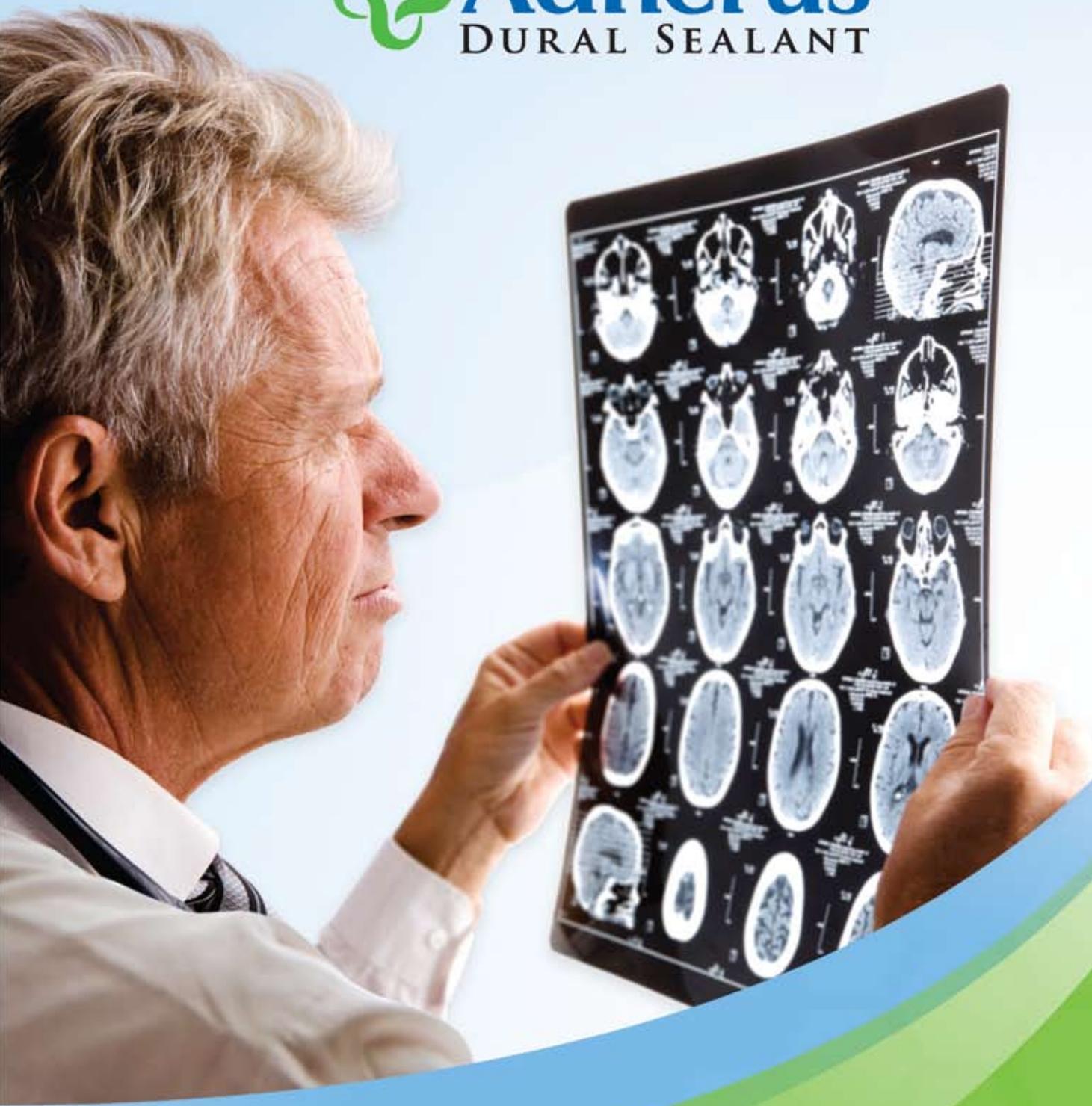


 **Adherus**<sup>®</sup>  
DURAL SEALANT



**HyperBranch Medical Technology, Inc.** creates innovative medical devices using synthetic hydrogels with novel tunable properties for use as surgical sealants in general and specialty surgery.

