Precision redefined: A digital end-to-end full-arch rehabilitation

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Digital technologies have transformed implant dentistry by enhancing diagnosis, treatment planning and surgical simulation through 3D visualisation.[1] Within this context, the ultimate goal of a definitive impression or scan is to accurately capture the 3D position of the implant in relation to adjacent hard and soft tissue as well as the opposing dentition.[2]

Although it requires investment in an intra-oral scanner, software and ongoing maintenance, the digital workflow offers higher productivity and cost-effectiveness compared with conventional methods.[4] One of its main advantages is greater patient satisfaction, since intra-oral scanning provides superior convenience compared with physical impression taking.[3] Intra-oral scanning eliminates the need for trays, impression materials, disinfection and shipping, simplifies laboratory steps such as pouring and trimming models, and allows secure digital storage, avoiding the fragility and space demands of stone casts.[5]

Clinical factors such as implant angulation and scanning strategy can further influence accuracy.[7] Increased distances between implants enlarge the scanning area, requiring more image stitching and thereby reducing

Fig. 1: Initial clinical situation.

Fig. 2: Initial clinical situation with the maxillary denture in place.

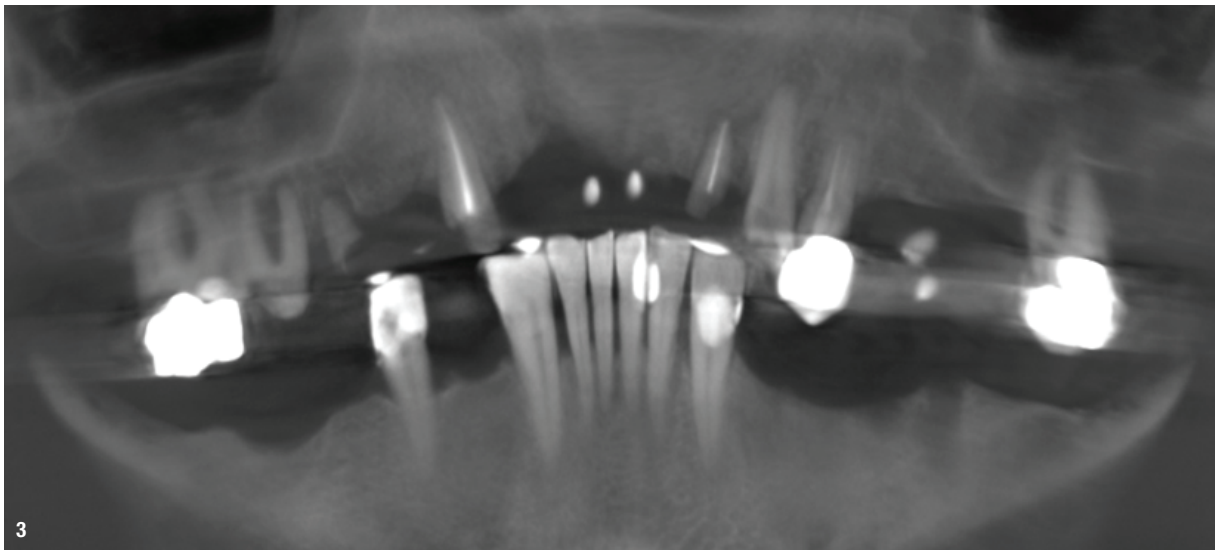

Fig. 3: Initial radiographic view.

