Review Article

A Comprehensive Overview at Extraoral Stents and Splints in Prosthodontics

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Abstract

Stents and splints are auxiliary devices used to support soft tissue or bony grafts during the healing process. They have a variety of clinical uses, such as dental implant placement, covering and protecting tissues, delivering medicaments and radiation therapy, and controlling bleeding. They can be made of acrylic resin or other materials and can be custom-fabricated for specific patients. In this article, we will delve into the different types of intraoral and extraoral stents and splints used in prosthodontics. Our attention will be directed toward extraoral stents, which are less commonly recognized, and the diverse applications they have in the field of dentistry as well as other areas of medicine we will discuss the usage of extraoral stents in various clinical conditions and their role in supporting and guiding the healing process and the different ways, in which extraoral stents can be utilized to enhance the effectiveness of radiation therapy and improve patient treatment outcomes.

Keywords: Extraoral stents, Prosthodontics, Radiation stents, Splints.

Introduction

As per GPT9 stents can be defined as "Any supplementary device used in conjunction with a surgical procedure to keep a skin graft in place; often modified with acrylic resin or dental modelling plastic impression compound that was previously termed Stent's mass; also refers to any device or mold used to hold a skin graft in place; or provides support for anastomosed structures."[1]

The terms prosthesis, splint, and stent are often used interchangeably, but they have distinct technical meanings. A prosthesis is an artificial replacement for an absent body part, while a splint is a device that is used to maintain hard and soft tissues in a predetermined position. A stent, on the other hand, is a mold that is used to support soft tissue or bony grafts during the healing process.[2] Stents have a variety of clinical uses and functions, such as covering and protecting tissues and teeth, delivering medicaments, and radiation therapy. They are often made of acrylic resin and are custom fabricated before radiation simulation appointments to ensure that the calculated dosimetry takes into account the position of the tissues when the patient is wearing the device.[2]

In addition to their use in delivering medications and radiation therapy, stents can also be used to control bleeding and guide the placement of dental implants. For example, a stent may be used to control bleeding after a tooth extraction or to determine the optimal location for a dental implant. Overall, splints and stents are valuable tools in prosthodontics and are used in a wide range of clinical situations.

In this article, we will delve into the different types of stents used in prosthodontics, with a specific focus on extraoral stents and their various clinical applications. We will explore how these stents are used to support and guide the healing process and can be utilized to improve the outcome of patient treatment.

Uses[3]

1. Dental Implant Placement
   - Utilizing radiographic diagnostic templates to determine the optimal location for dental implant placement
   - Employing surgical guide templates to guide the precise insertion of dental implants.
2. Tissue Protection and Healing
   - Shielding tissues following skin and mucosal grafts procedure

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- Retaining skin and mucosal grafts in place until adequate revascularization is achieved
- Mitigating contamination of wounds and facilitating healing through stimulation of underlying tissues
- Maintaining the depth of the vestibules after vestibuloplasty and ridge augmentation procedures
- Managing bleeding, particularly in individuals with hemophilia.

3. Medicated Stents
    - Administering fluoride, bleaching agents, medicaments, and surgical packs using stents
    - Utilizing stents to deliver and maintain radium materials for the treatment of malignancy.
4. Sports and Recreational Protection
    - Offering protection for teeth and associated structures during contact sports.

Types of Materials Used in Stent Fabrication[4]

Acrylic resin

Acrylic resin is a commonly used material in stent fabrication. It can be heat-curing or self-curing and can be lined with soft materials to provide additional comfort for the patient.

Soft materials

Soft rubber or soft resins are used for special purposes such as providing cushioning for sensitive areas of the mouth. These materials can also be fabricated from silicon vinyl rubber, but an additional reinforcement of resin is usually required for durability.

Modelling plastic and silicone

In emergency cases where time is of the essence, modelling plastic and silicone can be used directly in the oral cavity on the bleeding area to control bleeding and promote healing.

Types of Stents[3] (Table 1)

The stents are divided into two main categories: intra-oral and extra-oral stents. Intra-oral stents are further categorized as surgical or non-surgical stents. Table 1 provides a classification of stents based on their uses.

