A New Approach for Identifying Fracture Risk from a Standard Digital Radiograph

The Gap in Osteoporosis Diagnosis

An estimated 85,000 people per year are currently missing out on therapy for osteoporosis[1].

IBEX Trueview® software aims to improve patient outcomes [2] and reduce healthcare costs through increased identification of patients at risk of fracture, to enable intervention at or before the point of first fracture.

Opportunistic Fracture Risk Prediction from Digital Radiographs

IBEX Trueview® uses a combination of physics and AI to provide a measurement of projected bone thickness from standard digital radiographs.

The Trueview output is correlated to DXA-derived areal bone mineral density (aBMD) and, therefore, can be combined with other risk factors such as age, gender, and medical history to derive a 10-year risk of fracture.

As the technique can be performed opportunistically, a patient's inferred 10-year fracture risk can be used to support clinical decision making, for example, by more effective triage of patients into the rheumatology care pathway.
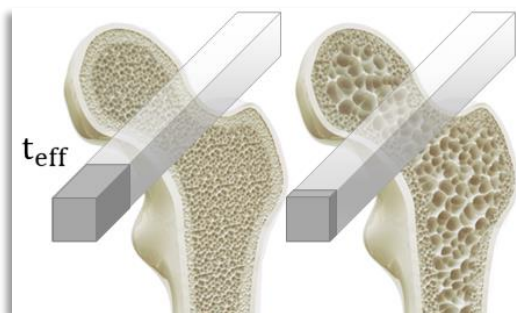

Illustration of the primary output from IBEX Trueview software which is a measure of the projected thickness of bone t_{eff}. Shown here for a healthy and osteoporotic femoral neck respectively (left and right).
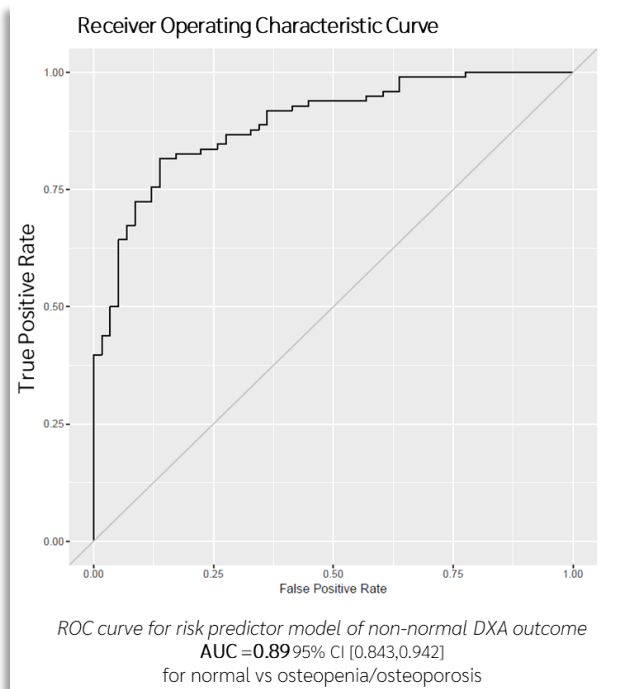
Evidence

Phantom studies demonstrate excellent correlation between Trueview projected bone thickness and CT-derived ground truth, to a level comparable to DXA aBMD.
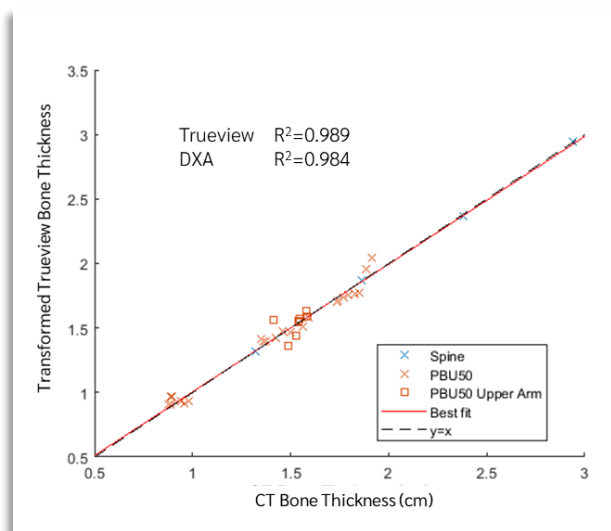
Trueview projected bone thickness demonstrates a strong correlation to both CT ground truth and DXA aBMD.

A Horizon 2020 funded in-vivo study on the Neck of Femur (NoF) demonstrated an AUC of 0.89 with 95% CI [0.84, 0.94] for a non-normal DXA outcome.

Receiver Operating Characteristic Curve

ROC curve for risk predictor model of non-normal DXA outcome
AUC =0.89 95% CI [0.843,0.942]
for normal vs osteopenia/osteoporosis

An additional clinical study is in progress to support CE marking and product adoption from 2022.

NHS and Patient Benefits

Trueview provides the opportunity to increase case finding and improve decision support for osteoporosis treatment across the UK.

Osteoporosis services are becoming more stretched as a result of an ageing population and the situation has been exacerbated by the COVID-19 pandemic, which saw the majority of osteoporosis services ceasing activity on or before lockdown commenced on 23rd March 2020[3].

A Health Economics model, audited by York Healthcare Economics Consortium, evidences the effectiveness of introducing Trueview as a decision support tool into the current care pathway.

Probabilistic sensitivity analysis (PSA) shows reduced healthcare provider costs and improved quality adjusted life year (QALY) benefits in 99% of potential scenarios, with even the most pessimistic interpretation falling well within the NHS cost effectiveness threshold.

Taking the centre value of the PSA would indicate a £2bn cost saving and 368,000 quality adjusted life years across the NHS over 20 years.

Clinical Use

IBEX Trueview® automatically identifies a region of interest to return a prediction of the 10-year risk of fracture on compatible scans. This bone health output can be presented on screen to the radiographer and sent to PACs for inclusion in the radiologist's report.

The aim is to provide seamless integration into clinical workflow, with results available to clinicians within seconds of capturing the digital radiograph.

Conclusion

Once in widescale use, opportunistic identification of fracture risk with Trueview is expected to deliver:

- More patients correctly identified at an earlier stage of disease progression.

- Greater awareness of bone health within the NHS.

In conclusion, Trueview provides decision support to clinicians to ensure

that those at highest risk of fracture are identified and can be offered effective follow up.

This has enormous potential to improve patient outcomes and reduce the ballooning cost of fractures within our growing and ageing population.

For more information, visit our website, https://ibexinnovations.co.uk, or get in touch at enquiries@ibexinnovations.co.uk.

References

[1] - The Royal Osteoporosis Society, "85,000 people with osteoporosis in England are missing out on the drug treatments they need," 18 August 2021. [Online]. Available: https://theros.org.uk/latest-news/2021-08-18-85-000-people-with-osteoporosis-in-england-are-missing-out-on-the-drug-treatments-they-need/. [Accessed 23rd September 2021]

[2] – R. Dimitriou, G. M. Calori, and P. V. Giannoudis, "Improving patients' outcomes after osteoporotic fractures" 2012 [Online]. Available: https://www.openaccessjournals.com/articles/improving-patients-outcomes-after-osteoporotic-fractures.pdf

[3] – The Royal Osteoporosis Society, "Written evidence submitted by the Royal Osteoporosis Society (DEL0233)" May 2020 [Online]. Available: https://committees.parliament.uk/writtenevidence/4575/pdf/ [Accessed 25th September 2021]