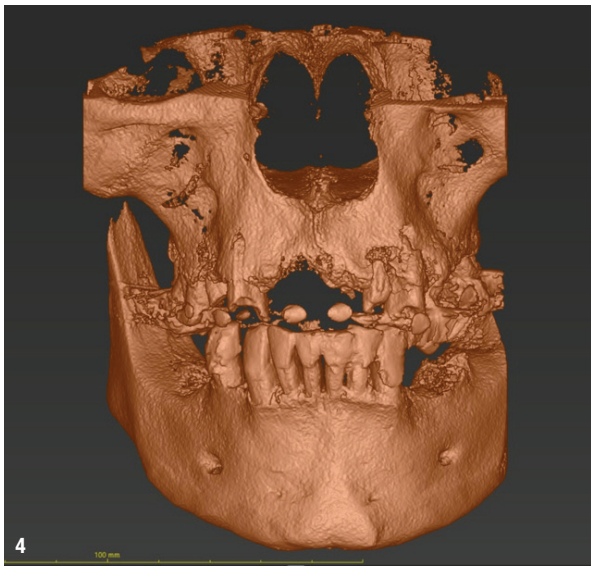

Fig. 4: CBCT scan for implant planning.

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accuracy.[8] In addition, some areas of scan bodies—especially screw access holes and proximal surfaces—are often incompletely captured, and this may compromise superimposition and processing.[9] Despite these limitations, studies indicate that deviations between full-arch intra-oral scans and conventional impressions generally remain within clinically acceptable thresholds.[10–12]

Within the digital workflow, obtaining highly accurate impressions remains a critical step, because precision directly affects the passive fit of implant-supported frameworks, which in turn determines the definitive treatment outcome.[13] Passive fit between prosthetic structures and supporting implants is widely recognised as a key determinant of long-term success, since inadequate fit may lead to mechanical complications such as screw loosening, fracture or prosthesis failure.[14] Although vertical and horizontal misfit within certain tolerances may not result in biological complications, mechanical outcomes appear to be more sensitive to misfit.[15] For this reason, passivity continues to be a decisive factor in the clinician's

