RESEARCH DOSAGE MANUAL

# Tirzepatide FlexPen

GIP / GLP-1 Receptor Dual Agonist · 30 mg / 3 ml · Research Grade

*Dual incretin receptor agonist (twincretin) — Manufactured in the Netherlands under cGMP*

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| **INN / Code** | Tirzepatide (LY3298176) |
| **CAS Number** | 2023788-19-2 |
| **Class** | GIP / GLP-1 Receptor Dual Agonist (twincretin) |
| **Molecular Weight** | ~4,813.5 Da |
| **Concentration** | 30 mg / 3 ml cartridge — 10.0 mg/ml |
| **Pen Dose Scale** | 1 unit = 0.01 ml = 0.10 mg \| 10 units = 1 mg \| 25 units = 2.5 mg |
| **Total Pen Doses** | 300 units per cartridge (30 mg total — 2 max-dose injections) |
| **Purity** | ≥ 99.0% HPLC · Endotoxin < 1 EU/mg |
| **Storage** | 2–8 °C · protect from light · do not freeze |
| **Batch / Expiry** | NL-2026-D · Expires 10/2029 |
| **Administration** | Subcutaneous injection (research) |

## 1. Compound Overview

Tirzepatide (LY3298176) is a first-in-class unimolecular dual agonist of the glucose-dependent insulinotropic polypeptide receptor (GIPR) and the glucagon-like peptide-1 receptor (GLP-1R), developed by Eli Lilly. Structurally, it is a 39-amino-acid synthetic peptide based on the native GIP sequence, modified to confer GLP-1R activity and conjugated to a C20 fatty diacid via an Aib-containing linker, yielding a half-life of approximately 116–123 hours (~5 days). This dual pharmacology is termed "twincretin" action, producing metabolic outcomes beyond what either receptor achieves individually.

Phase 3 SURPASS and SURMOUNT trials demonstrated unprecedented weight reduction: mean body weight loss of 15.0–20.9% at 5–15 mg/week over 72 weeks (SURMOUNT-1, Jastreboff et al., NEJM 2022). At 15 mg/week, 57.5% of subjects achieved ≥20% weight reduction—surpassing semaglutide 2.4 mg in direct comparison (SURMOUNT-5, 2024). Tirzepatide also produced significant improvements in HbA1c, hepatic steatosis (NASH), obstructive sleep apnoea, and cardiometabolic risk markers.

## 2. Mechanism of Action

Tirzepatide's dual receptor profile produces synergistic metabolic effects through complementary but distinct signalling pathways in adipose, pancreatic, hepatic, and neural tissue:

- **GIP receptor agonism:** GIPR activation in adipose tissue stimulates lipolysis and fatty acid utilisation, reduces lipotoxicity in peripheral tissues, and enhances insulin sensitivity in skeletal muscle. GIP receptor signalling in the CNS modulates hedonic feeding and reward circuitry, complementing GLP-1R-mediated homeostatic satiety.
- **GLP-1 receptor agonism:** GLP-1R activation in the hypothalamic arcuate nucleus and area postrema suppresses appetite and food intake; slows gastric emptying to prolong satiety; and potentiates glucose-dependent pancreatic insulin secretion while inhibiting glucagon release.
- **Synergistic twincretin effect:** Co-activation of GIPR and GLP-1R produces weight loss and glycaemic outcomes substantially exceeding those of GLP-1R agonists alone at equivalent doses, driven by complementary central and peripheral mechanisms.
- **Adipose tissue remodelling:** GIPR-driven upregulation of adiponectin and downregulation of pro-inflammatory adipokines (leptin, resistin, IL-6) improves the adipose secretome and reduces systemic low-grade inflammation.
- **Hepatic lipid clearance:** Combined GIPR/GLP-1R activation reduces hepatic de novo lipogenesis and promotes beta-oxidation, producing clinically significant reductions in intrahepatic fat in NASH research models.

## 3. FlexPen Operating Instructions

The VitalPep Pro FlexPen is a reusable multi-dose injection pen pre-filled with Tirzepatide (30 mg / 3 ml). Each unit on the dose dial delivers exactly 0.01 ml (10 µl) of solution. The pen accepts standard 31-gauge or 32-gauge pen needles (4–8 mm). Follow the steps below before every injection.

■ **Step 1 — Prepare the pen**

Remove the pen cap. Inspect the cartridge window: the solution should be clear and colourless. Do not use if particulates are visible or if the solution appears cloudy or discoloured. Attach a new sterile pen needle by screwing it clockwise until firmly seated. Remove both the outer and inner needle caps and set aside.

■ **Step 2 — Prime the needle**

Select 2 units on the dose dial by turning the dial clockwise. Point the pen needle upward and tap the cartridge gently to collect any air bubbles at the top. Press the injection button fully until it clicks and a small stream (or droplet) appears at the needle tip. Repeat if no flow is seen. Priming removes air and confirms the pen is working correctly.

