

**Philosophies of Prevention in Prosthetic Dentistry**

<sup>1</sup>Dr. Aushili Mahule, Post graduate student, Department of Prosthodontics, Crown, Bridge and Oral Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College, Nagpur

<sup>2</sup>Dr. Jaykumar Gade, Professor, Department of Prosthodontics, Crown, Bridge and Oral Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College, Nagpur

<sup>3</sup>Dr. Vandana Gade, Professor, Department of Conservative Dentistry and Endodontics, Swargiya Dadasaheb Kalmegh Smruti College, Nagpur

**Corresponding author:** Dr. Aushili Mahule, Department of Prosthodontics, Crown, Bridge and Oral Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Hingna, Nagpur - 441110, Maharashtra, India

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**Abstract**

The importance of disease prevention and health promotion is gaining increasing recognition. It is a universally accepted fact that prevention is better than cure and now with greater stress on preventive measures, this concept of prevention has been well expanded into the field of prosthetic dentistry. It has been suggested that the best preventive dental care would be established on the base of the proper plan for prevention and successful prevention could be accomplished through eligible preventive treatment planning. Thus, all the prosthetic dental procedures must be planned not only in terms of dealing with the past or present diseases but in terms of preventing future diseases as well. This article highlights various prevention strategies that can be used in prosthetic dentistry.

**Keywords:** preventive prosthodontics, residual ridge, denture, occlusion, implants, preservation

**Introduction**

Health promotion and disease prevention are major emerging themes in health care generally. Disease prevention involves the necessary actions taken to reduce or eliminate exposure to risks that might increase the chances that an individual or group will incur disease or disability. Prevention of oral diseases also has now become a priority. With the increasing importance on preventive measures, the dental profession has expanded this preventive concept into prosthodontics. Preventive prosthodontics comprehend all the procedures that can delay or eliminate future prosthodontic problems. The principal aim of prosthetic dentistry is to follow the golden statement by MM DeVan: “perpetual preservation of what remains rather than the meticulous restoration of

what is missing”.<sup>[1]</sup> This symbolizes the importance of prosthetic dentistry in preserving the patients’ teeth and its associated structures.

### **Concept of prevention**

The goal of prevention is to promote health, to preserve health, to restore health when it is impaired and to minimize suffering and distress. Prevention can be studied under three levels: primary, secondary and tertiary. ‘Primary prevention’ is defined as an action taken prior to the onset of disease, which removes the possibility that a disease will ever occur. ‘Secondary prevention’ is defined as an action which halts the progress of a disease at its incipient stage and prevents complications. ‘Tertiary prevention’ is defined as all the measures available to reduce or limit impairments and disabilities, minimizing suffering caused by existing departures from good health and to promote the patients adjustment to irremediable conditions.<sup>[2]</sup> Prosthetic dentistry is usually concerned with the prevention of loss of function and therefore should be considered as tertiary prevention.

### **Role of nutrition in prevention of oral diseases**

Nutrition is defined as the science of food, the nutrients, and other substances therein, their actions, interactions and the process by which the organism ingests, digests, absorbs, transports, utilizes and excretes food substance.<sup>[3]</sup> Tissues of the oral cavity are often the first to be affected by nutritional disturbances. Prosthodontists are usually associated with the treatment of elderly population. Hence prosthodontists can be aptly regarded as “Gerodontologists” and may deploy their knowledge in basic sciences to provide proper dietary suggestions for their patients.

### **Dietary recommendations for geriatric dental patients**

Elderly people suffer from malnutrition due to a plethora of factors such as impaired chewing and digestion, decreased appetite and absorption, concurrence of

systemic diseases and the effects of polypharmacy, and financial constraints etc [4,5]. A balanced diet is advisable for all the geriatric patients for the normal maintenance of the oral tissues. Protein intake is known to improve denture tolerance, thus a diet high in protein is recommended.<sup>[4]</sup> When several constraints prevents the intake of normal diet in geriatrics, multivitamins are considered as a valuable and cost effective adjunctive.<sup>[6]</sup>

### **Preventive philosophies in complete denture prosthodontics**

In the practice of complete removable prosthodontics, much attention is given to the preservation of residual ridge. The supporting bone acts as a foundation for the success of any denture. Bone is a dynamic tissue that responds to its function. The extraction of teeth eliminates the need for an alveolar process thus causing the bone to resorb. Denture pressure on the residual ridge also causes the bone to be resorbed.<sup>[7]</sup> Thus in cases of complete removable prosthodontics preventive concepts should emphasize methods that aid in preservation of residual alveolar ridges.