Extraoral Stents

Orofacial plug

An orofacial fistula is a condition that occurs when there is a lack of sufficient tissue to close a surgical wound or when there is a postsurgical infection. This results in the continuous drainage of saliva from the wound. One-way to manage this issue is using a silicone rubber plug, which is inserted into the fistula to control the flow of saliva until corrective surgery can be performed. To create the silicone rubber plug, an impression of the fistula is first made using irreversible hydrocolloid. This impression is then used to create a stone cast of the fistula. The cast is then carefully scraped on the intraoral surface to create a flange. This flange is important because it ensures that the silicone rubber prosthesis will have an adequate seal when it is inserted into the fistula. The extraoral surface of the silicone rubber prosthesis can also be tinted to match the colour of the surrounding tissue, making it less noticeable. This can help to improve the appearance of the fistula and make it less noticeable to others.

It is important to note that this is a temporary solution, and that corrective surgery should be performed as soon as possible to repair the fistula. The silicone rubber plug is used to manage the symptoms until that time (Figure 1).[5]

Nasal splint and stent

Nasal splints and stents are commonly used in various medical conditions to support and expand the nasal passages, making it easier for patients to breathe. They can be used to support collapsing nasal alae, expand obstructed nasal vestibules, improve facial appearance, and partially or fully occlude the nasal passages for patients with atrophic rhinitis.[2,6]

In reconstructive surgery, stents can be used to maintain airways after graft procedures. Scar contracture can cause the internal airway to collapse or become stenotic, which can lead to both functional and esthetic problems. To minimize cicatricial contraction, nasal stents should be inserted as soon

Table 1: Classification of stents

Intra oral stents		Extraoral stents
Surgical	**Nonsurgical**	
Stents for dental implantation	Occlusal stent	Orofacial plug
Surgical stents used after removal of exostosis	Periodontal stent	Stents for nasal defect
Surgical stents used in conjunction Withvestibuloplasty	For lip and cheek support	Auditory stents
Stent for epulis fissuratum	Pedodontic stents	Burn stent
Stent for resected maxilla	Mouth guard	Stent for neck scar
Palatal stent	Oral screen	Radiation stent
Antihemorrhagic stents	Radiotherapy stents	
Cyst plugs	Medicament carrier and fluoride carrier	
Drainage stent	Paraplegic stents	
	Trismus appliances	

Figure 1: Orofacial plug and nasal stent

as possible after surgery and should be worn for several months during the healing period.[2]

Stents are typically made from clear acrylic resin to make them less visible and to maintain a patent airway. They can also be fabricated from silicone rubber or vinyl, but additional reinforcement is usually required within the lumen to prevent collapse of the nares during inhalation. The use of nasal splints and stents can greatly improve the patient's breathing and overall quality of life (Figure 1).

Auditory stents

Custom auditory inserts, also known as custom ear plugs, are specially designed devices that can serve a variety of purposes in both medical and non-medical settings. They are typically made from materials such as acrylic resin, polyvinyl chloride, or silicone rubber. In the field of surgical reconstruction, custom auditory inserts may be used as stents during the surgical repair of the external auditory meatus. This can be particularly beneficial for patients with a condition called external auditory canal atresia, which causes conductive hearing loss. The main goals of surgery in this condition are to restore the normal sound-conducting mechanism of the ear and create a clean, well-epithelialized, and patent external ear canal. However, post-operative external ear canal stenosis and poor hearing can often occur, which may necessitate revision surgery. To reduce the rate of these complications, EAC stents in poly methyl methacrylate with an internal opening have been suggested as a valuable alternative. Custom auditory inserts can also be used as ear plugs following mastoid surgery, which is a type of ear surgery. This can provide added protection and comfort for patients during the healing process. In addition, swimmers who are plagued with chronic ear infections may benefit from the use of custom-made auditory inserts. In the field of anesthesia, custom auditory inserts can aid the anesthesiologist by providing auditory acuity and comfort during prolonged surgical procedures that require constant monitoring. The remote monitoring pickups are taped to the arm and chest of the patient and attached to the physician's custom acrylic resin insert.[7] Finally, custom auditory inserts can also be used by navy personnel to protect their internal ears from damage caused by loud engine noise (Figure 2).