The products are easy to use, strong enough to stop air and fluid leaks, a barrier to prevent unwanted adhesion formation, and inherently anti-microbial.

After a great surgery, why leave anything to chance?



Advanced Hydrogel Technology

- Superior strength during healing
- Minimal swelling
- Prevents adhesions
- Biodegradable
- Anti-microbial
- Provides a safe and effective water-tight seal.

**Closure with Confidence.**





## **Cerebrospinal Fluid Leakage**

CSF leakage can result in headache, vomiting, dizziness, vertigo and other more serious complications like meningitis, arachnoiditis, and ultimately pseudomeningocele formation.

The use of Adherus Dural Sealant improves the closure and reduces complications associated with CSF leakage.

Adherus Dural Sealant was specifically formulated to meet the requirements for a water-tight seal in cranial and spinal surgery. The physical characteristics of Adherus Dural Sealant coupled with an extended rate of degradation provide the necessary platform for proper healing to occur.

## **Minimizes Dural Adhesions**

Scarring between the tissue layers is an unwanted side effect of many surgeries. In some cases, a second surgery may be required. For many patients, this surgery is complicated by scar tissue at the original surgical site, making it extremely difficult to isolate the anatomy in that location.

Studies show that Adherus Dural Sealant minimizes dural adhesions and scarring by providing a protective shield between the dura and surrounding tissue. For instance, following a pre-clinical craniotomy study, Adherus Dural Sealant essentially eliminated dural adhesions and limited peridural fibrosis. (Protocol Report 2009-PD-02533-02840)

## **Closure with Confidence in Spinal and Cranial Surgery**



**Adherus Dural Sealant applied over collagen-based duraplasty material.**



**Four Month Evaluation after Adherus Dural Sealant applied over duraplasty material.**

**After four months no adhesions in canine model**

## Characteristics

- **Three Applicator Systems**

- 6ml Standard Adherus Sealant - (NUS-001)
  - Extended Tip - (APP-100)
- 1.5ml Design For Minimal Invasive Procedures - Adherus mis (NUS-003)
- 6ml AutoSpray - Adherus AUTOSPRAY (NUS-006)

- **Two Synthetic Components**

- Activated Polyethylene Glycol
- Polyethyleneimine

- **Crosslinking Components Reconstituted in Aqueous Solution**

- **Terminally Sterilized**

- **Room Temperature Storage**

- Adherus Dural Sealant should be stored below 86 °F (30 °C).

- **Key Properties**

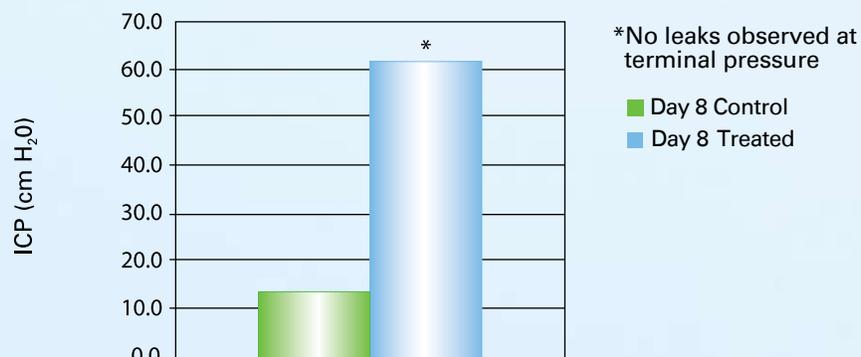
	<b>Standard &amp; AutoSpray</b>	<b>MIS</b>
– Set Time	~1 second	~30 seconds
– Swelling	~8% at Demensional	~0% Deminsional
– Burst Strength	>physiological @ Day 40	>physiological @ Day 21 (50ml /G)
– Degradation	~90 days	~80 days