### **The Theory Rest Impression**

DeVan (1952) stated that “preserve the alveolar bone, soft tissues will take care of themselves” while discussing the basic principles in impression making. When mucostatic impressions are made the tissues are completely contacted and are impuissant to move within the impression. The alveolar bone is best preserved with rest registrations. Hence whenever possible, such impression technique should be followed.<sup>[8]</sup>

### **The Role of occlusion in preservation and prevention**

Difference exists between the between natural and artificial teeth. Thus the dentist-created occlusion requires some modification.<sup>[9]</sup>

### **Requirement of artificial occlusion for tissue preservation**

- Stability of occlusion in centric relation
- Balanced occlusion for eccentric contacts.
- Unlocking of the cusps mesiodistally to accommodate the inevitable settling of denture bases.
- Control of horizontal force by buccolingual cusp height reduction according to residual ridge shape and interarch space.
- Functional balance by favorable tooth ridge crest position.
- Anterior clearance of teeth during masticatory function.
- Minimum occlusal stop areas for reduced pressure during function.

### **The neutrocentric concept of occlusion**

The term “neutrocentric” was first described by Devan (1954) and it embodies two key objectives in the making of a denture: neutralization of inclines and centralization of forces acting on the denture foundation. Both of the objectives primarily aims at decreasing the forces of occlusion created by the removable prosthesis and thus preserving the underlying residual ridges from resorption. To attain these objectives it may be necessary to: position the teeth as lingually as possible to reduce shear forces on the denture foundation; reduce the size and number of teeth; reduce the buccolingual width of the tooth; use of flat teeth; reducing the pitch or teeth inclination.<sup>[10]</sup>

### **Metal Denture Bases in Preventive Prosthodontics**

Metal denture bases have greater accuracy because they overcome the dimensional changes that occur during the polymerization of conventional denture resins; they show much less lateral deformation in function; better tissue tolerance because they are less porous, and additional weight for increased stability (Increased weight pertains to

the mandibular denture only). All these aids in prevention of the residual ridges.<sup>[11]</sup>

### **Role of Tissue Conditioners and Soft Liners**

Tissue conditioners and resilient liners are soft, flexible polymers that provides protection to the supporting tissues from functional occlusal stresses.<sup>[12]</sup> They serve to distribute the forces of mastication more evenly and provide a cushioning effect thus preventing the resorption of underlying residual ridges. Studies state that comfort and masticatory performance improves significantly after soft relining of the complete dentures.<sup>[13,14]</sup> However, these materials should not be considered a panacea as they are associated with a number of disadvantages.

### **Role of overdentures in preventive prosthodontics**

A completely edentulous patient experience a sequelae of events like loss of discrete oral sensory and kinaesthetic proprioception, gradual loss of remaining residual ridge, and relocation of the forces of occlusion from the teeth to the underlying residual ridge through the oral mucosa. The residual ridges were never intended to bear the stresses of mastication created by complete dentures. With the preservation of teeth or roots a very important part of myofacial nervous complex is retained and the proprioceptive ability of teeth under an overdenture aids to prevent resorption by providing signals against a physiologic overload of the system. Also, the retention of even a single root, decreases the patient’s fear of being completely edentulous. In addition overdentures offer better retention, support, stability and masticatory efficiency than conventional complete dentures. The concept of overdentures may not be the elixir, but it provides a pragmatic approach for delaying the process of complete edentulism and helps in the preservation of residual ridges.<sup>[15,16]</sup>

### **Submucosal vital root retention**

Conventional overdentures helps in preservation of the residual alveolar ridge and the supporting tissues but only covering teeth is not conducive to maintaining a plaque free environment. Development of a dead space around the gingival margins of the abutment teeth can act as a source of inflammation. If the communication occurs between oral cavity and submucosal supporting tissues potential exist for subsequent retrograde periodontal changes which can lead to a loss of hard and soft tissues adjacent to the retained abutments. Submucosally buried roots may provide an advantage of being separated from the oral cavity and are not subjected to the sequelae of poor oral hygiene and simultaneously preventing residual ridges resorption. <sup>[15,16]</sup>

