# 510(K) SUMMARY
# RedDress Ltd.'s RD1 System

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**Name of Device (Trade Name):**
RD1 System

**Common or Usual Name:**
Peripheral blood processing device for wound management

**Classification Regulation:**
21CFR 864.9245 (Automated blood cell separator)

**Regulatory Class:**
II

**Product Code:**
PMQ

**Predicate Device:**
Reapplix ApS 3C Patch System (BK140211)

**Reference Device:**
Cytomedix, Inc. Autologel System (BK060007)

**Device Description:**

The RD1 System contains 3 sets of components for drawing and handling autologous blood and allowing it to clot in a controlled manner in order to form the provisional wound matrix (preparation kit):

1. Blood withdrawal kit
2. Coagulation initiator and accelerator component
3. Clotting trays

The device includes an Instructions for Use manual detailing the different steps and materials for preparation of the whole blood clot wound care dressing.

## Intended Use / Indications for Use:

The RD1 System is intended to be used at point-of-care for the safe and rapid preparation of Whole Blood Clot gel from a small sample of a patient's own peripheral blood. Under the supervision of a healthcare professional, the whole blood clot gel produced by the RD1 System is topically applied for the management of exuding cutaneous wounds, such as leg ulcers, pressure ulcers, diabetic ulcers, and mechanically or surgically-debrided wounds.

## Summary of Technological Characteristics:

The RD1 kit is designed to allow healthcare professionals to safely prepare a whole blood clot from a small sample of the patient's own blood. All RD1 kit components are single-use.

To use the kit, 10ml of blood is drawn into a sterile syringe containing CPDA1 anticoagulant. The citrated blood is then gently mixed with a suspension of calcium gluconate and kaolin powder, and the coagulating blood is placed in a sterile clotting tray, containing cotton gauze, to coagulate for 12 minutes. After 12 minutes, the whole blood clot is placed on a wound and dressed with a secondary sterile non-adherent dressing. All RD1 kit elements and reagents are disposed of after a single use of the kit. The procedure may be repeated with a new RD1 kit after a few days.

The subject and predicate devices are both based on the in vitro coagulation of autologous peripheral blood at point-of-care to produce a blood-based clot gel that is topically applied to the patient's wound. The primary differences between the subject and predicate devices are:

(1) Production of the 3C Patch requires a 2-step centrifugation process, whereas production of the RD1 dressing only requires mixing the patient's whole blood with coagulation reagents;
(2) The 3C Patch System does not utilize any reagents in the production of the wound patch, whereas the RD1 System uses calcium gluconate and kaolin to initiate and accelerate the coagulation process; and
(3) The final product to be used on the patient with the RD1 System consists of a whole blood clot gel, whereas the final 3C Patch product is a platelet-rich plasma (PRP) + fibrin clot gel.

These technological differences do not raise different questions of safety or effectiveness. Performance testing further supports that the device is substantially equivalence to the predicate device, as further discussed below.

## Performance Data:

The RD1 System components were subject to in vitro and in vivo testing, with results demonstrating that the device is substantially equivalent to the predicate device.

The RD1 clotting tray with cotton gauze manufactured by RedDress was subject to the following tests in its final packed configuration:

- Packaging validation
- Sterility validation
- Endotoxin validation
- Shelf life validation

The RD1 Kaolin vial manufactured by RedDress was subject to the following tests:

- Specification validation of pharmaceutical LION Kaolin powder, USP
- Particle size validation
- Testing of the product in its final packed configuration:
    - Packaging validation
    - Sterility validation
    - Endotoxin validation
    - Shelf life validation

All other RD1 Kit elements and reagents are bought from medical manufacturers, including:

- CPDA1
- Calcium Gluconate
- Cotton gauze
- Syringes and needles

The subject device was tested for biocompatibility per ISO 10993, including cytotoxicity, sensitization, irritation, acute systemic toxicity, material-mediated pyrogenicity, subacute/subchronic toxicity, and implantation.
In addition, the company performed bench testing on the final RD1 System as a whole, to confirm that it functions per its specifications. The device functioned as intended and all results were passing. Comparative testing was performed for physico-chemical attributes (clot strength, shear modulus, and moisture content) and cell recovery (platelets, white blood cells, and red blood cells) parameters for blood clots prepared by RD1 and a protocol similar to that of the AutoloGel System. Reproducibility was also assessed by the coefficient of variation.

Each component of the RD1 System is separately sterilized and separately packed, after which the packed and sterile components are packaged together in a non-sterile package. Bacterial Endotoxin level is

determined for each batch as part of the release testing. The endotoxin testing is conducted using the Limulus Amoebocyte Lysate (LAL) test method according to AAMI ST72: Bacterial Endotoxins—Test Methodologies, Routine Monitoring, and Alternatives to Batch Testing.

The RD1 System was the subject of a Pre-Clinical animal study in a swine model on 18 wounds including 54 RD1 procedures (Article under peer review in the *Journal of Wounds*).

The RD1 was also the subject of 2 clinical investigations in humans, as with the 2 clinical investigations performed on the 3C Patch predicate device.

Study 1 –
A clinical investigation in humans on 9 wounds in 7 subjects including 35 RD1 procedures. (Article published: *Wounds* 2016;28(9):317-327).

This prospective, open-label, and uncontrolled study evaluated the safety and clinical performance of RD1 in the treatment of chronic wounds in 1 center in Israel.