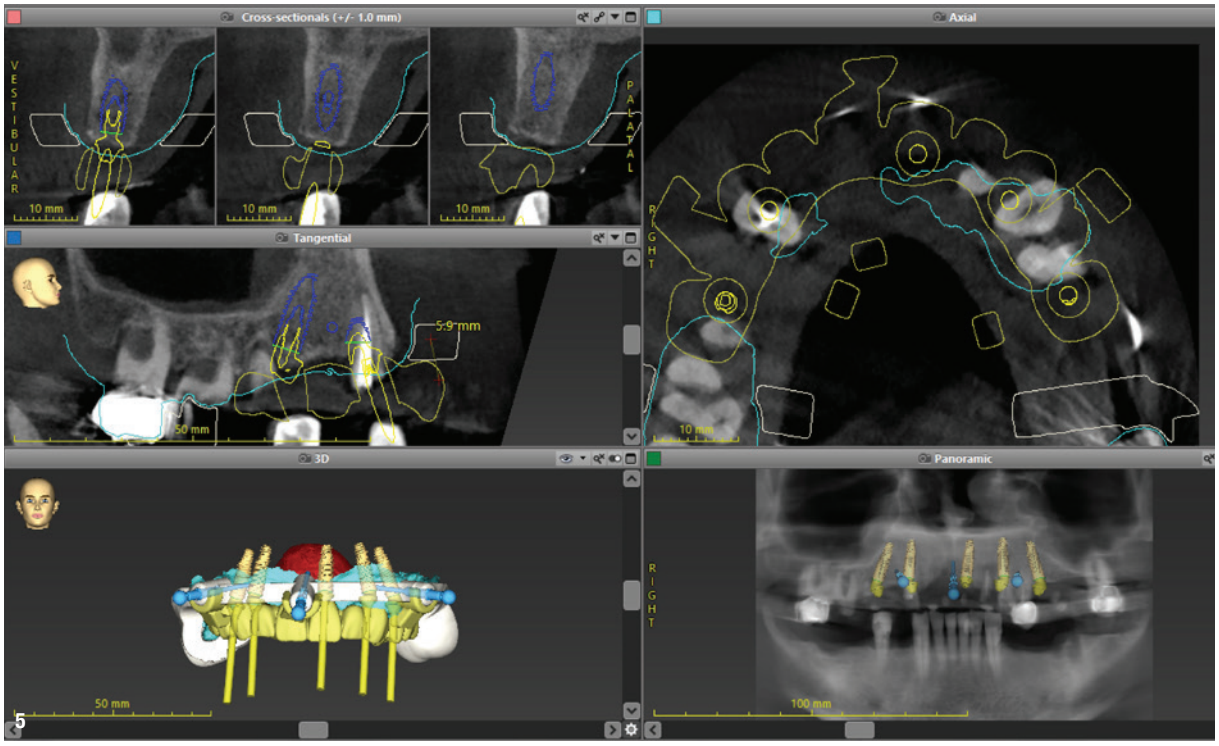

Fig. 5: Planning of the implant placement by Smile in a Box using coDiagnostiX.

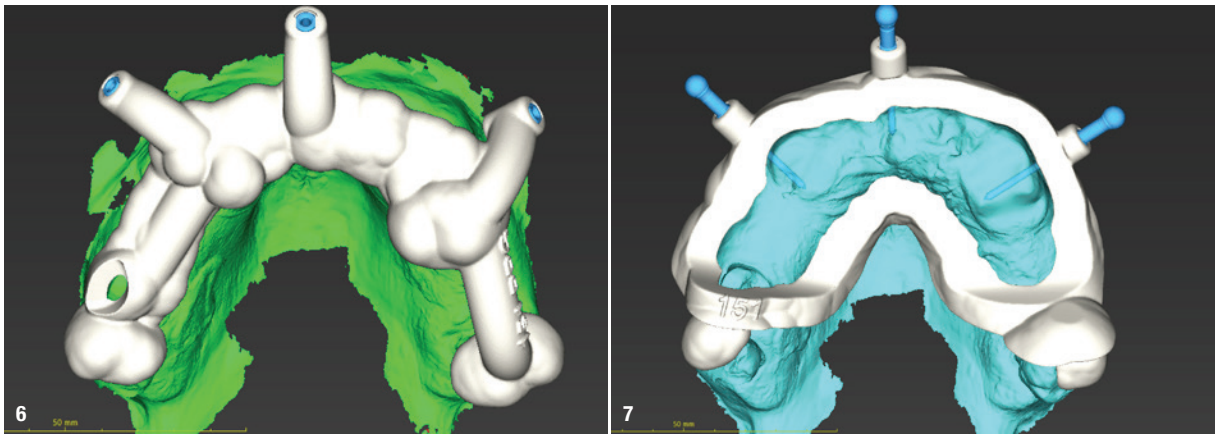

Fig. 6: Planning of the temporary prosthesis by Smile in a Box. – **Fig. 7:** Planning of the anchor pin guide by Smile in a Box.

