

 **one is enough**
Resyao-ONE Inj.
DVS(Divinyl sulfone) cross-linked hyaluronic acid

Product name is derived from a word “**re-synovia**”
which means it restores the damaged lubrication of the knee joint.

Generational change of the HA injection



1st generation

5 week injection

- Once a week for 5 times
- M.W: 1million Da
- Easy injection, Lubrication
- Low viscosity, Fast absorption
- Atri / Hyruan

2nd generation

3 week injection

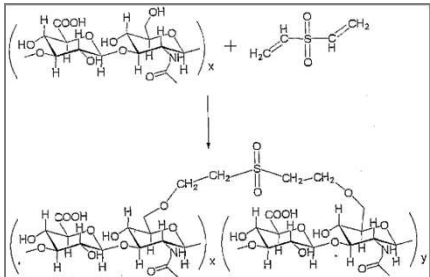
- Once a week for 3 times
- M.W: 3million Da
- High viscosity & Lubrication
- Extended lubrication
- Atri Plus/ Hyruan Plus

3rd generation (Now)

Monotherapy

- Only one time, lasting 6months
- Maximization of M.W by chemical crosslinking
- Extended degradation period, Long-lasting lubrication characteristics
- Resyno-one/ Synovian

Brief summary of Resyno-one®

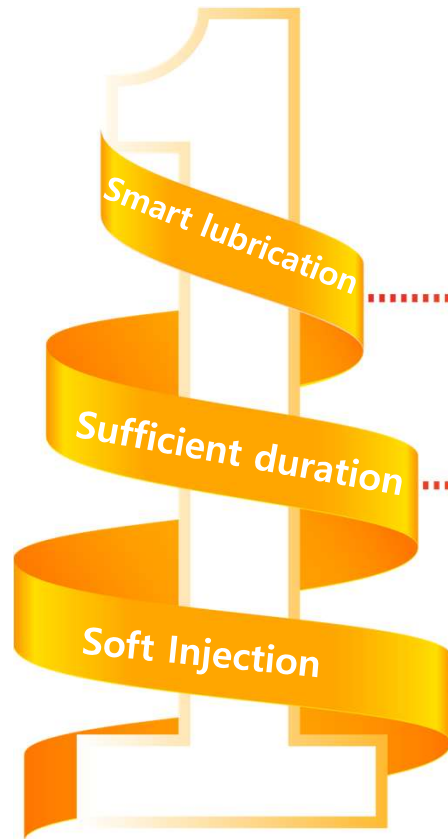


Composition	4:1 w/w mixed hydrogel of sodium hyaluronate gel crosslinked by divinyl sulfone and sodium hyaluronate fluid 2.0 g (as Sodium Hyaluronate 40mg) 2mL
Formulation	Pre-filled syringe (with needle 23G)
Indication	Treatment of Osteoarthritis of the knee
Dosage and Administration	The product is injected in to the knee joint and is administrated as a single intra-articular injection.
Manufacturer	YooYoung Pharmaceutical Co., Ltd.
Approval/Launching	Approval_2020. 10. 30 Launching in Korea_2021. 5 (Expect)
Features	<ul style="list-style-type: none"> - Soft injection force and continuos lubrication by mixed cross-linked HA gel and natural HA fluid. - Unique property Hydrogel through cross-linking techonology using DVS.

Resyno-one[®]

– 3S characteristics

3S characteristics of Resyno-one®



01.

Smart lubrication

-Immediate & continuous lubrication is possible.

02.

Sufficient duration

-It stays stably at the injection site.

03.

Soft Injection

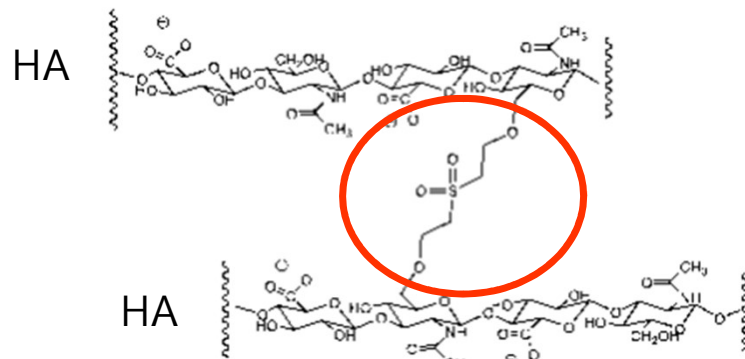
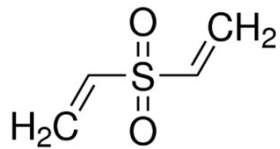
- It is injected softly.

