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## The "Loma Linda Pouch": A Technique for Repairing the Perforated Sinus Membrane



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*A technique, the "Loma Linda pouch," is introduced for repairing the perforated maxillary sinus membrane during sinus grafting procedures. A collagen membrane is placed against the perforated site and subsequently covers the internal surface of the maxillary sinus. The collagen membrane is then folded along the lateral access window to form a pouch that surrounds and isolates the graft material. (Int J Periodontics Restorative Dent 2003;23:593-597.)*

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Dental implants offer a predictable treatment modality for completely or partially edentulous patients.<sup>1,2</sup> After the introduction of the sinus grafting technique,<sup>3,4</sup> implant placement and prosthetic rehabilitation of the resorbed posterior maxilla have become a valid treatment option.<sup>5-8</sup>

Several grafting materials have been used to augment the antral space, including autografts,<sup>3,4,9-13</sup> demineralized freeze-dried bone powder,<sup>5,14-16</sup> hydroxyapatite,<sup>5,8,12,16-18</sup> xenografts,<sup>19,20</sup> and combinations of these.<sup>5,8,12,19,21-26</sup> Regardless of the type of graft used, the sinus augmentation procedure involves elevation of the Schneiderian membrane and placement of the graft material into the space underneath the reflected membrane.<sup>3</sup> The most common complication during sinus graft surgery is tearing or perforating the sinus membrane.<sup>26-28</sup> If membrane perforation occurs, the opening can be sealed with a piece of resorbable collagen membrane.<sup>8,19,26-31</sup> However, to date, no study has validated such repair.



**Fig 1** Placement of a collagen membrane has been proposed along the perforated site to seal membrane perforation.

**Fig 2 (right)** By only sealing the perforated membrane site, graft material can be released into the maxillary sinus area through the perforation.



A human study was performed at the Center for Prosthodontics and Implant Dentistry at Loma Linda University, California, to evaluate the results of sealing the perforated maxillary sinus membrane with a resorbable collagen membrane. In all cases, the repair of the perforated membrane was accomplished by applying a resorbable collagen membrane against the area of the perforation (Fig 1). Biopsies were taken during implant placement, and the preliminary data indicated no or minimal bone formation at the perforated site. The data from this study will be published elsewhere. In most cases, the graft material escaped beyond the confines of the Schneiderian membrane (Figs 2 and 3). As a result, the same center

developed a technique in which the resorbable membrane not only covers the perforated site, but forms a pouch around the entire internal sinus area to protect and isolate the graft material in place.

The purpose of the present article is to introduce a new technique, the "Loma Linda pouch," for repairing the perforated maxillary sinus membrane. This technique may offer superior protection and isolation of the graft material.

### Technique

After identifying the perforated site (Fig 4), a resorbable collagen membrane is inserted into the maxillary sinus area (Fig 5). A curette can be

used to facilitate the insertion. The collagen membrane covers the entire internal maxillary sinus surface (Fig 6). The membrane needs to extend beyond the boundaries of the lateral window osteotomy. The graft material is inserted (Fig 7). A curette can be used to facilitate the insertion of the graft into the sinus (Fig 8). The excess graft material is removed. The collagen membrane engages the graft material, forming a pouch that isolates the graft material in place (Figs 9 and 10). The lateral edges of the collagen membrane are folded at the area of the lateral window osteotomy (Figs 11 and 12). The buccal/palatal flaps are sutured above the collagen pouch.



**Fig 3** Escape of graft material into the sinus area. Collagen membrane placed passively against perforated site cannot resist the mechanical forces exerted when graft material is impacted into the sinus.



**Fig 4** Large perforation of the maxillary sinus membrane can be observed.



**Fig 5** Resorbable collagen membrane is inserted into the sinus area. A curette is used to facilitate the insertion.



**Fig 6** Collagen membrane covers the entire internal sinus area.



**Fig 7** Graft material is inserted into the pouch created by the membrane.



**Fig 8** Curette is used to further condense graft material into maxillary sinus area.



**Fig 9 (left)** Placement of the graft material has been completed.

**Fig 10 (right)** Collagen membrane covers entire internal maxillary sinus surface.



**Fig 11 (left)** Membrane is folded along external sinus area where lateral access window osteotomy has been performed. Membrane forms a pouch to cover and isolate graft material. Mechanical pressure during graft placement cannot displace membrane beyond perforation site (as in Figs 2 and 3).

**Fig 12 (right)** Collagen membrane is folded along the lateral window site, forming a pouch that isolates the graft material.



## Discussion

Perforation of the Schneiderian membrane is the most common complication during sinus grafting procedures.<sup>26–28</sup> Jensen et al<sup>28</sup> report a 35% frequency of sinus membrane perforation, while others<sup>26</sup> report a 40% occurrence when the sinus grafting procedure is performed for single-implant placement.

The use of a resorbable collagen membrane to repair the perforated Schneiderian membrane has been advocated by many authors.<sup>8,19,26–31</sup> However, some concerns have been reported in the literature regarding the results of the sinus grafting procedure when such a complication occurs. Jensen et al<sup>28</sup> advocate the use of bone chips around the penetrated part of the sinus membrane because of potential displacement of the graft material into the sinus. Others<sup>32</sup> report that the use of particulate bone graft is not predictable when the sinus membrane has been perforated and recommend the use of a block graft. The described pouch technique may offer increased protection and isolation of the graft material during sinus grafting procedures.

In addition, the formation of a pouch in the described method offers the potential to cover the lateral access window by the same collagen membrane used to seal the perforated site. This may provide further isolation of the graft material. Several authors have proposed the sinus grafting procedure without the use of any barrier against the lateral

window.<sup>13,25,29</sup> However, these reports are based on the subjective assessment of each author. An evaluation of histologic specimens harvested in humans demonstrated superior bone formation within the grafted maxillary sinus when a non-resorbable barrier was used to protect and isolate the graft material.<sup>19</sup> Nevertheless, other authors<sup>23</sup> advocate the use of a resorbable collagen membrane.

The Loma Linda pouch technique may offer superior protection and isolation of the graft material during sinus grafting procedures and when a perforation of the Schneiderian membrane has occurred. However, a clinical study that would include histologic specimens demonstrating bone formation within the area of the sinus is necessary to validate this technique.

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