### **The role of immediate denture in preventive prosthodontics**

When a patient is restored with an immediate denture the ridges are subjected to early function, causing a less resorption of the underlying ridges and the resultant ridges are better preserved and adapted to supporting a complete denture. Also, with the use of immediate dentures there is a minimal change in muscle tone and the loss of occlusal vertical dimension can be prevented. The masticatory and facial muscles are not given the chance to change, and unfavourable speech and chewing habits such as development of pseudo class III malocclusion can be prevented. The tongue is not given the chance to enlarge. The most important advantage, especially from the patient's perspective, is that at no time will he or she be without teeth thus providing a psychological benefit simultaneously preventing them from social embarrassment. <sup>[17,18]</sup>

### **Preventive philosophies for removable partial dentures**

The following preventing measures can be undertaken to prevent the damage to the supporting tissues when a patient is restored with a removable partial denture.

- Frameworks should be designed to contact sufficient abutment teeth for physiological stress distribution and avoidance of overloading.
- Clasps should be designed so that all the functional forces on abutment teeth are reciprocated.
- Major connectors should be fabricated with adequate rigidity. Denture bases should be designed to have maximum coverage of denture bearing areas.<sup>[19]</sup>
- Reducing the load by proper selection and placement of artificial teeth: The vertical load on the saddle in mastication may be reduced by reducing the size of the occlusal table in anteroposterior as well as buccolingual directions. This can be achieved by: Using canines and premolars instead of premolars and molars; using narrower teeth; leaving tooth off the saddle. The considerable narrowing of the artificial tooth both buccolingually and anteroposteriorly than that of the corresponding natural teeth reduces the amount of stress transmitted from the occlusal surfaces of the artificial teeth to the residual ridge.<sup>[20]</sup> Omitting the most distal tooth on the saddle reduces the magnitude of any abutment tooth movement caused by the denture; as more distally applied load to the saddle produces a greater magnitude of abutment tooth movement.
- Establishing proper guiding planes: Establishing proper guiding planes helps to maintain the integrity and health of supporting tissues by providing a predictable, repeatable path of insertion and removal of the prosthesis and thus preventing any injuries to the soft tissues as well as excessive stresses on the abutments.

### **Distal extension removable partial dentures**

The distribution of occlusal forces varies according to the condition of the partially edentulous state. In a tooth-supported partial denture, the occlusal forces are mainly distributed to the abutment teeth. But in cases of distal-extension removable partial denture occlusal forces are dissipated to different quality of supporting tissues, anteriorly to abutments and posteriorly to residual ridge. Due to the differences in the nature of supporting tissues, rotation of the denture usually becomes inevitable during function. This is an important factor which needs to be considered while designing a distal extension removable prosthesis.<sup>[21-23]</sup>

### **Distributing the forces between the teeth by using stress breakers**

**Stress Breaker:** It is a device or system that relieves specific dental structures of part or all of the occlusal forces and redirects those forces to other load bearing structures or regions.<sup>[24]</sup>

**Split palatal and mandibular major connector as a means of stress breaker in distal-extension removable partial denture:** The split palatal major connector or a mandibular split lingual bar major connector is an effective, simple, and inexpensive stress-breaker design for distal-extension removable partial dentures, especially for patients with reasonably good residual ridges and weak abutment teeth.<sup>[22,23]</sup>

### **Functional impression as a means of stress reduction**

In a distal extension removable partial denture, a destructive class-I lever is created, due to the relative discrepancy in the degree of movement that occurs between the tooth and mucosa covering the ridge, in response to various occlusal forces. Hence a dual impression procedure is indicated to record final impression. There are two categories of dual impression techniques. These categories may be defined as

physiologic impression techniques and selected pressure techniques. The physiologic impression techniques are the functional reline method, the McLean-Hindels technique, and the fluid wax impression (altered cast) techniques. Physiologic impression techniques record the ridge portion of the cast in its functional form by placing an occlusal load on the impression tray during the impression procedure. Functional impression techniques aims to provide maximum support for the removable partial denture bases. This limits the movement of the denture base as well as allows for the maintenance of occlusal contact between both natural and artificial dentition. Although some tissue ward movement of the distal extension base is unpreventable, it can be minimized by providing the best possible support for the denture base. These dual impression techniques also helps to dissipate the forces of occlusion to a broader area, decreases excessive stress to the abutment tooth during occlusal loading and thus aids to preserve the health of remaining oral tissues.<sup>[21,25,26]</sup>