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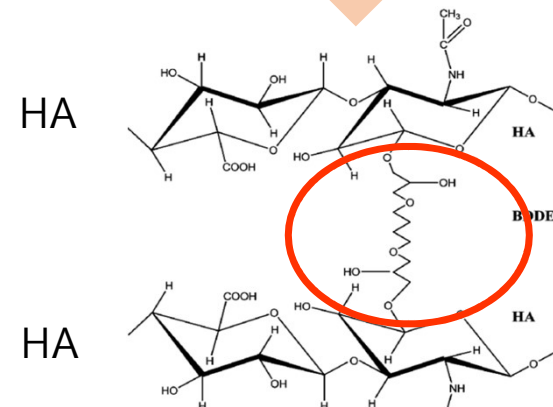
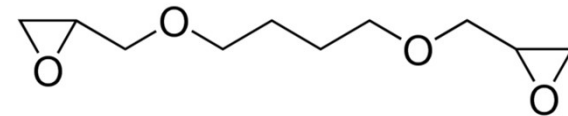
*CF : DVS vs. BDDE_ Chemical structure and Cross-linked form



✓ DVS(divinyl sulfone)



✓ BDDE(1,4-Butanediol diglycidyl ether)

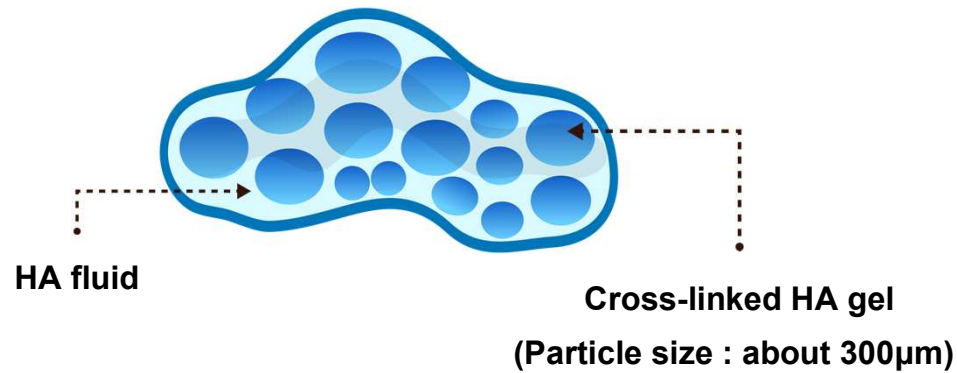


3S – 1. Smart lubrication - Composition

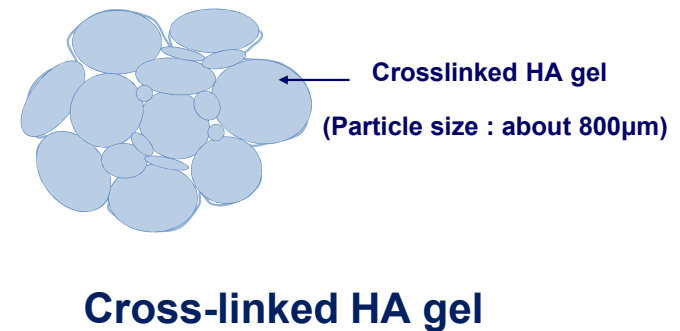


✓ Mixed gel of HA fluid and cross-linked HA gel

Resyno-one



BDDE cross-linked HA



