

Free, Donna

From: Free, Donna
Sent: Wednesday, November 10, 2004 4:32 PM
To: 'Allen, Samie Niver'
Cc: Hanafi, Nada O; Michael, Maher
Subject: RE: P030053a5 - modes and causes of rupture

Hi Samie,

Attached please find our responses to the modes and causes of rupture questions you posed on 11/2/04. Please do not hesitate to contact us if you have any questions.

Regards,

Donna

-----Original Message-----

From: Allen, Samie Niver [mailto: SXN@CDRH.FDA.GOV]
Sent: Tuesday, November 02, 2004 1:45 PM
To: 'Free, Donna'
Cc: Michael, Maher; Hanafi, Nada O
Subject: P030053a5 - modes and causes of rupture

Here are a couple more. Thanks, Samie

<<Mentor temp - 11-2-04.doc>>

On 11/2/04, I emailed the following to Mentor regarding the modes and causes of rupture.

From Brandon's report, the following is a summary of the failure modes.

Failure Modes	N
Sharp instrument damage (needle or blade)	10
Localized shell fatigue (i.e., fold flaw failure)	11
Miscellaneous failures ¹ (cause unknown)	3
Long failure lines ² (cause unknown)	3
Unknown (i.e., short failure lines) ³ (cause unknown)	2

For clarity, we have restated the table above. We have separated control and explanted device samples into two separate columns.

Failure Modes	No. of Device Samples (N)	Control Samples	Total
Sharp instrument damage (needle or blade)	8	2	10
Localized shell fatigue (i.e., fold flaw failure)	11	0	11
Miscellaneous failures ¹ (cause unknown)	3		3
Long failure lines ² (cause unknown)	2	1	3
Unknown (i.e., short failure lines) ³ (cause unknown)	2	0	2

From Attachment 5, the following is a summary of the failure modes:

Failure Mode	Number of RUC/NAEU Devices	Number of RUC/NAEU plus Iatrogenic Devices
Thin line shell failure - Instrument damage	11 (5%) Of 132	121 (39%)
Thin line shell failure - Localized shell stress from implantation procedure (<i>speculated cause</i>)	121 (60%) Of 132	121 (39%)
Shell/patch junction (thin line)	23 (11%)	23 (7%)
Localized shell fatigue	20 (10%)	20 (6%)
Shell/patch delamination	12 (6%)	12 (4%)
Patch internal (thin line)	3 (1%)	3 (1%)
Combination Failures (<i>unknown mode and cause of failure</i>)	13 (6%)	13 (4%)
Total Failed Device Population	203 (100%)	313 (100%)

1. Please provide the numbers for the thin line shell failures in the table above.

The numbers have been inserted in the table as requested.

It was noted that this table contains failure modes as a percent of total devices. If the calculated percentages are intended to provide a characterization of failure modes of all failed Mentor devices, they will not be representative of that total population unless devices from the Iatrogenic (User Related) category are included in the combined populations. Devices with iatrogenic failures resulting from scalpel cuts or needle punctures are included under the Thin Line Failures category. There is a much larger population (110 devices) of such devices in the Iatrogenic (User

Related) category than the number of devices that were identified in the RUC and NAEU categories during the re-examination of devices. Therefore, we have added another column to the table above, to include these devices and the percent of total devices has been re-calculated. We believe that these percentages more closely represent the total population of overtly failed Mentor devices.

2. Please identify any manufacturing or design changes you are going to make based on the modes and causes of rupture findings.

Mentor's overt rupture failure rate of its gel-filled implants is very low relative to the large number of implanted devices with *in vivo* times up to 20 years. Mentor evaluates every returned explanted device to determine the mode of failure as we are seriously concerned about the failure of every device. As seen from our analyses, most of the failures occur within the first few years. Mentor is currently conducting and/or considering reviews and studies, as described below, to address potential ways to mitigate these early failures over time. Mentor will then consider modification of the design or manufacturing of its silicone gel-filled implants post-approval, should the results of these longer-term efforts suggest that such changes could reduce the incidence of these failures. However, as discussed below, Mentor believes that the causes of the early failures that have been identified can be primarily addressed through training and labeling.

• **Sharp Instrument Cuts (Iatrogenic damage) - Thin line shell failure**

The majority of the early reported failures are due to iatrogenic damage during implantation. Although Mentor provides adequate warnings in the physician labeling (see below), the ultimate resolution of this type of failure is in the hands of the surgeons.

Training/Labeling

Mentor currently warns against the danger of sharp instrument cuts in its physician labeling. The following warnings are included:

- "3. *Avoiding Damage during Surgery*
- Care should be taken not to damage the implant with surgical instruments.
 - Use care in subsequent procedures such as open capsulotomy, breast pocket revision, hematoma/seroma aspiration, and biopsy/lumpectomy to avoid damage to the implant shell.
 - Do not contact the implant with disposable, capacitor-type cautery devices."

Mentor also intends to add a segment in its training program regarding insertion techniques and the various failure modes resulting from some of these surgical practices. The training segment will include photographs of failed devices as well as copies of micrographs that depict at the microscopic level, the different failure modes.

