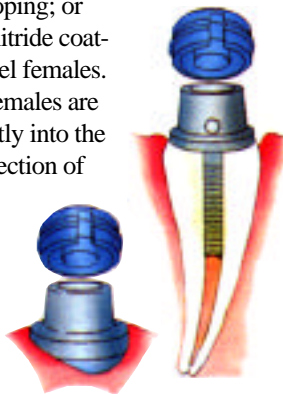


### For Removable Partial Denture:

ERA's female burn-out pattern is cast as an integral part of a retainer crown. Choose from two male designs. Using the ERA-RV male, the attachment is 0.5mm shorter than with the standard ERA male - making it only 2.5mm high.

### For Overdentures on Natural Teeth:

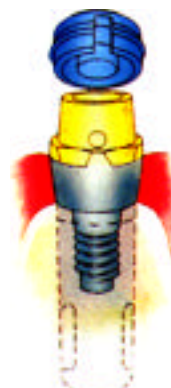
You have a choice of two kind of females: a plastic female pattern cast as part of a post and coping; or prefabricated, nitride coated, stainless steel females. Prefabricated females are cemented directly into the tooth, and a selection of post angles accommodates divergent roots. Only approximate parallelism (5°) is required.



### For Implant Overdentures:

The ERA implant abutment is made of titanium and is nitride coated. Versions are made for all of our ImplaMed external hex implants, as well as the implants of other manufacturers. To part, angled abutments are available for divergent implants. The ImplaMed 20N•cm torque wrench with ERA adaptor is the perfect tool for securely seating the abutment.

The Stern ERAs aren't only resilient attachments you'll ever need, but they're close to it!! A **snap** to order or to request detailed technical information. Call **Sterngold/ImplaMed at 800-243-9942.**



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