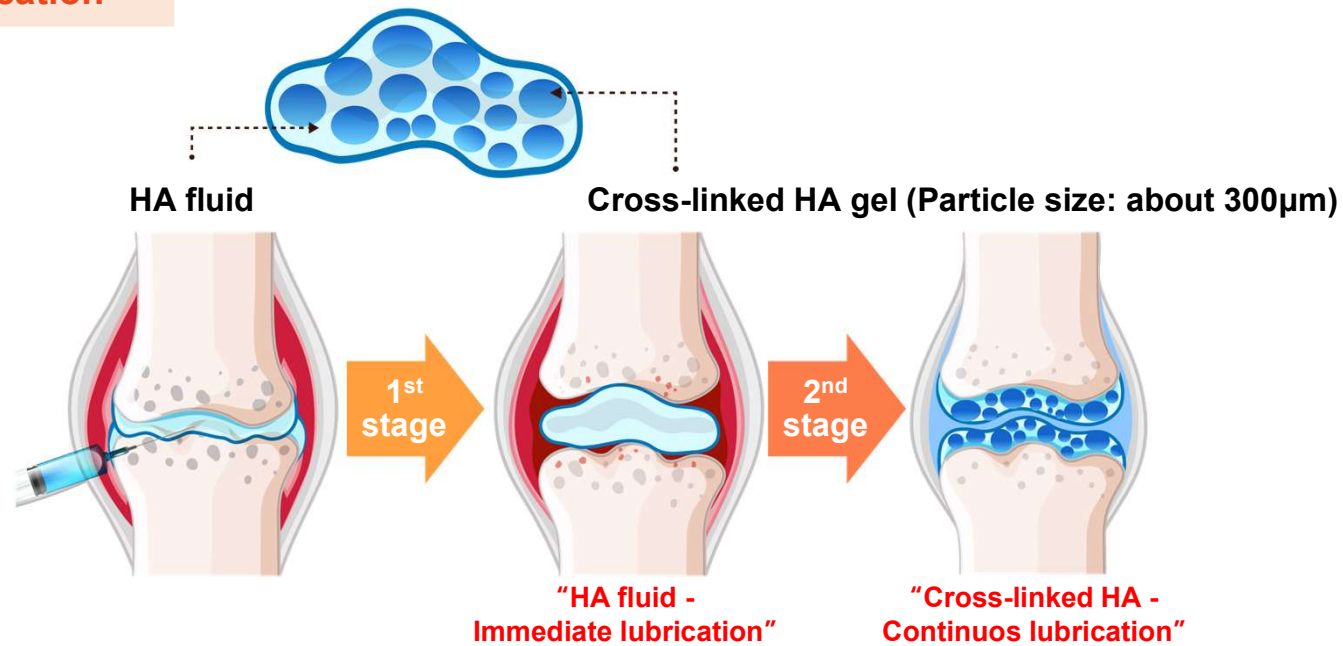
Other monotherapies include only crosslinked HA gels,
but Resyno-one includes mixed gel of natural HA fluid and crosslinked HA gels.

3S – 1. Smart lubrication

- Lubrication mechanism



✓ Resyno-one Lubrication

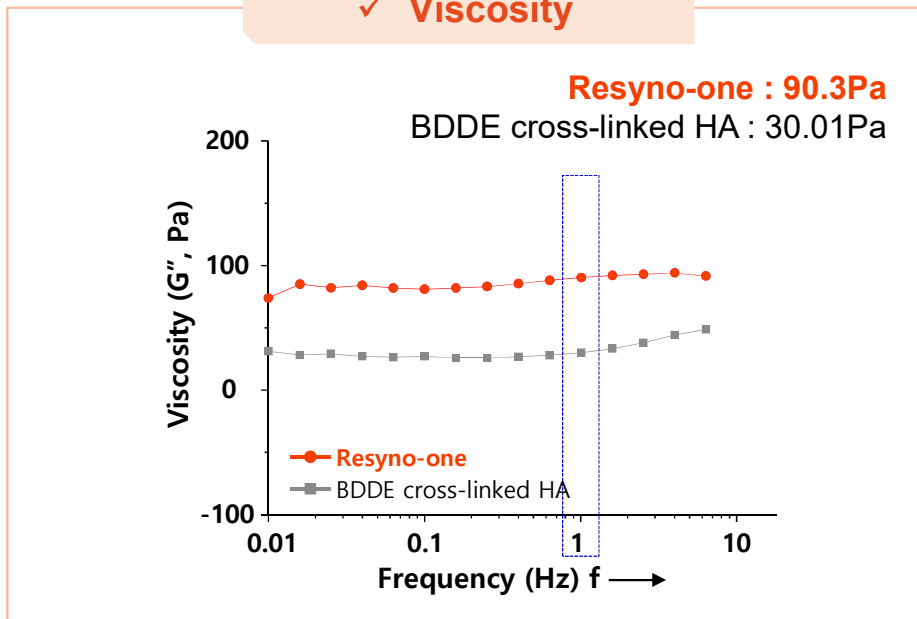


As Resyno-one includes mixed gel of crosslinked HA gel and natural HA fluid, natural gel shows immediate effect and crosslinked HA gels shows long lasting effect.