- **Allows Cellular Infiltration to Facilitate Natural Healing**

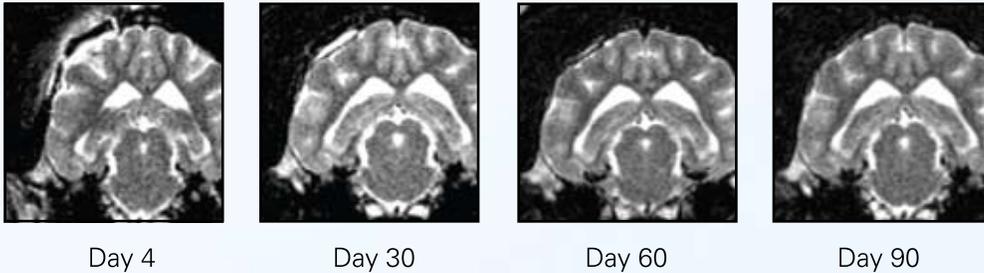
## Effectiveness

Adherus Dural Sealant has been evaluated in canine durotomy and duraplasty repair models and proved to be 100% effective in preventing CSF leaks from dural incisions. No CSF leaks at any time point occurred in the treatment group, even when the CSF column was challenged to a superphysiological pressure.

Comparison of Mean Terminal Cerebrospinal Leakage Pressure between Control and Treated Groups



The persistence of Adherus Dural Sealant was also monitored by MRI (T2 coronal) on a monthly basis. After 90 days, it was noted that the hydrogel was no longer detected and prior to that point, no excessive swelling of the hydrogel resulting in compression of tissues occurred.



Adherus Dural Sealant also exhibits anti-adhesion characteristics. Based on a rating scale\* of zero to four, after one week, Adherus Dural Sealant-treated animals were consistently rated as a zero, indicating that the bone flap was easy to remove and no adhesions were present. The control animals all presented with adhesions that were typically rated as a two, indicating that there was moderate difficulty in removing the bone flap and moderate adhesions were present. Similar adhesion scoring was evident when Adherus Dural Sealant was used with collagen-based duraplasty materials. (Final Report 2007-PD-00787-01181)

## Duraplasty

Special studies were conducted to determine the effectiveness of Adherus Dural Sealant when used with different types of duraplasty material. These studies enhance the previous craniotomy studies and provide compelling evidence for the use of Adherus Dural Sealant with both autologous and non-autologous duraplasty materials. (Protocol Report 2009-PD-02533-02840)

## Safety

Adherus Dural Sealant is non-irritating, non-hemolytic, non-toxic, and non-mutagenic as determined by ISO-10993 testing. In vivo pre-clinical testing shows Adherus Spinal Sealant is non-neurotoxic.

