



A Role For Tannic Acid In Restoring Elastogenesis Impaired By Common Aesthetic Agents

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Background

- Aesthetic management of aging skin relies on precise extracellular matrix (ECM) homeostasis to maximize youthful resilience, fullness, and elasticity while mitigating risk of dermal fibroses.
- Elastogenesis is critical to this.
- Currently, several 'natural agents' - growth factors, vitamins C and D3, hyaluronic acid (HA), and ferulic acid (FA) - are marketed to augment aesthetic outcomes in plastic surgery
- These agents carry pleiotropic effects on ECM homeostasis and with some hindering elastic fiber formation while promoting fibrosis.
- Our team has demonstrated the benefit of tannic acids (TAs) to protect new elastic fibers from degradation.

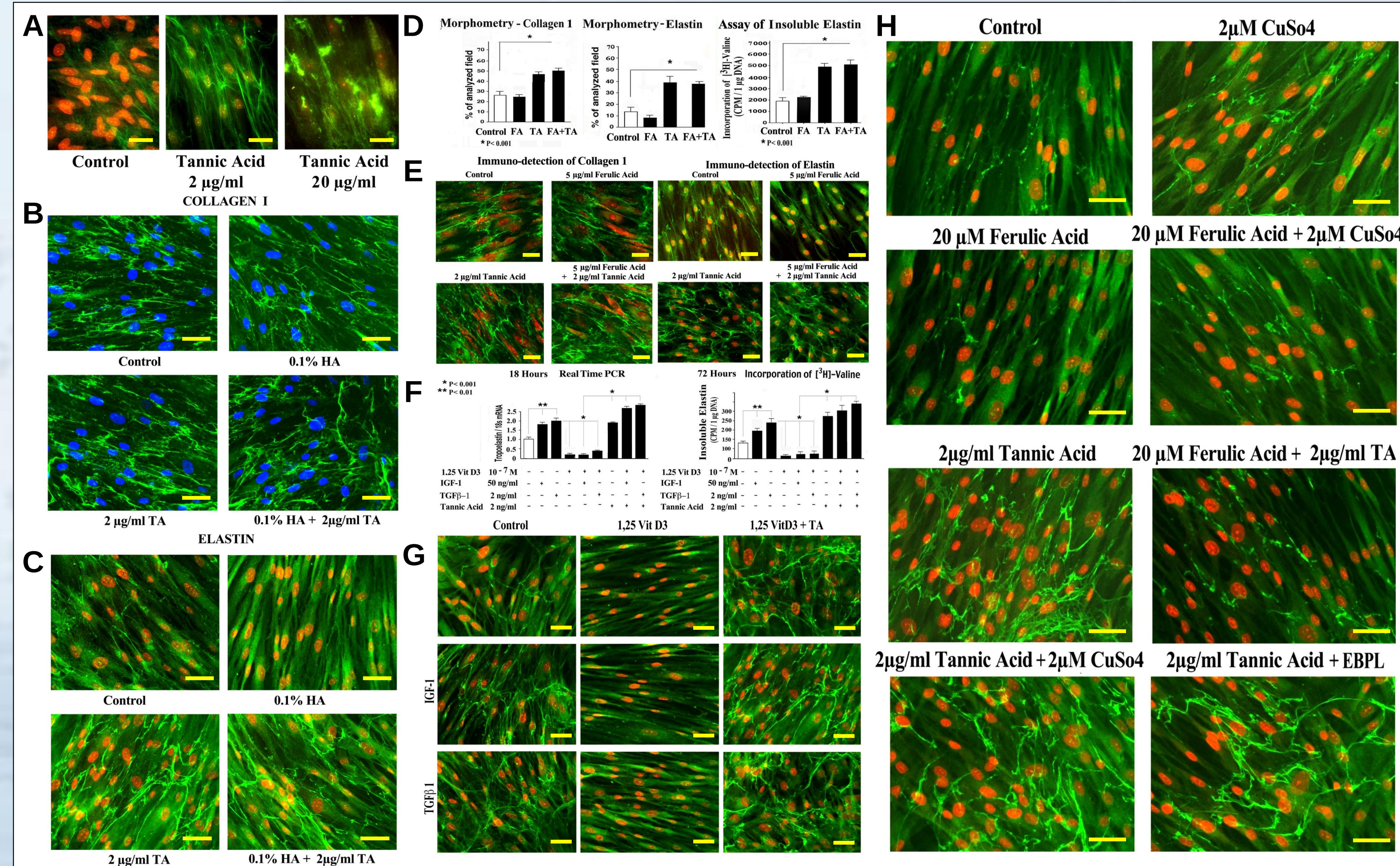
Aims

- Here we sought to assay these agents with or without TAs to evaluate for ECM modifications.

Methods

- In vitro evaluation of:
 - a) dermal fibroblast culture from skin biopsy, female (n=3)
- Parallel culture was maintained in the presence or absence of tannic acid (TA) at 2.0 and 20.0 uM (Fig A)
- Samples treated with Vitamin D3, Hyaluronic Acid (HA) (0.1%), and Ferulic Acid (FA) (20 uM), or CUSO4 (2 uM).
- Stimulation assay with IGF-1 and TGFbeta-1.
- Immunofluorescence for Collagen 1 and/or Elastin. Assessed by Morphometry per High-Power Field, Real-Time PCR, and Insoluble Elastin Production.

Data



Results

- 20 micro-molar TA in parallel cultures led to irregular elastin aggregates, causing widespread elastosis.
- Vitamins D3, and HA boosted collagen synthesis but suppressed elastic fiber formation, while FA suppressed all ECM.
- Introducing 2 micro-molar TA to cultures reinstated regular elastic fiber synthesis, as well as improving collagen-1 synthesis in FA and Vitamin D-treated samples under control, IGF-1, and TGFbeta-1 stimulation.