The dual impression technique is most often indicated for mandibular distal extension applications because only a limited ridge area can be used as a stress-bearing site. It is more difficult to obtain the proper peripheral extension of the mandibular denture base than it is to perform this same procedure for a maxillary denture base. This is primarily due to the mobility of the floor of the mouth. The maxillary distal extension ridge is usually covered by a firm, well-attached mucosa or can be surgically prepared in that form. The stress-bearing area includes the crest and buccal slope of the ridge. Therefore, a dual impression does not often improve the stress distribution. The border definition is also much simpler and can be read from a single anatomic impression.<sup>[25]</sup>

Selected pressure impression techniques are intended to equalize the support between the abutments and the soft

tissues and to direct forces to the portions of the ridge that are most capable of withstanding such forces. This can be achieved by relieving the tray in some areas while allowing the impression tray to contact the ridge in other areas. Areas where relief is provided are minimally displaced during impression procedures. In those areas where relief is not provided, greater soft tissue displacement occurs.<sup>[25]</sup>

### **Preventive philosophy in fixed prosthodontics**

#### **Preservation of tooth structure by designing fixed partial denture:**

One of the basic precept of restorative dentistry is to conserve as much tooth structure as possible. This can be achieved by the use of following:

- Preparation of teeth following the biomechanical principles of tooth preparation.
- The frequent use of supragingival margin whenever possible.
- Use of partial coverage rather than complete coverage restorations, wherever indicated.
- If necessary teeth should be orthodontically repositioned.

**Protection of periodontium:** One of the prime goals of restorative therapy is to establish a physiologic periodontal climate and facilitate the maintenance of periodontal health. Periodontal health is affected by crown contour, margin placement as well as pontic design.

**Crown contour:** The contours of a restoration play a supportive role in establishing a favorable periodontal climate. Three prominent theories of crown contour have evolved.<sup>[27]</sup>

**Gingival protection theory:** This theory advocates that contours of cast restorations be designed to protect the marginal gingiva from mechanical injury. This concept implies that undercontouring of the clinical crown will cause deflection of masticated food onto the gingival margin, forcing it into the sulcus, thus initiating gingivitis.

**Muscle action theory:** This theory suggest that overcontouring prevents the normal cleansing action of musculature and allows food to stagnate in the overprotected sulcus and hence it should be avoided.

**Theory of access for oral hygiene:** This theory states that the plaque is the primary etiologic factor in caries and gingivitis. Thus crown contour should enable plaque removal and not impede it.

Guidelines for crown contouring with emphasis to this theory includes:

- Buccal and lingual contour should be flat, not fat to reduce plaque retention.
- Open embrasures: If plaque is a primary etiologic factor in gingivitis, then every effort should be made to allow easy access to the interproximal area for plaque control. Open embrasure spaces allow for easy access. An overcontoured embrasure will reduce the space intended for the gingival papilla and may cause broadening of the col area which may lead to the irritation of the papilla thus inhibiting effective oral hygiene.
- Location of contact areas: Contacts should be high (directed incisally) and buccal in relation to the central fossa (except between maxillary first and second molars). For the posterior restorations contact areas should be placed as occlusally as possible to facilitate access for interproximal plaque control.
- Furcation involvement: Furcations that have been exposed owing to loss of periodontal attachment should be “fluted” or “barrelled out”. The concept of fluting into molar furcations may help to eliminate plaque traps and facilitate plaque control.