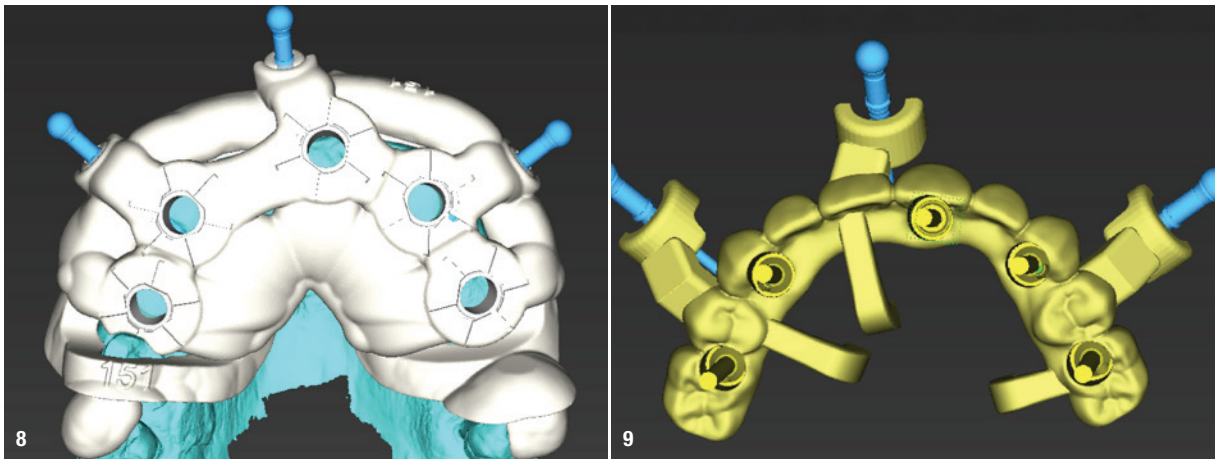

Fig. 8: Planning of the bone reduction guide by Smile in a Box. – **Fig. 9:** Planning of the implant placement guide by Smile in a Box.

selection of materials and production methods, ensuring both restoration longevity and implant health.[16]

The objective of this case report is to present a complete digital workflow for full-arch rehabilitation. In doing so, it will demonstrate how the integration of novel scan bodies with an implant system helped to mitigate discrepancies inherent to digital workflows and achieve superior outcomes in terms of accuracy, aesthetics, patient comfort and a passive prosthetic fit.

Initial situation

A 51-year-old male patient presented with severe partial edentulism in the maxilla. He reported a history of smoking but had quit, and no other comorbidities were identified (Fig. 1). The patient presented with a maxillary denture (Fig. 2). The patient did not have any existing implants (Fig. 3).

Treatment planning

After clinical and radiographic evaluation, guided full-arch implant surgery was planned, including tooth extraction and immediate implant placement. For the guided surgery procedure, intra-oral and CBCT scans were taken (Fig. 4). The scans were sent to the Smile in a Box implant planning service (Straumann), which planned the tooth extraction and flapless implant placement by overlaying the CBCT and intra-oral scans using coDiagnostiX planning software (Dental Wings; Fig. 5).

The surgery was planned for the placement of Helix GM implants (Neodent; 4 × 13 mm) in tooth positions #15, 12, 21, 23 and 25. Custom surgical guides were designed and manufactured based on the digital planning. The patient's existing denture was incorporated into the planning to aid in designing the temporary prosthesis (Fig. 6). Once the designs had been approved, the guides were produced and delivered along with the implants, anchor pins, abutments and temporary prosthesis.

Surgical procedure

Implant placement was performed using a fully guided protocol, and a sequence of three stackable guides was used for each arch: an anchor pin guide, stabilised by the patient's teeth (Fig. 7); an open fixation guide for bone

reduction, stabilised by the anchor pins (Fig. 8); and an implant placement guide, stabilised through the stackable system with fixation sleeves (Fig. 9).

The five implants were placed at torques between 35 and 50 Ncm (Fig. 10). Bone grafting biomaterial was used after implant placement in the facial and canine areas as required. Immediately after surgery, the temporary prosthesis was placed over the bone reduction guide to verify its fit (Fig. 11).

Prosthetic procedure

After implant placement, five GM Mini Conical Abutments were attached, and the prefabricated temporary prosthesis was delivered (Figs. 12+13). A radiograph was then acquired to confirm the correct positioning of the implants (Fig. 14).

After a three-month healing period, the patient was scanned using Straumann EXACT. The system is composed of titanium scan bodies and LINKS that facilitate full-arch scanning with an intra-oral scanner. From this, two scan files were created as follows:

1. Maxillary, mandibular and occlusion scans were taken. The maxillary scan was then removed, and a complete 360° scan of the temporary prosthesis used during surgery was performed.
2. Scan bodies and LINKS were placed on the abutments, and the LINKS were bonded (Fig. 15). Scans were then taken (Fig. 16). Afterwards, the bonded structure was removed, and a full soft-tissue scan was completed (Fig. 17).