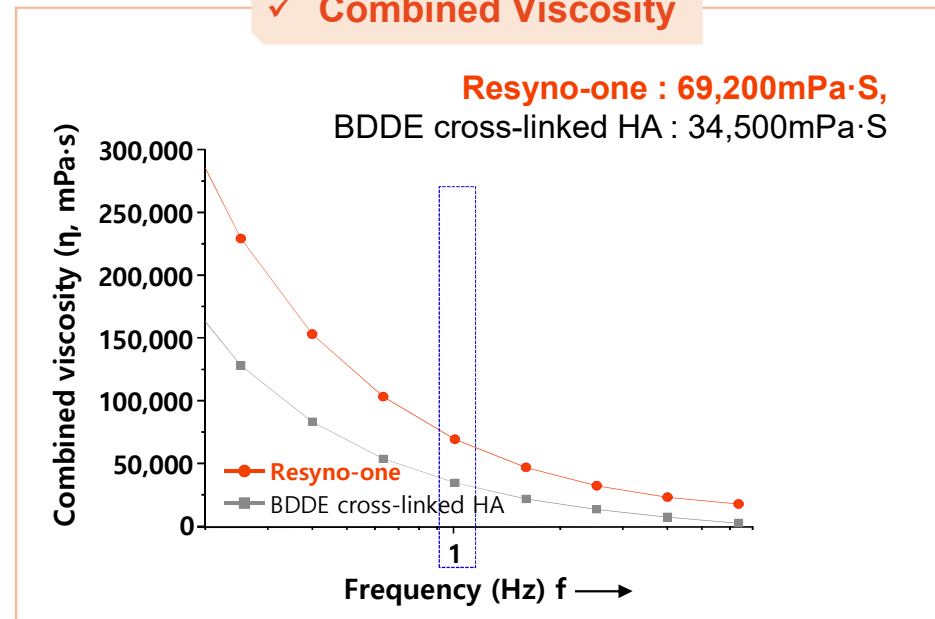
3S – 1. Smart lubrication - Rheological behavior



✓ Viscosity



✓ Combined Viscosity



In addition, Resyno-one has a higher viscosity than other Monotherapies, so it is located stably in the joint cavity and shows immediate and continuous lubrication.

3S – 1. Smart lubrication - Anti-inflammatory effect



[Study] Efficacy in rabbit study (13-700-3)

1) Group

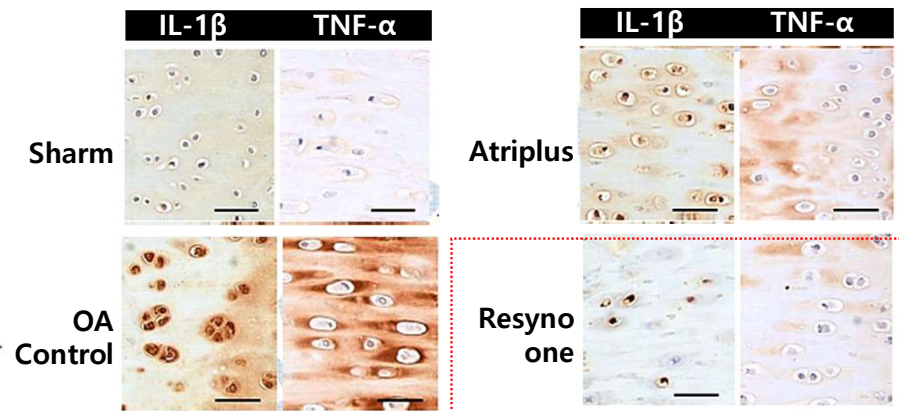
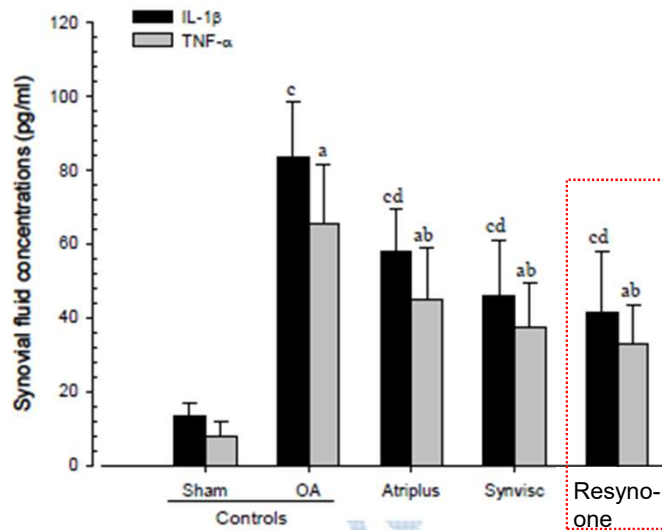
- Sham control : Sham operated + Saline injection
- OA control: OA operated + Saline injection
- Atriplus : OA operated + Atriplus
- Synvisc : OA operated + Synvisc
- Resyno-one : OA operated + Resyno-one

2) Study Period

Osteoarthritis(OA) induced after 5weeks.