• **Localized Stress Applied during Implantation - Thin line shell failure**

This mode of failure is a direct function of the localized stress applied to the device during implantation. Mentor believes that this failure mode is a function of the

incision size as well as the size and shape of the surgical pocket, which is indicative of the surgeon's technique.

Training/Labeling

As stated above, Mentor intends to add a segment in its training program regarding insertion techniques and the various failure modes resulting from some of these surgical practices. The training segment will include photographs of failed devices as well as copies of micrographs that depict at the microscopic level, the different failure modes. In the physician labeling, Mentor currently includes warnings about the potential damage during insertion as well as the following advice to the physicians: "avoid too small of an incision." Post approval, Mentor will re-evaluate the labeling to determine if additional verbiage specific to failure modes and insertion techniques is appropriate.

Mentor will also be commencing an *in vitro* study to determine the optimum size of incision for the various sizes of implants. This study will involve practitioners who can guide the study and assess the results. As this is a longer term study, the results will be available post approval. At that time, the recommended sizes of incisions for each device size, or range of sizes will be presented in the training segment and will be included in the labeling.

Design - Insertion Device

The localized stress may also be reduced by providing an introducer to be used to insert the device through the incision. This may eliminate the extreme localized stress put on the device by the surgeon's fingers as the device is pushed into the surgical pocket. Currently, there is a project within Mentor to develop and evaluate such an introducer. If this longer-term development project is successful, this product could reduce the localized stresses being placed on the devices intraoperatively and reduce failures.

- **Localized Shell Fatigue Failures:**

There is strong evidence that localized shell fatigue failures result from wrinkling or folding of devices. If wrinkling or folding can be eliminated or reduced, localized shell fatigue failures could be essentially eliminated. Mentor believes this may be accomplished in two ways.

Training/Labeling

In the short term, Mentor believes it is critically important that the surgical pocket created during the implantation procedure be the proper size and shape. It is recognized that the surgeons themselves are the experts in the implantation procedure. Nevertheless, there needs to be clear warnings about the importance of the pocket size and shape and the consequences of not providing one. Currently the physician labeling includes the following important surgical and implant sizing information: "A well-defined, dry pocket of adequate size and symmetry must be created to allow the implant to be placed flat on a smooth surface." This information will be communicated in the physician training program. Post

approval, Mentor will re-evaluate the labeling to determine if additional verbiage specific to failure modes and insertion techniques is appropriate.

Design – Alternative Texturing

Since shell fatigue failures have been observed essentially with only textured devices, it could be assumed that residual stresses in the texture layer could contribute to the failures. Mentor is currently conducting a study to assess whether an alternate texturing process could reduce this failure mode. This is a longer term project, and results which may provide proof of improved resistance to shell fatigue failures are expected post approval.

- **Patch/Shell Junction and Patch Internal Failures – Thin line failures**

Abrupt stress changes at the shell/patch junction are the source of these failures. These rare failures were observed in textured devices. Anything that can be done to reduce or eliminate these changes will reduce the likelihood of failures by this mode. Mentor is assessing the following 2 considerations:

Design- Patch

Mentor believe that one possible way of mitigating patch/shell failures is by reducing the patch size so that the stress change occurs over a wider area, i.e., the patch/shell junction is moved further away from the radius area of the device. Smooth devices have a small patch remote from the radius area. Mentor is conducting a project to optimize the patch size and for each respective shell to minimize the stress at the patch/shell junctions. Additionally, we are evaluating the use of a “contoured patch” which provides a smooth transition between the patch and shell.

Design – Alternative Texturing

This type of failure may also be reduced if the patch/shell junction was moved further away from the radius area of the device. This might be possible with a new texturing process. As stated above, smooth devices have a small patch remote from the radius area. If a process for texturing could be devised to permit a smaller patch, these failures might be reduced. Mentor is currently conducting a study to assess the feasibility of providing a new texturing process. This is a longer term development process that requires extensive pre-clinical testing, and results are expected post approval.

- **Shell/Patch Delamination Failures**

Although shell/patch delamination failure is extremely rare, this failure mode was identified in the NAEU population of the Barber report found in Attachment 5. Bond failure between the shell and patch of a device results in a shell/patch delamination failure mode, e.g., air void.

Manufacturing – In-process monitoring

The strength and permanence of the shell/patch bond is related to the vulcanization process for producing the bond. Mentor recognizes that this failure occurs very infrequently and Mentor does not believe any mitigation is required. However, this failure is monitored as part of our in-process monitoring program and results are reported on a routine basis.

General: It should be noted that Mentor already has some of these recommended actions and projects underway, i.e., projects with the objectives of developing (1) an introducer, (2) reduced patch size and (2) an alternate texturing process. Each of these projects have provided promising preliminary results, but we do not have any guarantee that the particular approaches that are currently being pursued will be successful in the longer term. However, we want to state that Mentor is committed to pursuing these programs and product improvements until the desired results are achieved.