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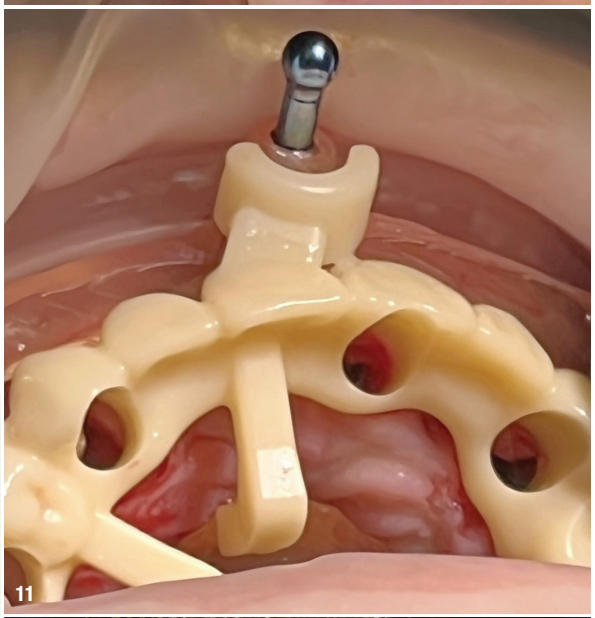
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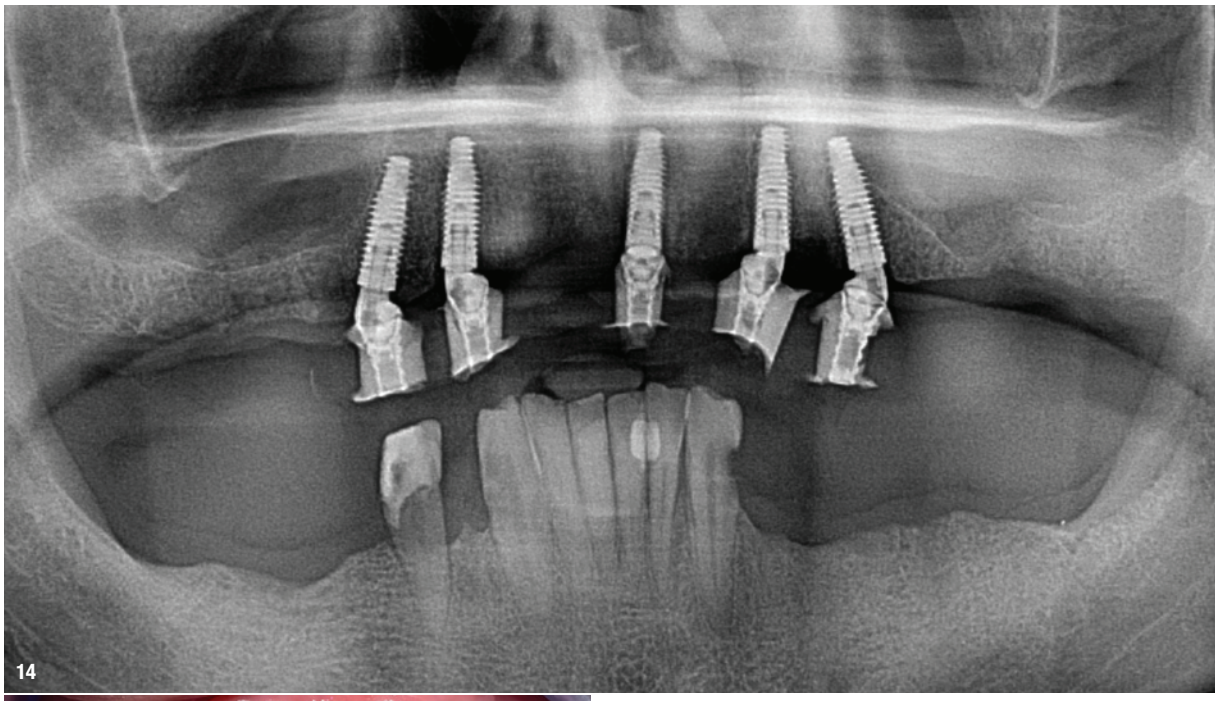
Fig. 10: Implant guide fitted and implants placed. – **Fig. 11:** Temporary prosthesis placed to assess fit. – **Fig. 12:** Temporary prosthesis prepared for placement. – **Fig. 13:** Temporary prosthesis in position.