**Pontic design:** The pontics acts as a raison detre for fixed partial dentures. Because some of the supporting tissues are lost when the tooth is removed and because the pontic lies over the tissue instead of growing from its

modification must be made in basic tooth morphology to ensure that the pontic is cleanable and non-injurious to soft tissues. Few guidelines for pontic designing are recommended as follows.<sup>[28]</sup>

- The area of contact between the pontic and tissue should be as small as possible.
- The pontic should exert no pressure on the ridge.
- The area of pontic touching the edentulous ridge should be highly glazed or polished porcelain to prevent any injury to underlying edentulous ridge and to prevent any plaque accumulation beneath the pontic.
- The contact between the pontic and tissue must allow the passage of floss.
- The mesial, distal and gingival embrasure of the pontics should be kept wide open to allow the patient easy access for cleaning.
- The modified ridge-lap design in the posterior region and the ridge-lap facing design in the anterior region offer minimal tissue contact, acceptable cosmetic value, proper cheek support, and accessibility for adequate oral hygiene.
- For the mandibular posterior region sanitary pontic is usually advisable.

**Prevention of iatrogenic damage:** Dental iatrogenic damage can produce an injury either on the tooth or the soft tissues or both.

**Adjacent teeth:** The chances of iatrogenic damage to the adjacent tooth while restoring missing teeth with a fixed partial denture is a common error. Dykema, Goodacre and Philips suggested the use of metal bands such as a matrix band, to be placed around teeth to prevent possible damage to the adjacent tooth. Rosenthiel, Land and Fujimoto suggested leaving a thin lip or fin of enamel interproximally on the tooth being prepared, using fine tapering diamond instruments to protect the adjacent

tooth. The fin is removed in the final stage of preparation. If any enamel surfaces are damaged, they should be restored with acid-etch microfill composite restorative material.<sup>[29]</sup>

**Soft tissues:** Injury to the oral soft tissues during dental procedures may lead to severe pain, non-co-operation and also affect the quality of the treatment. Soft tissue damage is most commonly caused while using burs during treatment procedures. While using air-turbine handpieces, the rotating instrument does not stop immediately when the foot control is released; the operator must either wait for the instrument to stop or be extremely careful when removing the handpiece to prevent any soft tissue lacerations. Extra care should be undertaken while preparing the lingual surface of lower molars to prevent accidental damage to the tongue. Other preventive measure such as proper retraction and isolation of soft tissues using mouth mirrors, rubber dam, cotton rolls, and suction can provide better visibility and access to the work area and may prevent injuries to adjacent soft tissues. Informing and instructing the patient about the dental procedure before commencing any treatment can aid to gain the patient's co-operation and prevent any iatrogenic damage.

**Pulp:** The response of the pulp to restorative procedures is cumulative. When performing tooth preparations even minor trauma may cause pulpal degeneration. Handpiece inadequacy, use of worn-out diamonds and burs, improper cutting techniques, excessive tooth preparation depths, inadequate water coolant, over-drying tooth preparation can all lead to the stressed pulp. Hence such activities should be avoided. Tooth preparation must be done following the biomechanical principles of tooth preparation, and proper selection of techniques and materials according to the individual case is recommended in order to prevent pulpal damage.<sup>[30]</sup>

**Temporization:** Because of the sensitivity of prepared teeth and the accumulation of plaque on the areas that are not self-cleansing the prepared tooth needs to be protected from the oral environment.<sup>[31]</sup> Provisional restorations helps to maintain relationship of the prepared tooth with the adjacent and opposite tooth. They also aid to maintain the health of gingival tissue and may serve as a blueprint for the design of the definitive prosthesis.

**Microleakage:** All cements shrink on setting which results in microleakage. Microleakage can lead to postoperative sensitivity, secondary caries, pulp pathoses, plaque accumulation, cement dissolution and ultimately the failure of prosthesis. Thus, cements which are less soluble in oral environment are recommended. Eg. Resin cements

**Use of resin retained fixed partial dentures:** Resin retained fixed partial dentures was described by Rochette in 1973. Its advantages include minimal removal of tooth structure, use of more conservative supragingival margins, minimal potential for pulpal trauma and no requirement of anesthesia.<sup>[32]</sup>

**Use of fiber reinforced composite resin fixed prostheses:** Fiber reinforced composite resin fixed prosthesis can be used as an alternative to traditional metal ceramic restorations. The associated advantages over conventional metal-framed resin-bonded bridges include better adhesion of the luting agent to the framework, lower cost and better aesthetics and less wear of opposing tooth structure. The main materials used for fibre-reinforcement are glass, ultra-high molecular weight polyethylene and Kevlar fibres. Glass fibres have been shown to offer increased strength when compared to other fibres.<sup>[32]</sup>