The 9 wounds were in patients with multiple and serious comorbidities, including 3 venous ulcers, 4 pressure ulcers, one tear wound and one amputation wound. The wounds were 4 to 12 weeks in duration, from 0.9 to 28.1 $cm^2$ in size, and had not responded to previous treatments. Seven patients with 9 lower wounds were treated weekly with RD1 for 9 weeks, or until healing was complete.

Efficacy: Of the 9 wounds included for treatment, seven (77%) healed completely during the nine-week study period. In 1 venous ulcer with a non-healing fistula, 76% wound closure was achieved. In 1 pressure ulcer treatment was terminated at 82% wound closure, because an unexpected mechanical trauma resulted in deterioration.

Safety: There were 35 RD1 procedures and applications, there were no blood draw-related adverse events, and there was only 1 non-related adverse event, of a patient that had mechanical trauma on the wound.

Study 2 –
The RD1 was also the subject of a clinical investigation in humans on 20 diabetic foot ulcers in 20 subjects, including 149 RD1 procedures.

This was a prospective, open-label, uncontrolled study evaluating the clinical performance of RD1 in chronic diabetic foot ulcers at three wound care clinics in the USA.

Following a screening period of 2 weeks, wounds were treated weekly for up to 12 weeks with the RD1 device in addition to standard of care (debridement, offloading, and infection management). Forty-one subjects with diabetic foot ulcers (DFUs) were screened and based on the inclusion and exclusion criteria, 20 subjects with 20 study DFUs were enrolled at 3 sites beginning in June 2014 with the study ending in August 2016. Four subjects had to discontinue the intervention due to ulcer deterioration or infection; 2 subjects were not compliant with the protocol, resulting in 20 subjects for the ITT (intent-to-treat) analysis and 18 for the PP (per protocol) analysis.

The study population was largely male (80%), Caucasian (85%), ambulatory (80%) but also obese (70%) with 25% being current smokers. Mean patient age was 58.6 years. The mean number of comorbidities per patient was 8.8, with the majority having type 2 diabetes (95%), diabetic neuropathy (85%), hypertension (65%), and hyperlipidemia or cholesterolemia (60%). A substantial proportion of subjects also had an allergy to a drug, dressing, or antiseptic (55%), depression (30%), gastroesophageal reflux disease (25%), and a previous chronic wound (30%). Subjects were taking a mean of 9.9 medications with type 2 diabetes medications (75%), type 1 diabetes medications (60%), lipid/cholesterol lowering medications (60%), neuropathic pain medications (60%), beta blockers (55%), anticoagulants (50%), and proton pump inhibitors (40%) being the most prevalent.

The majority of wounds were University of Texas (UT) grade 1 (75%), located on the foot (60%), and were new wounds (70%). Mean wound age was 36.4 weeks and mean initial area and depth were 2.5 cm2 and 2.4 mm, respectively. A substantial number of wounds had been treated with other advanced therapeutics prior to RD1, including antimicrobial dressings (25%) and Negative Pressure Wound Therapy (NPWT) (20%). The most common mode of offloading during the screening period was a boot (75%). Eighty-five percent of all wounds were debrided on the first day of screening and the mean count of debridements during treatment was 4.9.

Safety:
There was a total of 32 adverse events (AEs), of which 2 were serious adverse events (SAEs), and 2 were possibly device-related adverse events (DRAEs) determined as such only due to location of AE. The 2 SAEs, comprising a nervous breakdown, and pulmonary embolism, involved 2 subjects, and none were related to the device or study wounds. The 2 DRAEs occurred in the same subject involving a left hallux infection with subsequent increased pain in the same hallux and foot. There was no evidence that these 2 noted DRAEs were related to the device; but since they were at the target wound, the investigator classified them as

possibly related. There were no complications either in the preparation of the RD1 clot or for other procedures performed during the study.

The mean AE rate for both the intent-to-treat (ITT) and per protocol (PP) populations was 1.6 and 1.7 respectively. The proportion of subjects experiencing an AE, SAE, or DRAE, and venous access complications for the ITT population was 0.8, 0.1, 0.05, and 0 (PP population: 0.83, 0.11, 0.06, and 0). When the AEs were classified according to severity, 21 AES were classified as mild (66%), 9 (28%) as moderate, and 2 (6%) as severe. In the ITT population 5 out of 20 subjects (25%) were impacted in regard to use of the RD1 device by AEs; in 4 subjects this resulted in device discontinuation and in 1 subject only an interruption.

Efficacy: The proportion of wounds healed in the ITT and PP populations was 13/20 (65%) and 13/18 (72%), respectively. There were 4 occurrences of ulcer recurrence following initial healing, with 2 occurrences resulting in unhealed wounds (same for both ITT and PP populations). Percentage area reduction (PAR) for the ITT population at 4 and 12 weeks was 61.3% and 66.6%, respectively; the figures for the PP population were comparable at 4 weeks but better at 12 weeks: 60.0%, and 76.1%, respectively. Mean time to heal in the ITT population was 59 days and 56 days in the PP population.

**Conclusion:**

The RD1 System is as safe and effective as the predicate 3C Patch System. The RD1 System has the same intended use and very similar indications for use, technological characteristics, and principles of operation as its predicate device. The minor difference in the indications for use does not alter the intended therapeutic use of the device. In addition, the minor technological differences between the RD1 and its predicate device do not raise different questions of safety or effectiveness. Performance data (bench, animal, and clinical testing) further demonstrate that the subject device is as safe and effective as the predicate device. Thus, the RD1 is substantially equivalent to the predicate device.