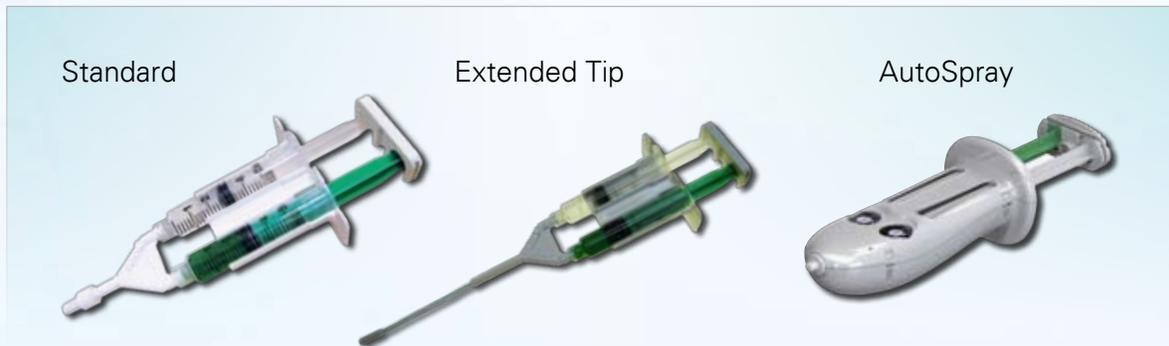
## Histology

Histological examination of tissues revealed that Adherus Dural Sealant was well tolerated. The study concluded that "there were no adverse changes in the brain, calvarium, dura, meninges or non-nervous system organs associated with the test article." (Northern Biomedical Research Study 057-004)

### \*Rating Scale:

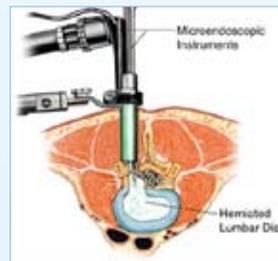
- 0 – Bone flap easily removed, no adhesions present
- 1 – Bone flap removal not difficult, minimal adhesion
- 2 – Moderate difficulty in removing bone flap, moderate adhesion
- 3 – Considerable difficulty in removing bone flap, considerable adhesions
- 4 – Extensive difficulty in removing bone flap, extensive adhesions present

## Applications



Adherus Dural Sealant is intended for use as an adjunct to standard methods of dural repair, such as sutures, during neurosurgical intervention to provide watertight closure. The preparation time is minimal and easily accomplished by following the IFU. Adherus Dural Sealant should be used within 2 hours of preparation of the green precursor. When the solutions within the syringes are mixed together within the tip of the applicator, the precursors crosslink to form the hydrogel sealant. The resulting hydrogel sealant is absorbed over approximately 90 days, sufficient time to allow for healing.

## Minimally Invasive Applicator



The Adherus MIS Applicator is designed for neurosurgical procedures when only a small amount of material is required to close a durotomy. The preparation time is minimal and easily accomplished by following the IFU. The Adherus Sealant has a set time of approximately 30 seconds from the time the reconstitution begins, allowing the surgeon enough time to properly place the material.



Product Attributes	Clinical Benefit
HyperBranched Chemistry	Withstands greatest pressure requirements that may be exerted on the dura during healing. Non-toxic/biodegradable
Degradation Matched to the Healing Time of the Dura	Maintains strength throughout extended healing times of irradiated dural tissue
Minimal Swelling	Allows safe application in confined spaces Prevents mass effect
Set Time Adjusted For Specific Application	Provides an immediate barrier to CSF fluid

### **In Conclusion**

Adherus Dural Sealant is safe and well tolerated, successfully creates a water-tight seal and eliminates CSF leaks.

- Stronger – Requires less material
- Longer lasting – Prevents late-forming pseudomenigocele
- Lower swelling – Allows for use in confined spaces
- Anti-adhesion – Minimizes dural adhesions and reduces scarring after healing
- Anti-microbial – Controls infection

### **Better clinical outcomes and shorter OR times.**

#### **After a great surgery, why leave anything to chance?**

Adherus Dural Sealant is a synthetic, non-immunogenic hydrogel which seals the dura as it heals and provides a barrier to minimize dural adhesions and limit peridural fibrosis.

## Quality Policy

Guided by our core values of integrity, accountability, and commitment to mutual success, **HyperBranch Medical Technology, Inc.** is dedicated to:

Delivery of exceptional surgical sealants and adhesives that provide innovative ways for health care practitioners to improve the clinical outcomes of their patients.

Compliance with all relevant regulatory standards and requirements as a necessary and appropriate commitment to product safety and effectiveness.

Maintenance of an effective quality management system that sustains the company's ability to satisfy its customers and business obligations.



[www.HyperBranch.com](http://www.HyperBranch.com)