Circum oral burn stent

Microstomia, a condition characterised by a small or narrowed opening of the mouth, is a common complication of burns to the mouth and surrounding tissues. The cause of the burn may be chemical, thermal, or electrical, but the scar contracture that

Figure 2: Extraoral commissure stent and external auditory canal

occurs is a common sequela of each. The contraction of the tissue surrounding the oral cavity can affect a patient's ability to obtain optimal dental care and maintain good oral hygiene. In severe cases, eating habits may also be affected, which may be compounded by the occurrence of an upper airway problem.[8]

However, microstomia can be managed or prevented using a commissural splint, which helps to maintain the normal relationship of the commissures during the healing process and offers physical resistance to scar contracture. These splints or appliances can be either tooth or tissue-borne and can be prefabricated or customised. They can also be static or dynamic in function and can be placed intraorally or extraorally. Intraoral appliances require impressions of the maxillary and mandibular arches and a full complement of teeth to provide adequate retention for the appliance, while extraoral appliances are bulky, may require intraoral anchorage, are difficult to fabricate, and are unesthetic.[9]

The objectives of the appliance are to prevent scarring, minimize lip adhesions, and contracture during healing, and to obtain adequate mouth opening for the patient. The appliance should also be retentive and comfortable for the patient to wear. Factors that influence the choice of an appliance suitable for a particular patient include the type of injury, the age of the patient, the condition and status of the dentition, compliance, manual dexterity, availability, and financial status of the patient (Figure 2).[8,9]

Stent for neck scar

Burn injuries can have a devastating impact on a person's life, leaving them with physical and emotional scars that

can last a lifetime. One of the most common and debilitating consequences of burn injuries is contracture, a condition in which scar tissue tightens and shrinks, causing functional impairment and disfigurement. In cases where the face and neck are affected, the impact on a person's quality of life can be particularly severe.[10] To prevent and manage contracture, a post-surgical splint may be used to support the form of the skin graft and residual tissue. These splints, which are designed and fabricated by a maxillofacial prosthodontist, can help improve the final esthetic results and reduce contracture, allowing the patient to recover both physically and emotionally from their injuries. By providing physical support and protection during the healing process, these splints can play a critical role in helping burn survivors reclaim their lives.[10,11]

Uses of prosthodontic stents and splints during radiotherapy[3]

Prosthodontics stents and splints can be an important tool in the treatment of cancer, particularly in the head and neck region. They are used to help deliver radiation therapy to specific areas, while also protecting healthy tissues. These stents are designed to hold the patient in a consistent position during treatment, making it easier to target the cancerous cells. In addition, they may also be used to shield surrounding tissues from exposure to radiation.[5] While the use of these devices is primarily limited to the head and neck region, they may also be used in other parts of the body. We can classify radiation stents as follows.

Perioral cone positioning devices

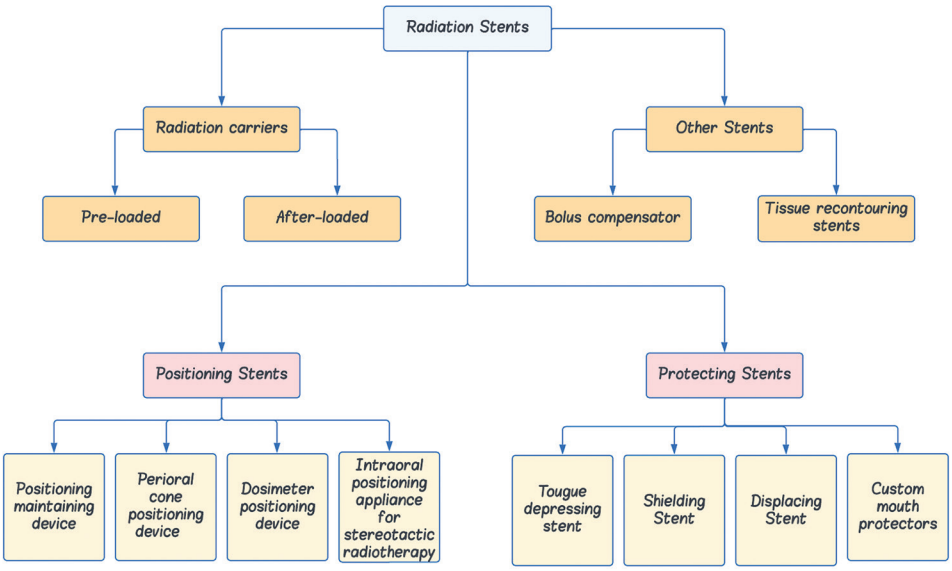
Treatment for small, superficial lesions located in accessible areas of the oral cavity can be done with a perioral cone boost of radiation therapy. This approach involves first administering external radiation therapy to a wider field and then delivering a higher dose of radiation to the primary tumour site through a perioral cone. This technique helps to spare vital nearby structures such as the mandible, teeth, and salivary glands. The lesion should be small in size and able to be encompassed by one of the available cone sizes, typically located in the front of the mouth, hard or soft palate, or oral tongue. To ensure accurate and repeatable positioning, a custom docking device can be created. This is done by wrapping tinfoil around the cone and forming an acrylic ring of 4–6 mm around it. The acrylic ring is then attached to the maxillary record base for edentulous patients or occlusal indices for edentulous patients, ensuring the cone is centered over the lesion (Figure 3).[3,4,12]