**Rationale for dental implants:** Implant supported prosthesis offer a number of advantages over removable or fixed prosthodontics. Cardinal advantage associated with the use of implants is that they stimulate the bone and

maintain its dimension in a manner quite similar to healthy natural teeth. An implant prosthesis improves or regains oral proprioception; provides improved masticatory performance; allows normal muscle function. The implant prosthesis is stable and retentive without the effort of musculature and do not require soft tissue support for its retention like removable prosthesis and thus improves oral comfort. Implants acts as independent units and when used for replacing the missing teeth they may prevent the need of altering adjacent intact natural teeth and thus prevent their future damage which is commonly seen while restoring the teeth with fixed partial dentures.<sup>[33]</sup>

**Role of Immediate implants in preventive prosthodontics:** Immediate implant placement is defined as the placement of an implant into the extraction socket at the time of tooth extraction. With the placement of the immediate implants the architecture of the alveolar bone is maintained, soft tissue collapse at the extraction site is prevented thus providing optimal restorative esthetics, and reduces or eliminate the need for future bone augmentation procedures. Other advantages of the immediate implant therapy includes the following.<sup>[34,35]</sup>

- A reduction of surgical procedures,
- A reduction in treatment time,
- An improvement in the patients' psychological outlook for dental treatment.
- The ideal orientation of the implant may be easier to achieve.

**Partial extraction therapy or socket shielding:** In the maxillary anterior region the supporting jaw bone is usually very thin; no spongy bone is found here and the cortical plate is fused with alveolar bone proper. Following tooth extraction, the thin bone walls are severed, thereby causing facial bone plate resorption. Retaining a natural tooth or root structure may prevent



facial bone resorption. In socket-shield technique the patient's tooth tissues (a thin buccal root fragment) and associated periodontium is kept attached to the thin facial bone to preserve the alveolar ridge and thus limit the post-extraction resorption.<sup>[36,37]</sup>

**Preventive philosophies for maxillofacial prosthesis:**

**Proper pre-surgical planning for the rehabilitation of maxillofacial defects:**

The success of a future maxillofacial prosthesis can be greatly enhanced by careful presurgical evaluation and communication involving the patient, the surgeon, and the prosthodontist.<sup>[38]</sup> It is the responsibility of the prosthodontist to educate surgeons about the prosthodontic requirements for restoring the patients that undergo ablative surgeries. The prosthodontist should suggest the advantages of removing or retaining tissue adjacent to the surgical site. Although the exact extent of the surgical margins may not be known in the presurgical conference, guidelines can be established. This knowledge aids the surgeon in preparing his patient to receive a successful prosthesis after surgery.

**Immediate obturators:** Surgical obturator is a temporary maxillofacial prosthesis inserted during or immediately following surgical or traumatic loss of a portion or all of one or both maxillae and contiguous alveolar structures (i.e., gingival tissue, teeth).<sup>[24]</sup> Rehabilitation of patients with maxillary defects using obturator prosthesis is an appropriate and non-invasive treatment modality. Results support that good obturators contribute to a better life quality.<sup>[39]</sup> Improvements in the psychological status and the presence of positive emotions can provide better health outcomes.

**Role of maintenance and recall in prevention:** It is very important to maintain proper oral hygiene around the prosthesis to use it longer. For the patients with fixed partial dentures and implant supported prosthesis tooth-

brushing instruction should be followed according to the Charter's method along with regular flossing and use of interdental brush. Oral prophylaxis is recommended on regular basis. Oral health education for denture wearer regarding regular denture cleaning with denture brushes and cleansers is advisable to keep the prostheses plaque free, thereby ensuring better tissue health. Regular recall visits to evaluate denture for any readjustments or repair is recommended.

**Conclusion:** Prosthetic dentistry is mainly concerned with the tertiary level of prevention. The various concepts of prevention should be applied to all the dental patients requiring prosthetic rehabilitation in order to offer a long term service of prosthesis while simultaneously preserving the oral tissues. Every possible attempt should be made to preserve what is given by nature and to stick to the principle "prevention is always better than cure". Practicing preventive prosthodontics might be a successful way to manage dental patient with continuous preventive care clinically.

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