



DEVICES USED IN HYPERLIPIDEMIA

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ABSTRACT :

Hyperlipidemia refers to elevated levels of lipids (fats), including cholesterol and triglycerides, in the blood. This condition increases the risk of cardiovascular diseases like heart attacks and strokes. This study presents development and implementation of certain diagnostic devices used in hyperlipidemia condition.

INTRODUCTION

Devices used in hyperlipidemia encompass diagnostic tools for lipid monitoring and therapeutic interventions for managing elevated cholesterol levels including STANDARD LipidoCare, smart contact lenses, lipoprotein apheresis. *STANDARD LipidoCare* is a compact, battery-operated cholesterol meter by SD Biosensor that measures a full lipid panel and glucose using just 35 µL of capillary blood. *Smart Contact Lens* is a soft, wireless device equipped with an electrochemical cholesterol biosensor, NFC antenna, and integrated circuitry that continuously measures tear-fluid cholesterol and transmits data to a smartphone. *Lipoprotein Apheresis* is a clinical, dialysis-like therapeutic procedure that removes LDL and Lp(a) directly from plasma over 2–4 hours per session, typically weekly or biweekly.

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➤ CHOLESTEROL METER

A cholesterol meter (or cholesterol monitor) is a *portable, handheld device* designed to measure lipid levels—such as total cholesterol, HDL (“good”), LDL (“bad”) cholesterol, and sometimes triglycerides—in a small drop of capillary (finger-prick) blood.

WORKING

- Wash hands, ensure device and strips are ready.
- Some models may require calibration before use.
- Use a lancet to prick your finger and place a drop of blood on a test strip.
- Insert the strip into the meter.
- Most meters give results within 2–5 minutes.

BENEFITS

- *Convenience*: Test anytime, anywhere—no clinic visit needed.
- *Speed*: Results typically in minutes.
- *Cost-effective*: Reduces frequent lab visits, saving time and money.
- *Early Detection*: Enables timely lifestyle/medical intervention if levels are abnormal

EXAMPLE

The STANDARD LipidoCare by SD Biosensor is a compact and efficient cholesterol meter, battery-operated device designed for both clinical and home use, offering comprehensive lipid and glucose testing.

Key Features

- *Comprehensive Testing*: Measures Total Cholesterol (TC), Triglycerides (TG), High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), LDL/HDL ratio, non-HDL cholesterol, and blood glucose levels.

- *Minimal Blood Sample:* Requires only 35 µL of blood for a full lipid profile and 10 µL for single tests.
- *Quick Results:* Lipid tests complete in 3 minutes; glucose tests in 5 seconds.
- *User-Friendly Design:* Portable and battery-operated for on-site testing; strips can be stored at room temperature (2–32°C).
- *Memory Capacity:* Stores up to 500 test results for tracking and analysis.

Measurement Ranges:

- *Total Cholesterol (TC):* 100–450 mg/dL
- *Triglycerides (TG):* 45–650 mg/dL
- *HDL:* 25–95 mg/dL
- *Glucose:* 20–600 mg/dL

LIPOPROTEIN APHERESIS

Lipoprotein apheresis is an extracorporeal procedure—similar to dialysis—that removes LDL-cholesterol, lipoprotein(a) [Lp(a)], and other atherogenic particles from the bloodstream. It's primarily reserved for patients with:

- Severe familial hypercholesterolemia (especially homozygous, or heterozygous cases resistant to therapy)
- Elevated Lp(a) with documented cardiovascular disease when standard medications (statins, ezetimibe, PCSK9 inhibitors) are inadequate.

WORKING

1. Venous blood is drawn from the patient.
2. A cell separator isolates plasma from blood cells.
3. The plasma passes through filters or adsorbers. e.g., dextran-sulfate, immunoabsorption, that selectively remove LDL, Lp(a), and related particles
4. The treated plasma and blood cells are then recombined and returned to the patient.
5. A typical session lasts 2–4 hours, repeated every 1–2 weeks for sustained effect

BENEFITS

- Improved endothelial function
- Lower blood viscosity
- Reduced oxidative stress
- Enhanced microvascular perfusion .

LIMITATIONS

- Invasive/time-consuming: Each session requires significant time commitment and vascular access; may impact quality of life and adherence
- Costly: It's an expensive therapy, typically limited to high-risk cases .
- Evidence base: Most clinical support comes from retrospective studies. While event reductions are dramatic, large randomized trials are still needed
- Adjunctive therapy: Apheresis doesn't replace medications—it complements them (statins, ezetimibe, PCSK9 inhibitors), and is used when these are insufficient .

SMART CONTACT LENS

A soft, wireless smart contact lens designed for real-time, non-invasive monitoring of free cholesterol in tear fluid. It embeds:

- An electrochemical cholesterol biosensor (cholesterol oxidase-based)
- A stretchable antenna and NFC chip for wireless communication
- Fully integrated circuitry, all while maintaining optical transparency and comfort.

WORKING

1. **Biosensing:** The lens contacts tear fluid; cholesterol oxidase catalyzes reactions generating measurable electrical signals. Performance is

- highly linear (0–1.2 mM) with high selectivity against tear interferents
2. Wireless transmission: A serpentine antenna transmits data via NFC to a smartphone, no external device needed
3. Real-time readout: A smartphone app receives and displays the wearer's cholesterol levels instantly, hidden beneath the wearer's vision

BENEFITS

- Non-invasive & continuous monitoring
- Hands-free operation—just wear the lens and check the app
- Portable & user-centered—smartphone acts as both power source and display

LIMITATIONS

- Clinical validation needed: Initial results promising, but broader human trials are essential.
- Long-term comfort & safety: Ocular biocompatibility must be confirmed over extended wear.
- Regulatory hurdles: Must meet medical device standards for reliability and safety.

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