■ **Step 3 — Set your dose**

Dial your required dose by turning the dose selector clockwise. For example, to inject 2.5 mg, dial to 25 units; for 5 mg, dial to 50 units; for 15 mg, dial to 150 units. The current dose is displayed in the dose window. You can turn anti-clockwise to reduce the dose before injecting — the pen will not dispense solution while dialling.

■ **Step 4 — Choose the injection site**

Subcutaneous injection sites: abdomen (at least 5 cm from the navel), outer thigh, or upper arm. Rotate sites with each injection to avoid lipohypertrophy. Wipe the skin with an alcohol swab and allow to air-dry for 10 seconds before injecting.

■ **Step 5 — Inject**

Pinch a fold of skin with two fingers. Insert the needle at a 45–90° angle (use 90° for a 4 mm needle, 45° for longer needles). Press the injection button slowly and firmly until it stops. Hold the button down and count to 10 seconds before withdrawing — this ensures full dose delivery and prevents backflow.

■ **Step 6 — Withdraw and recap**

Withdraw the needle at the same angle it was inserted. Do not rub the injection site. Replace the outer needle cap using the one-hand scoop method, then unscrew and safely dispose of the used needle in a sharps container. Replace the pen cap. Never store the pen with the needle attached.

■ **Step 7 — Storage after use**

Store the pen at 2–8 °C (refrigerated) when not in active use. Do not freeze. The pen may be kept at room temperature (up to 25 °C) for a maximum of 28 days during an active dosing cycle. Record the date of first use on the pen label.

■ **Always use a new sterile needle for each injection. Sharing pens or needles poses a serious infection risk. The cartridge is pre-filled and sealed — do not attempt to refill or modify the pen.**

## 4. Research Dosing Protocol

**Concentration** 10.0 mg/ml — 1 unit on the pen dial = 0.01 ml = 0.10 mg | 10 units = 1 mg | 25 units = 2.5 mg | 150 units = 15 mg

Tirzepatide is administered once weekly by subcutaneous injection. The escalation schedule below mirrors the SURPASS and SURMOUNT Phase 3 trial protocols and the standard reference framework at peptidedosages.com. Slow stepwise escalation is essential — tirzepatide produces pronounced gastrointestinal effects at higher dose tiers without adequate prior adaptation.

### Weekly Dose Escalation Schedule

| Phase | Weeks | Weekly Dose | Units to Dial | Volume (ml) | Frequency |
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| Initiation | 1–4 | 2.5 mg | 25 units | 0.25 ml | Once weekly |
| Escalation 1 | 5–8 | 5.0 mg | 50 units | 0.50 ml | Once weekly |
| Escalation 2 | 9–12 | 7.5 mg | 75 units | 0.75 ml | Once weekly |
| Escalation 3 | 13–16 | 10.0 mg | 100 units | 1.00 ml | Once weekly |
| Escalation 4 | 17–20 | 12.5 mg | 125 units | 1.25 ml | Once weekly |
| Maintenance | 21+ | 15.0 mg | 150 units | 1.50 ml | Once weekly |

**Pen longevity:** At 15 mg/week maintenance (150 units), the 30 mg cartridge provides 2 weekly doses per pen. At the 2.5 mg initiation dose (25 units), the cartridge provides 12 weekly doses. Plan pen procurement against the escalation schedule.

**Dose day:** Choose a consistent weekly injection day. Administer on the same day each week. If a dose is missed by more than 4 days, skip and resume on the next scheduled day without doubling.

**■ Tirzepatide causes pronounced dose-dependent nausea, vomiting, and diarrhoea in research models, particularly at higher dose tiers. Do not skip escalation steps. If GI effects persist at a given dose level, remain at that dose for an additional 2–4 weeks before escalating. Never exceed 15 mg per weekly injection (150 units).**

**■ Monitor pancreatic enzyme levels (lipase, amylase) during extended research protocols. GIP and GLP-1 receptor dual agonism may affect exocrine pancreatic function at high dose levels. Discontinue and evaluate immediately if acute pancreatitis symptoms are observed.**

## 5. Storage & Handling

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| **In-use storage** | Up to 25 °C for a maximum of 28 days during active dosing cycle |
| **Between-use** | 2–8 °C (refrigerated) · do not freeze |

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| **Light protection** | Keep pen cap on at all times when not injecting |
| **Inspection** | Solution must be clear, colourless, and free of particles |
| **Expiry** | Do not use after printed expiry or 28 days post first puncture |

## 6. Key References

Jastreboff AM et al. (2022). Tirzepatide Once Weekly for the Treatment of Obesity. N Engl J Med. 387(3):205–216.

Frias JP et al. (2021). Tirzepatide versus Semaglutide Once Weekly in Patients with Type 2 Diabetes. N Engl J Med. 385(6):503–515.

Del Prato S et al. (2021). Tirzepatide versus insulin glargine in type 2 diabetes and increased cardiovascular risk (SURPASS-4). Lancet. 398(10313):1811–1824.

Wadden TA et al. (2023). Tirzepatide for Sustained Weight Reduction in Adults with Obesity (SURMOUNT-3). Nat Med. 29:2687–2694.

peptidedosages.com — Tirzepatide average research dosing protocols (accessed 2026).