3) Analysis

- change on knee thickness, maximum extension angles, Inflammatory cytokines (IL-1 β , TNF- α) Assay, X-ray, Histopathological femur and tibia articular cartilage profile.

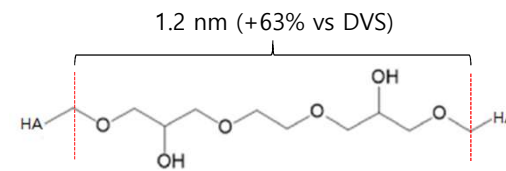
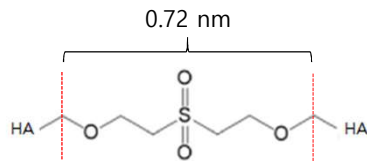
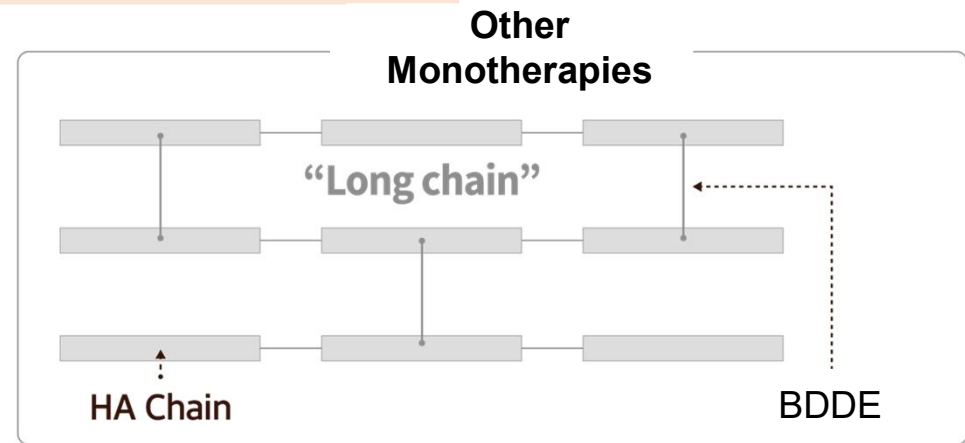
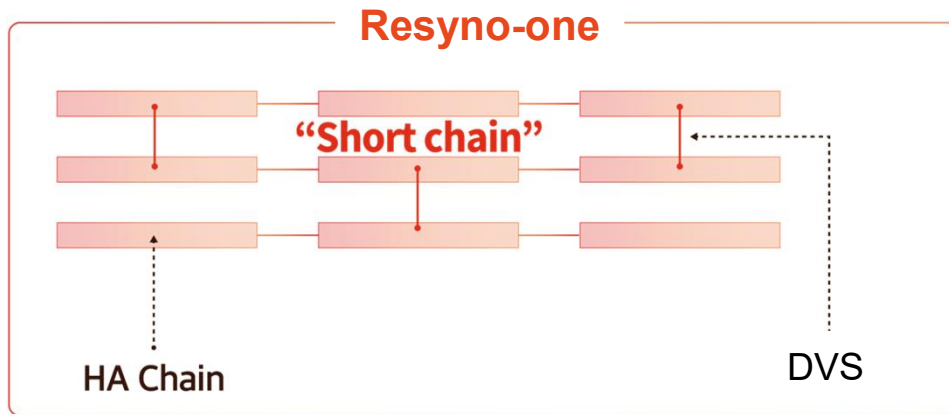


Resyno-one effectively inhibits osteoarthritis.

3S – 2. Sufficient duration - HA gel structure



✓ Resyno-one is structurally well-packed form → Increased in vivo stability



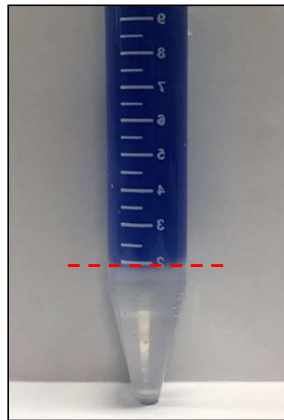
Resyno-one is structurally well-packed form compared to other monotherapies, so it increases in vivo stability.