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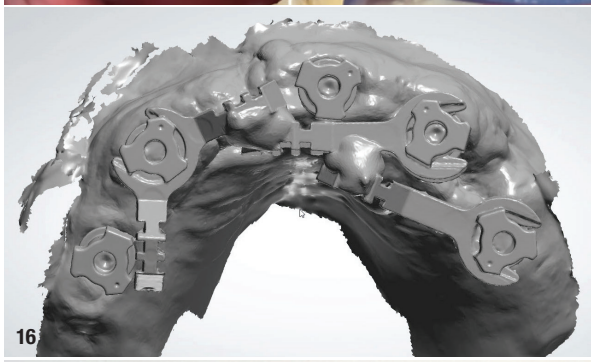

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Both scan files were sent to Straumann UN!Q services, along with a digital wax-up, to order a 5-14 CoreBar for a cemented zirconia restoration. The CoreBar was requested with a gold hue to enhance case aesthetics and was supplied together with the prosthetic screws for the conical abutments. No physical impressions were taken or models made. The surgical temporary prosthesis was adjusted to provide a more ideal appearance and function for the patient, thereby reducing the likelihood of adjustments at the try-in and final delivery stages.

After approximately three weeks, a PMMA prosthesis and the CoreBar for try-in were delivered (Figs. 18a+b). As this was the first case utilising the Straumann EXACT workflow in both the clinic and the laboratory, the decision was made to order the bar for the try-in stage to verify passivity and aesthetics separately. Once bar passivity had been confirmed (Fig. 19), and since minimal adjustments were required at the try-in (Fig. 20), the laboratory was instructed to proceed with fabrication of the definitive prosthesis. A few weeks later, the definitive zirconia prosthesis was delivered (Figs. 21+22).

Treatment outcomes

Full-arch treatments today are often a hybrid of conventional and digital techniques, typically involving physical

Fig. 14: Post-op radiograph. – **Fig. 15:** Straumann EXACT scan bodies and links placed. – **Fig. 16:** Capture of Straumann EXACT scan bodies and links. – **Fig. 17:** Full tissue scan completed after removal of the Straumann EXACT scan bodies and links.

Figs. 18a+b: PMMA prosthesis **(a)** and CoreBar **(b)** delivered as separate components. – **Fig. 19:** CoreBar fit check to confirm passive fit. – **Fig. 20:** PMMA prosthesis placed over the bar to confirm positional accuracy.

“Although there may be initial scepticism about achieving a well-fitting definitive prosthesis using intra-oral scanning only, the use of Straumann EXACT after proper training for both clinic and laboratory proved to be highly effective.”

Fig. 21: Definitive zirconia prosthesis delivered. – **Fig. 22:** Final smile.

impressions, free-hand surgery and frequent chairside adjustments. In contrast, this case utilised a fully digital end-to-end workflow from diagnosis to final fit, eliminating the need for physical impressions, cast pouring or model production, and requiring only minimal adjustment of the definitive prosthesis. Importantly, the Straumann EXACT system used is fully compatible with the Helix GM implant system.

This approach simplified and standardised the full-arch treatment process by reducing manual steps for both the clinician and the laboratory. The techniques employed did not require any specialised clinical equipment beyond an intra-oral scanner, making the workflow highly accessible and easy to adopt. The patient experience was extremely positive, and the clinical team observed clear efficiency gains through the guided and digital prosthetic procedures.