Figure Legends

- Immunofluorescence of dermal fibroblasts from human skin at low and high dose of Tannic Acid (TA). (Green) Elastin (Red) PI.
- Immunofluorescence of dermal fibroblasts after control or treatment with Hyaluronic Acid (HA) and/or Ferulic Acid (FA). (Green) Collagen 1; (Blue) DAPI.
- Immunofluorescence of dermal fibroblasts after control or treatment with Hyaluronic Acid (HA) and/or Ferulic Acid (FA). (Green) Elastin; (Red) PI.
- Dermal fibroblasts after control or treatment with Hyaluronic Acid (HA) and/or Ferulic Acid (FA). (left) Collagen 1 morphometry per high power field. (middle) Elastin morphometry per high power field. (right) Insoluble elastin assay via incorporation of [³H]-Valine into insoluble Elastin at 72 hours. * = p<0.001.
- Immunofluorescence of dermal fibroblasts after control or treatment with Tannic Acid (TA) and/or Ferulic Acid (FA). (Left, Green) Collagen 1; (Right, Green) Elastin; (All, Red) PI.
- Treatment of Dermal Fibroblasts with control, Vitamin D, IGF-1, TGFbeta-1, Tannic Acid. (left) Real Time PCR for Topoelastin mRNA at 18 hours. (right) Incorporation of [³H]-Valine into insoluble Elastin at 72 hours. * = p<0.001; ** = p<0.01.
- Immunofluorescence of dermal fibroblasts after control or treatment with Vitamin D (1,25 Vit D3) with or without Tannic Acid (TA). Co-Culture with Control (top row), IGF-1 (middle row), TGFbeta1 (bottom row). (Green) Elastin (Red) PI.
- Immunofluorescence of dermal fibroblasts after control or mono-treatment/co-treatment with CuSo4, Tannic Acid (TA), Ferulic Acid (FA) an/or EBPL. (Green) Elastin (Red) PI.

Conclusions

- Elastin and Collagen stimulation/ inhibition do not directly correlate across Vitamin D3, HA, and FA.
- TA in micro-molar levels can counteract the elastin inhibitory effects of Vitamin D3, HA, and FA.
- This potentially elucidates both the poor survival of fat grafts in HA-rich regions and identified a role for TA.