3S – 2. Sufficient duration - HA gel density and elasticity



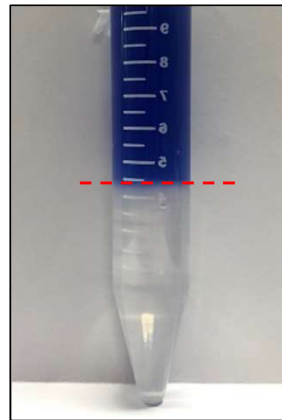
✓ Density

Resyno-one



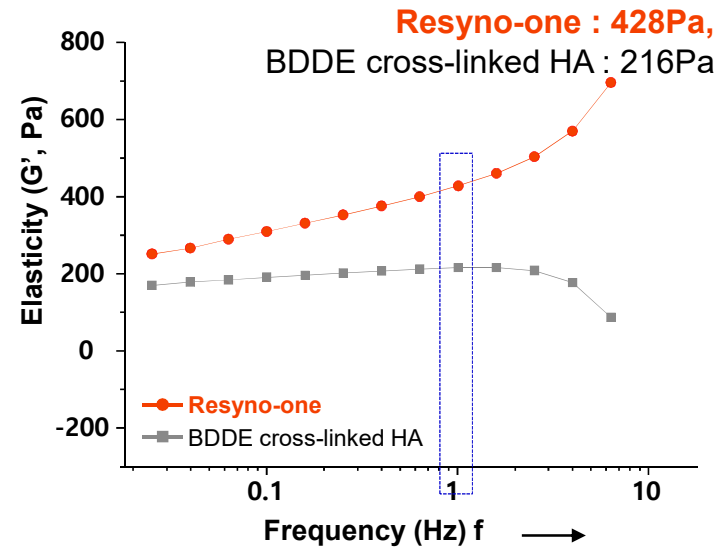
219%

BDDE cross-linked HA



419%

✓ Elasticity



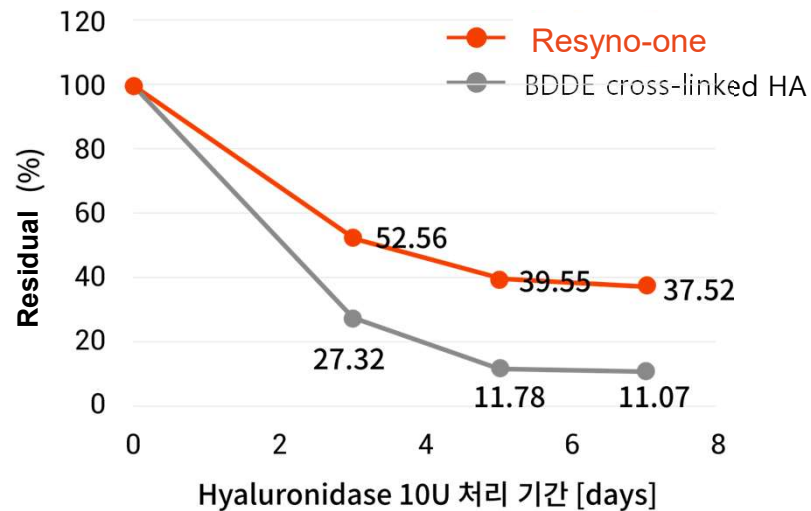
Resyno-one proves a structurally well-packed form compared to other monotherapies in the density and elasticity evaluation.

3S – 2. Sufficient duration - Degradation & Elimination



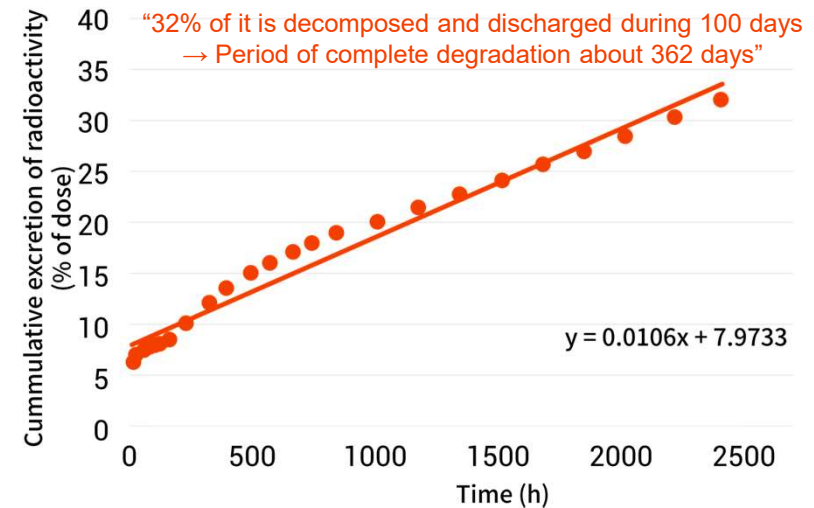
✓ Degradation

Model for evaluating typical degradation properties of Cross-linked HA formulations



✓ Elimination

Single Intra-articular administration



It was confirmed that Resyno-one remained stable compared to other monotherapies through the enzymatic degradation test and in-vivo degradation characteristics test.