Tissue bolus

Treating head and neck cancer patients with radiation therapy presents unique challenges due to the irregular contours of the tissue in this area. These contours can lead to uneven distribution of the radiation dose, making it difficult for the radiation oncologist to ensure that all areas receive an appropriate amount of treatment. To address this issue, a bolus may be used. A bolus is a material that is similar to the tissue it is applied to and is placed directly on or within the irregular contours. This helps to create a more uniform distribution of the radiation dose. The most commonly used materials for bolus in head and neck cancer treatment are saline, wax, and acrylic resin.[12-14]

Vaginal radiation carrier

The use of individually constructed vaginal carriers for intracavitary therapy, using either Iridium-192 or Radium, has recently become popular at some cancer centres. These carriers are used to treat specific patients with carcinoma of the vagina, recurrent endometrial carcinoma of the vaginal vault, and carcinoma of the cervix with a narrow vaginal vault. The advantages of this method include the ability to achieve optimal placement of the radioactive sources adjacent to the lesion, as the carrier is tailored to the patient's anatomy and tumour volume. The carrier also does not shift position, unlike other methods, resulting in little distortion of normal anatomy.



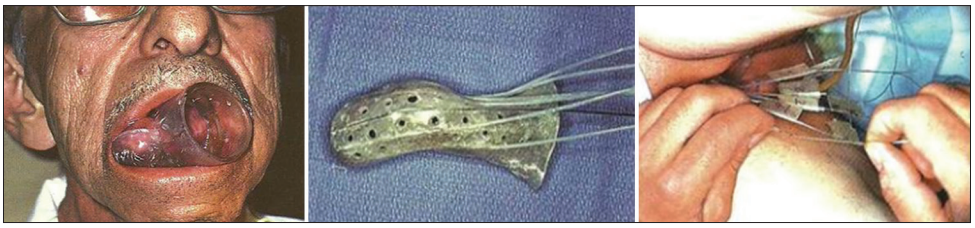


Figure 3: Perioral cone positioning devices and acrylic vaginal radiation carrier

In addition, more accurate dosimetric calculations are possible when combining intracavitary therapy with external beam therapy, and patient comfort is improved as no packing or external means of immobilization are required with the vaginal molds. This technique allows the radiotherapist to selectively irradiate specific portions of the vaginal wall while sparing other sections. It is typically used for the early and superficial lesions and follows a radiation therapy of 4000–5000 rads (Figure 3).[5,13]

Conclusion

Extraoral stents are medical devices that are used to support soft tissue or bony grafts during the healing process after surgical procedures. They can be used for a variety of purposes, such as protecting and covering tissues, delivering medication, and administering radiation therapy.

Despite their potential benefits, the use of extraoral stents is not yet a widely accepted practice. To ensure that patients receive the best possible treatment, it is important for surgeons and radiotherapists to consult with a maxillofacial prosthodontist prior to any case of burn treatment or radiotherapy. This professional can advise on the appropriate type of radiation stent required and assist in its fabrication. By following this simple and effective preventive measure, the treatment process can be made easier and more comfortable for the patient.

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