Although there may be initial scepticism about achieving a well-fitting definitive prosthesis using intra-oral scanning only, the use of Straumann EXACT after proper training for both clinic and laboratory proved to be highly effective. It significantly reduced chair time, eliminated manual steps and delivered a prosthesis with excellent fit. The try-in phase required only minimal modifications, reinforcing the importance of this step in ensuring that the definitive prosthesis meets clinical expectations. The patient was fully satisfied with the outcome and appreciated the digital nature of the treatment.

Author’s testimonial

“My experience with the Straumann EXACT system was simple and precise from the very first try. The workflow gives me confidence that the final restoration will achieve a passive fit.”

about the author

Dr Ryan Ollerton is a highly skilled implantologist specialising in full-mouth and complex rehabilitation cases. He is a graduate of the University of Liverpool in England and holds a certificate in advanced implant dentistry. Dr Ollerton has completed advanced training through international courses and workshops and continues to refine his expertise to provide cutting-edge care and transformative results for patients.

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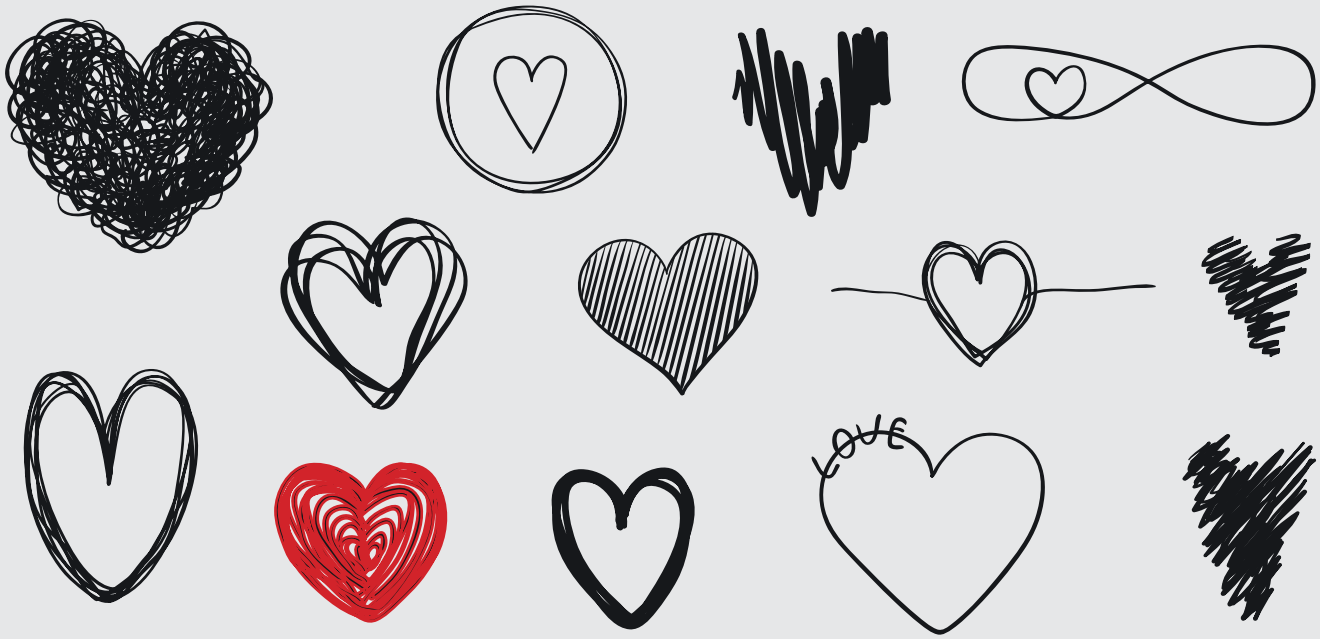
References



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