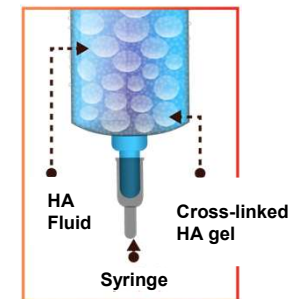
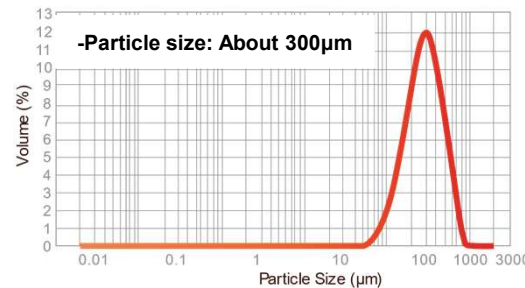


3S – 3. Soft injection

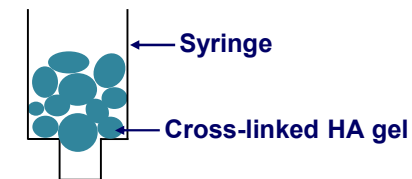
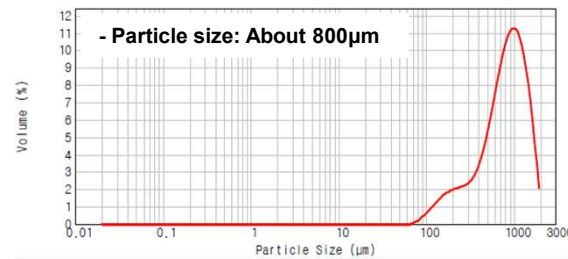
- HA gel particle size control

✓ Uniform particle size

Resyno-one



BDDE cross-linked HA



“Clogging → Irregular injection pressure occurred”

Resyno-one's particle size is about 300μm, which is smaller than other monotherapies.

3S – 3. Soft injection - Even injection force



✓ Soft& even injection force → Easy to inject

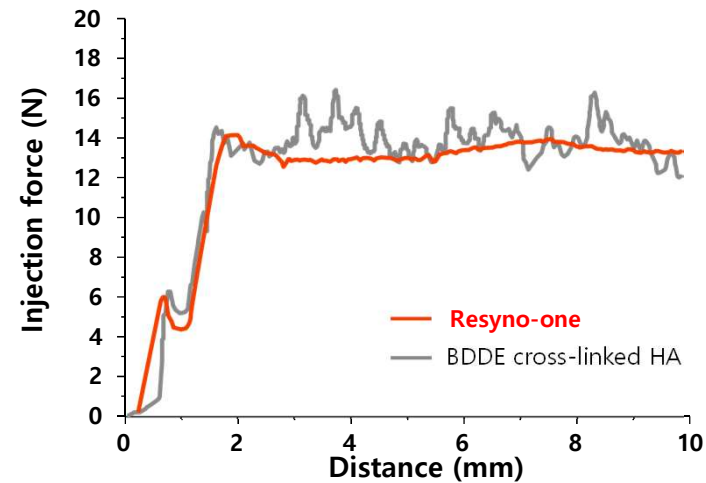
BDDE cross-linked HA



Resyno-one



- Injection speed : 13mm/min
- Needle Gauge : 23G

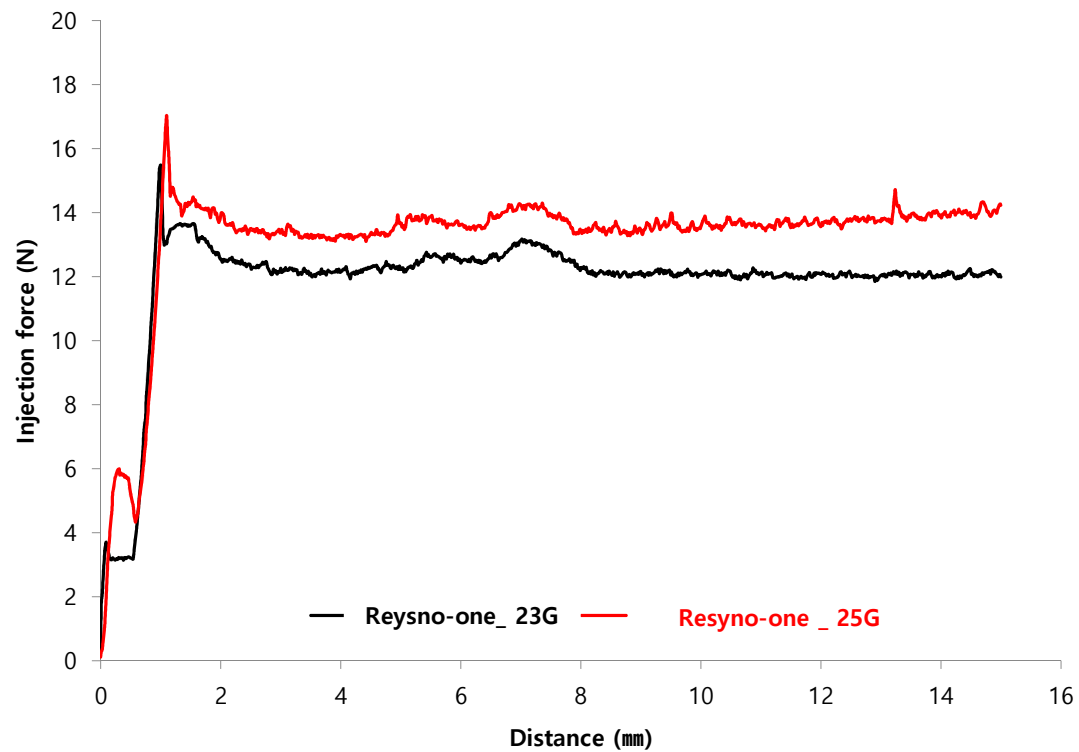


The particles of the Resyno-one are small and uniform, so it is softly injected and the injection amount is constant.

3S – 3. Soft injection - Suitable to a thinner needle



✓ 25G needle applicable → Reduced pain



Product comparison



Resyno-one is a knee joint injection for improving OA symptoms that achieves ease of treatment (Needle, Amount of injection), immediate effect (Natural HA), long lasting effect(HA gel), and maximization of intra-joint cushion effect (Viscoelasticity) at the same time.

Product name	Resyno-One (YooYoung)	Synvisc One (Sanofi-aventos)	Durolane (Q-med AB)	Synovian (LG life science)
Active ingredient	DVS crosslinked HA gel (80 wt%) + natural HA (20 wt%)	Hylan B (20 vol%)* + Hylan A (80 vol%)**	BDDE crosslinked HA gel	BDDE crosslinked HA gel
Composition	40 mg/2 ml (2 w/v%)	48 mg/6 ml (0.8 w/v%)	60 mg/ 3 ml (2 w/v%)	60 mg/3 ml (2 w/v%)
Source	Streptococcus equi.	Chicken comb	Streptococcus equi.	Streptococcus equi.
Volume	2 ml	6 ml	3 ml	3 ml
Syringe	Glass lure lock/ 3 ml	Glass lure lock/ 10 ml	Glass lure lock	Plastic lure lock
Needle gauge	23G	Non	Non	21G
Needle gauge (Recommended)	23G, 25G	18~22G	18 ~ 20G	21G
Crosslinking agent	Divinyl sulfone (DVS)	Divinyl sulfone (DVS)	1,4-butanediol diglycidylether (BDDE)	1,4-butanediol diglycidylether (BDDE)
Viscosity (2.5 Hz)	G': 500~600 Pa G'': 100~110 Pa	G': 100~120 Pa G'': 20~30 Pa	G': 500~600 Pa G'': 60~70 Pa	G': 100~200 Pa G'': 50~60 Pa

* Hylan B: HA gel crosslinked with DVS

** Hylan A: water solution including modified HA showing enlarged molecular weight(5~6 MDa) than natural HA(1~3 Mda). A crosslinker, DVS is introduced as a chain extender.

Summary



Resyno-one has 3S(Soft lubrication, Sufficient duration, Soft injection) characteristics !!!

1) Smart Lubrication

Resyno-one shows continuous smooth lubrication characteristics through the immediate effect of natural HA and long lasting effect of crosslinked HA gel.

2) Sufficient Duration

It exhibits a “well-packed” crosslinked structure which increases the resistance of degradation and improves the in vivo duration.

3) Soft Injection

The lubrication properties of natural hyaluronic acid and the uniform particle size of crosslinked hyaluronic acid show a constant and smooth injection force.



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THANK YOU